UNIVERSIDADE ABERTA

Modeling BDN Framework in ArchiMate

Benefits Management of IS Investments Applied in the Context of Media and Television Industry Digital Transformation.

Fernando José de Barros Antunes

Dissertation to obtain the Master of Science Degree in

Informação e Sistemas Empresariais

Supervisor: Dr. Sérgio Luís Proença Duarte Guerreiro

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Acknowledgments

The moment when this work is complete brings the reflection on the journey taken to achieve the results and on the people that took part in it.

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Abstract

The alignment between Information Technologies (IT) investments and business objectives definition is recurrently referred in the literature as a paramount task owning a direct impact on the organization's profit. Enterprise Architecture (EA) plays an important role in describing the dependencies between an IT migration roadmap and business counterparts, therefore, facilitating the stakeholder's decisions. However, evidence shows that a significant number of IT projects fail to deliver the desired outcomes. Usually, the failure causes are (i) the dominance of black-box financial management approaches offering poor indicators, e.g., return-on-investment or cost reduction, and (ii) not identifying the real business benefits provided by the value that can be generated by an IT investment. This paper uses ArchiMate to propose a model to understand, design, and manage the business benefits. ArchiMate enables, among others, to model business, application, technology, or strategy layers and is now extended with business benefits. In specific, an ArchiMate viewpoint based on the Benefits Dependency Network (BDN) model is presented. The purpose of this viewpoint is to support the stakeholders that are managing the benefits to be achieved by an IT investment. The conceptual solution is argued and demonstrated in the context of the media video and television industry use case. Afterward, the ontological deficiencies of this model are discussed using the Wand Weber method and through interviews with experts.

Keywords: ArchiMate BDN Business Benefits Enterprise Architecture.

Resumo

O alinhamento entre os investimentos em Tecnologia da Informação (TI) e a definição dos objetivos de negócios é recorrentemente referido na literatura como uma tarefa primordial com impacto direto no lucro da organização. A Arquitetura Corporativa (EA) desempenha um papel importante na descrição das dependências entre um roteiro de migração de TI e as contrapartes de negócios, portanto, facilitando as decisões das partes interessadas. No entanto, as evidências mostram que um número significativo de projetos de TI não consegue entregar os resultados desejados. Normalmente, as causas do fracasso incluem (i) a predominância de abordagens de gestão financeira de caixa preta que oferecem indicadores fracos, emph eg, retorno sobre o investimento ou redução de custos, e (ii) não identificar os benefícios de negócios reais fornecidos pelo valor que pode ser gerado por um investimento em TI. Este artigo usa ArchiMate para propor um modelo para entender, projetar e gerenciar os benefícios do negócio. ArchiMate permite, entre outros, modelar camadas de negócios, aplicativos, tecnologia ou estratégia e agora é estendido com benefícios de negócios. Especificamente, é apresentado um ponto de vista da ArchiMate baseado no modelo Benefit Dependence Network (BDN). O objetivo dessa visão é apoiar os stakeholders que estão gerenciando os benefícios a serem alcançados por um investimento em TI. A solução conceitual é discutida e demonstrada no contexto do caso de uso da indústria de televisão e vídeo de mídia. Posteriormente, as deficiências ontológicas desse modelo são discutidas utilizando o método Wand Weber e por meio de entrevistas com especialistas.

Keywords: ArchiMate BDN Business Benefits Enterprise Architecture.

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Acronyms

ADM Architecture Development Method. vii, xiii, 2, 4, 10, 11, 13, 14, 27, 28, 35, 97

BDN Benefits Dependency Network. vii, viii, xi, xiii, xiv, 2, 4–6, 10, 13, 15–17, 20, 22–24, 29–31, 34–43, 47–52, 58, 59, 61, 62, 64, 65, 72, 74–76, 80–85, 88–95, 97–99

DSRM Design Science Research Methodology. vii, xiii, 3–5, 7

EA Enterprise Architecture. vii, viii, 2, 4–6, 10, 11, 15, 20, 22–24, 27–29, 35, 80, 89–95, 97, 98

EBU European Broadcasting Union. 67

HD High Definition. 70, 71

IABM International Trade Association for the Broadcast Media Industry. 3, 67

IEEE Institute of Electrical and Electronics Engineers. 10

IP Internet Protocol. 70

ISO international Organization for Standardization. 10

ODA Optical Disk Archive. 46

OTT Over The Top. 70, 72

ROI Return On Investment. 46

SDI Serial Digital Interface. 70

TCO Total Cost of Ownership. 46

TOGAF The Open Group Architecture Framework. vii, xiii, 2, 4, 5, 10, 11, 13, 14, 27, 28, 35, 37, 97

UHD Ultra High Definition. 70, 71

Chapter 1

INTRODUCTION

1.1 Context and Scope

The alignment of investments on technology platforms and business is crucial to achieving the outcome of business objectives. For this reason, Enterprise Architecture (EA) has taken an important role to support stakeholders as "EA standards provide a road map to organizations for introducing technology, data, and process standardization and integration across the enterprise" [Boh and Yellin, 2007].
The adoption of EA practice by major organizations worldwide as "The insights provided by an enterprise architecture are needed on the one hand in determining the needs and priorities for change from a business perspective, and on the other hand in assessing how the company may benefit from technological and business innovations" [Lankhorst, 2017b]. Also, EA for the success of business strategies arises as it provides optimal governance of resources and that also addresses the concerns of stakeholders regarding the transformation processes. EA, as a systematic process provides *"management with insight and overview to harness complexity. a coherent and integral fashion"* [Op 't Land et al., 2008]. Besides EA practice available to support stakeholders in portfolio and investment management decisions, evidence shows that a significant number of IT projects fail to deliver the expected outcome in what concern business benefits, "recent surveys continue to show that this is the case in about 70-85% of IT investments." [Ward and Daniel, 2013]. The causes for such a high rate of failure are attributed to the dominance of financial management. These focus on indicators as ROI and cost reduction and not properly identifying the real business benefits of the value that can be generated by the investment.
The benefits management approach consists of a plan to realize benefits. Starting on the initial definitions and accurate definition of the expected benefit outcome for the project, but linked across project implementation and post-implementation, to guide decisions on how to adjust project scope to keep in line with the projected benefits.
The Benefits Dependency Network (BDN) provides the "framework for explicitly linking the overall investment objectives and required benefits, with the business changes necessary to deliver those benefits and the essential IT capabilities that enable the changes" [Ward and Daniel, 2013].
This research proposes the integration of the BDN framework in the ArchiMate modeling tool, enabling a viewpoint that can provide a representation of the BDN concepts, within the scope of an EA process under The Open Group Architecture Framework (TOGAF) integrated into the Architecture Development Method (ADM) continuum.
Moreover, ArchiMate has been developed to address the TOGAF framework, as a graphical modeling language. ArchiMate relevance resides on the layered views and ability to create distinctive viewpoints, to address each stakeholder's requirements, together with the possibility of accommodating extensions to the needs that arise from new concepts [Group, 2018].

The research question of this work is to provide a solution on: **How to model the semantic alignment of Benefit Dependency Network framework with ArchiMate to provide an**

integrated model to manage the benefits of IT investments?

This research is conducted in the context of the Broadcast and Media Industry, which is facing a radically changing business environment that requires an adaptive strategy execution. The digital revolution enabling the convergence of the internet with TV business, and individualized content to be consumed in either Smart TV's or mobile devices with global content providers like Netflix, Amazon Prime and the emergence of social networks taking a significant advertisement revenue share from traditional TV. Intensive technology investment is key to keep the competitive capability or even survival, as well as where the business value of a project needs to be maximized. Industry research by the International Trade Association for the Broadcast Media Industry (IABM) asked the *"participants to select at least three important factors that drive the purchases of media technology"*. Respondents cited *"makes us more efficient/saves money"* more often than any other factor as the *"most important"* driver of product purchase, coming next was *"total cost of ownership"* and *"makes us more agile/responsive to market changes"* [IABM and Industry, 2019]. These results challenge the industry to the need for understanding how a technology project is evaluated in the light of a market in continuous change, where intensive technology investment is key to keep the competitive capability or even survival, as well as where the business value of a project needs to be maximized.

To that end, a model integrating the BDN Benefits management framework and ArchiMate is explained, applied to a case study, and argued. To develop this proposal, the Design Science Research Methodology was applied following an iterative cycle composed of five iterative phases: Awareness of the problem, Suggestion, Development, Evaluation, and Conclusion [Vaishnavi and Kuechler, 2004].

The Awareness of the problem phase involved a definition of the theoretical background and a systematic literature review focused on Benefits Management on IT projects, linked with EA, TOGAF and ArchiMate, as presented respectively in Chapter 2 - Theoretical Background and in Chapter 3 - Systematic Literature Review.

The demonstration of the proposed solution to use cases is argued in Chapter 7.

The evaluation of the solution is presented in the chapter Evaluation based on Wand and Weber methodology and also on interviews with industry professionals.

Conclusions taken from the research and results obtained and future work developments that can improve the proposed solution are developed in Chapter 9 - Conclusion.

1.2 Research Methodology

Considering the problem raised, the response to it resides on the construction of an artifact. "It is a fundamental premise that design is problem-driven and leads to an artifact that solves the problem when the artifact is introduced into nature" [Baskerville, 2008].

Design Science Research Methodology (DSRM) is the methodology that is considered to address the problem as it involves the construction of a non-existing artifact using techniques,

models, and methods that can be sustained in theories. This generates new knowledge based on design, analysis, and reflection.

In this proposal, the DSRM is applied through 5 phase process model [Vaishnavi and Kuechler, 2004], This model consists of an iterative cycle composed by:

- **Awareness of the problem** – in this case, an industry-related problem associated with the EA discipline and with a value associated with the contribution of a solution.
- **Suggestion** - *"Immediately following the development for a proposal based on an awareness of a problem is the phase of suggestion. Suggestion is a creative step wherein new functionality is envisioned based on a novel configuration of either existing or new and existing elements."* On the suggestion phase is proposed a solution involving the use of a metamodel to incorporate on an existing reference modeling language (ArchiMate), to address the Benefits Dependency Network (BDN) and apply to IS investments. The outcome of this phase is a Tentative Design.
- **Development** - *"The Tentative Design is further developed and implemented in this phase*". On this phase a structured metamodel that is consistent with the theories that sustain it: TOGAF ADM, ArchiMate and BDN is the resulting artifact.
- **Evaluation** - "Once constructed, the artifact is evaluated according to criteria that are always implicit and frequently made explicit in the Proposal (Awareness of Problem phase). Deviations from expectations, both quantitative and qualitative are carefully noted and must be tentatively explained.", The proposed artifact will be applied on a real use case and defined an evaluation methodology that will respond to the relevance of the solution applied in terms of objectives that it accomplishes.
- **Conclusion** - "This phase could be just the end of a research cycle or is the finale of a specific research effort." This proposal is expected that further subsequent work will be prosecuted as a new cycle, based on the knowledge contribution derived from the proposed solution.

For this research, the development phase was performed by a real-life scenario demonstration that was submitted to evaluation. From the evaluation results that enabled us to understand the areas where further development and corrections the artifact was applied to another real-life scenario in other to implement the learning from the first demonstration.

1.3 Research Problem

To provide proper management of the challenges of integrated IS technologies in organizations, proper tools are required. In an industry where flexibility is essential, "to support flexible processes, well-organized resources are required. Using an Enterprise Architecture (EA), enter-

prises can manage strategies, flexible processes, and supportive resources systematically and can maintain relations between business strategies and execution processes" [Kang et al., 2010].

The benefits management approach provides a process to manage the potential benefits of IT investments. By involving key stakeholders on a benefits realization plan, "Many organizations that have adopted this approach have not only improved the success of their IT projects but they have also significantly improved the relationship between their business and IT staff" [Ward and Daniel, 2013].

Benefits Dependency Network (BDN) addresses the construction of a benefits realization plan and realizes a framework that links "the overall investment objectives and required benefits with the business changes necessary to deliver those benefits and the essential IT capabilities that enable the changes" [Ward and Daniel, 2013].

The proposed objective for the research is to respond to the question:

- **How to model the semantic alignment of Benefit Dependency Network framework with ArchiMate to provide an integrated model to manage the benefits of IT investments?**

This research is done by providing also the response to sub-questions that arise, from the context:

- What are the key success factors identified to achieve the objectives of the integration of BDN with ArchiMate?
- Can the modeling of BDN on ArchiMate provide a solution to manage benefits from their technological investments?
- What limitations are identified when transposing BDN to ArchiMate?

On this research, the objective is to obtain the mapping between concepts of both frameworks in order to provide a coherent equivalence of concepts and connections.

The document follows a structure that mirrors the DSRM sequence, applied to the research problem.

1.4 Applying DSRM to the Research Problem

The application of this methodology to the research problem, adopting the 5-phase process described previously [Vaishnavi and Kuechler, 2004], described in figure 1.1, is considered in the following steps:

1. **Awareness of the problem:**

   A systematic literature review process in the areas of publications addressing digital migration processes, Benefits Management on IT projects and Enterprise Architecture (EA), TOGAF, and ArchiMate as a representation model.

2. **Suggestion:**

   To provide a suggestion that can be better understood and subjected to critics as part of the iterative process, the analysis of a simpler case study in the area of the Media Industry was done to develop an example on how the solution can be applied and also understand the processes that need to be undertaken to achieve the development of the proposed solution. For this phase was analyzed a Music Hall media production project and a Broadcast TV station technology project as it addresses a common area of the industry, and a process of modeling using ArchiMate was developed as well as the representation of the BDN framework. The suggestion of the solution to integrate BDN was designed based on common concepts of both framework concepts and relations.

3. **Development:**

   The development phase the analysis of background theory on BDN and ArchiMate and of existing related work to address the process of modeling of BDN in ArchiMate out to establish a coherent model. A metamodel will be the result.

4. **Evaluation:**

   To evaluate the model, there are some methodologies to be considered:

   - Demonstration of the application of the solution is to be performed as applying it to a real-life case on the industry. Application to the SIC Television Digital Studio Project in Portugal can provide the basis for. (An overview of the SIC Project is provided on Annex 1)
   - Evaluation through the interview with EA practitioners can provide both qualitative and quantitative evaluation.
   - Conceptualization by analyzing how the concepts used in ArchiMate was transposed in other related works and the coherence with the approach taken on this research, for this the Wand-Weber Model for Ontological evaluation of reference models will be the framework applied.

5. **Conclusion:**

   As a result of evaluation the conclusion regarding the achievement of the objectives and what further work can be taken to complement the solution to the research problem or to extend it into other areas.

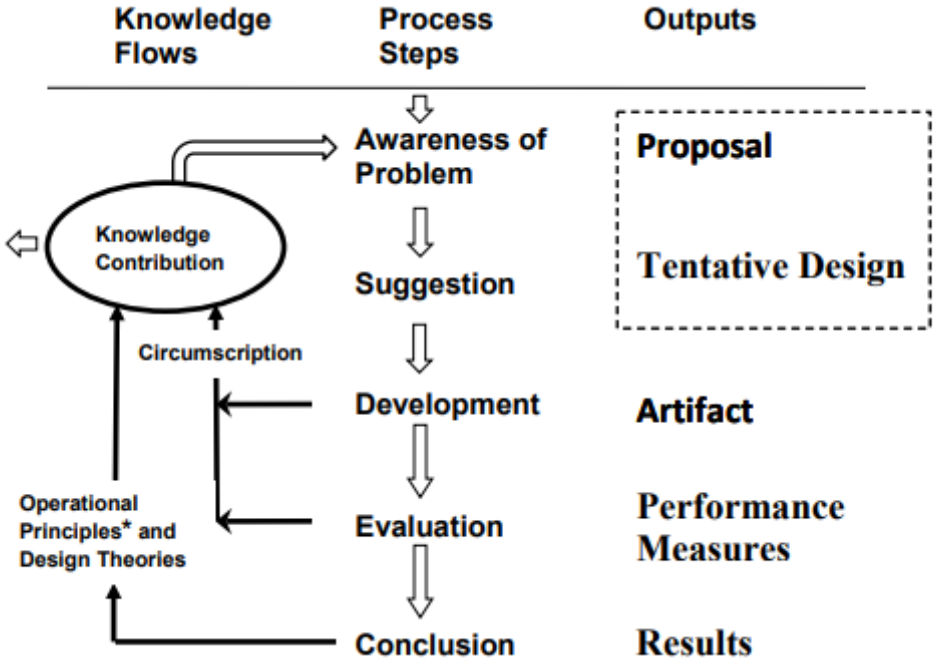


Figure 1.1: DSRM Steps and Outputs [Vaishnavi and Kuechler, 2004].

Chapter 2

Theoretical Background

2.1 Theoretical Background

This section provides an overview of the concepts involved in this work and their context, to provide an understanding of the problem addressed and how the proposed solution is articulated. The foundation concepts for this work that are cross related and interdependent are:

- Enterprise Architecture (EA);
- The Open Group Architecture Framework (TOGAF);
- Architecture Development Method (ADM);
- ArchiMate;
- Benefits Management;
- Benefits Dependency Network (BDN)

The principles for each one are covered in the next sections of this chapter.

2.2 Enterprise Architecture (EA), TOGAF and ADM

EA definition establishes a holistic vision of an organization considering the introduction and development of information systems to purpose enable the organizations to achieve their business objectives.
An organization is defined as a collection of organizations, Each one with its objectives that integrated should have the focus on a common purpose. In this sense, each organization is focused on its purpose as part of the of the overall. To achieve this common purpose it is necessary to introduce methodologies that enable the integration of the information systems with the adjustment of the balance of the different stakeholder's viewpoints towards the system concerning how it fits in the organization and to the specific objectives of each sub-organization [Lankhorst, 2017b].

The EA definition from the ISO//IEEE 42010 standard states: "An architecture is the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution" [612, 2011]. The definition integrates the fundamental aspects that are addressed in this work: the environment that influences the strategic drivers of the organization, the design of the systems that are composed of technology and people, and the governance of the systems to ensure that it is permanently aligned with the organization strategy.

As an instrument to support the organization in the execution of its strategy, EA acts in the role of planning and steering to implement plans, projects and is key to different stakeholders

concerns by using models that provide views focusing on specific areas, for specific stakeholders.

The Open Group Architecture Framework (TOGAF) provides a method and tools to develop Enterprise Architecture for organizations. TOGAF views EA implementation as a continual process and it's a *de facto* standard for EA practitioners [Group, 2018].

TOGAF establishes the integration of different architectural frameworks. The heart of TOGAF that enables this architectural integration is the Architecture Development Method (ADM). ADM provides several architecture development phases: Business Architecture, Information Systems Architectures, Technology Architecture in a cycle, as an overall iterative process template for architecture development activity [Josey, 2018]. The sequence of the ADM phases is represented in Figure 2.1.

2.3 ArchiMate

ArchiMate, has been developed to address TOGAF framework, as a graphical modeling language, provides a vision of the architecture representing the distinct elements that assist decision making and stakeholder information The role of the ArchiMate standard is to provide a graphical language for the representation of enterprise architectures over time.

The use of an architectural modeling language allows different stakeholders like project managers, board management, end-users, etc... to benefit from specialized visualization techniques. *"And by using a uniform modeling language, architects can avoid a Babel-like confusion"* [Jonkers et al., 2003].

The core language consists of three main types of element: Active structure elements, Behavior elements and Passive structure elements [Group, 2019].

Based on these elements a layered structure results from the specializations of the core concepts. Architects and other stakeholders can define their views on the enterprise architecture. These views are specified by viewpoints that define abstractions on the set of models representing the enterprise architecture, addressing specific types of stakeholders and sets of concerns [Group, 2019].

The ArchiMate Framework is represented in Figure 2.2.

The structure of the framework allows for the modeling of the enterprise from different viewpoints, where the position within the cells highlights the concerns of the stakeholder. A stakeholder typically can have concerns that cover multiple cells. The Business layer offers products and services to external customers, which are realized in the organization by business processes.

The Application layer supports the business layer with application services that are realized by (software) applications.

The Technology layer offers infrastructure services.

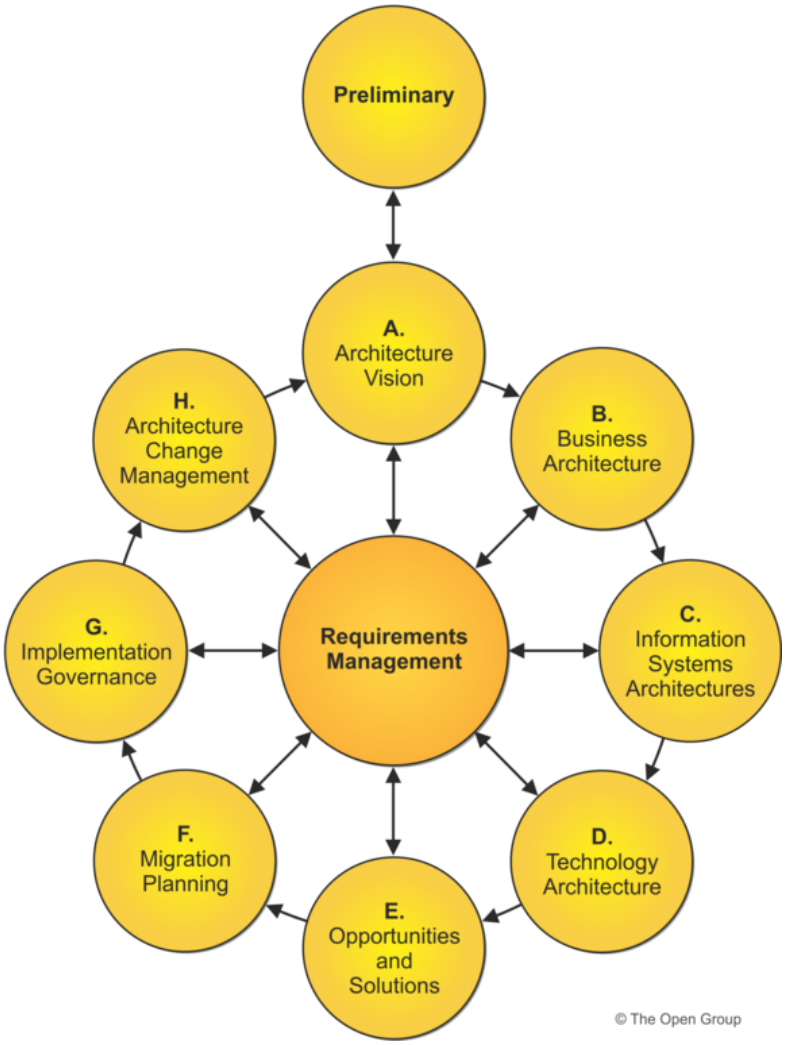


Figure 2.1: The ADM Cycle Sequence [Group, 2018]

The Active structure aspect represents the structural concepts (the business actors, application components, and devices that display actual behavior.

The Behavior aspect represents the behavior (processes, functions, events, and services) performed by the actors.

The passive structure aspect represents the objects on which behavior is performed.

The Motivation Elements provides the context or reason lying behind the architecture of an enterprise. The Strategy extension is typically used to model the strategic direction and choices of an enterprise, as far as the impact on its architecture is concerned. They can be used to express how the enterprise wants to create value for its stakeholders, the capabilities it needs for that, the resources needed to support these capabilities, and how it plans to configure and

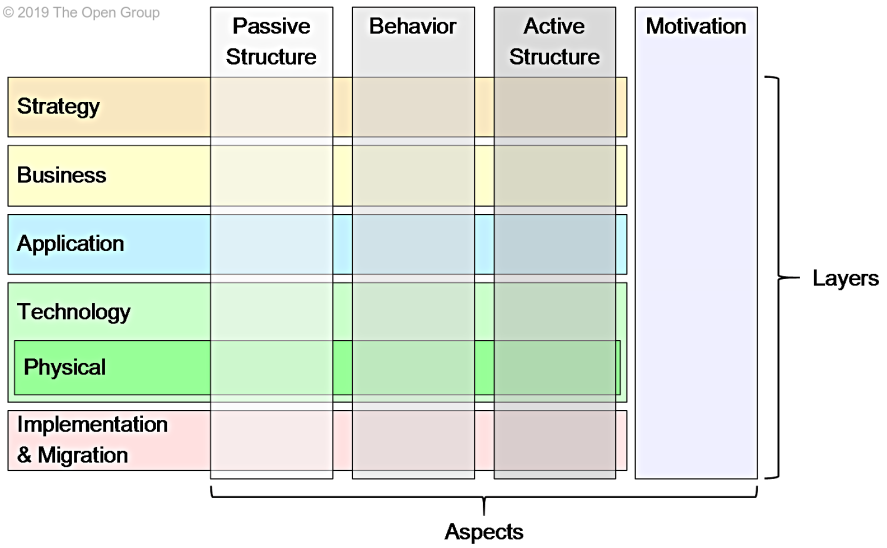


Figure 2.2: ArchiMate Framework [Group, 2019]

use these capabilities and resources to achieve its aims.

Implementation and Migration extension of ArchiMate adds concepts to support the late ADM phases, related to the implementation and migration of architectures: Phase E (Opportunities and Solutions), Phase F (Migration Planning), and Phase G (Implementation Governance).

There is no formal semantics assigned to the use of colors, this is left to the modeler. They can be used freely to stress certain aspects of models.

A viewpoint in the ArchiMate language is a selection of a relevant subset of the ArchiMate elements and their relationships. The structure of the ArchiMate core language closely corresponds with the three main architectures as addressed in the TOGAF ADM.
The strategy, motivation, implementation, and migration elements approximately map onto the remainder of the ADM (although these elements may also be used in Phases B, C, and D). On figure indicates the mapping between TOGAF views and the ArchiMate viewpoints. [Group, 2019]

Viewpoints are a means to focus on particular aspects of the architecture. These aspects are determined by the concerns of a stakeholder with whom communication takes place, so viewpoints are designed to communicate certain aspects of an architecture [Group, 2019].

2.4 Benefits Management and Benefits Dependency Network (BDN).

A benefit is defined as a ‘flow of value’ triggered by the realization of an outcome [Zwikael and Smyrk, 2012, Ashurst, 2012].

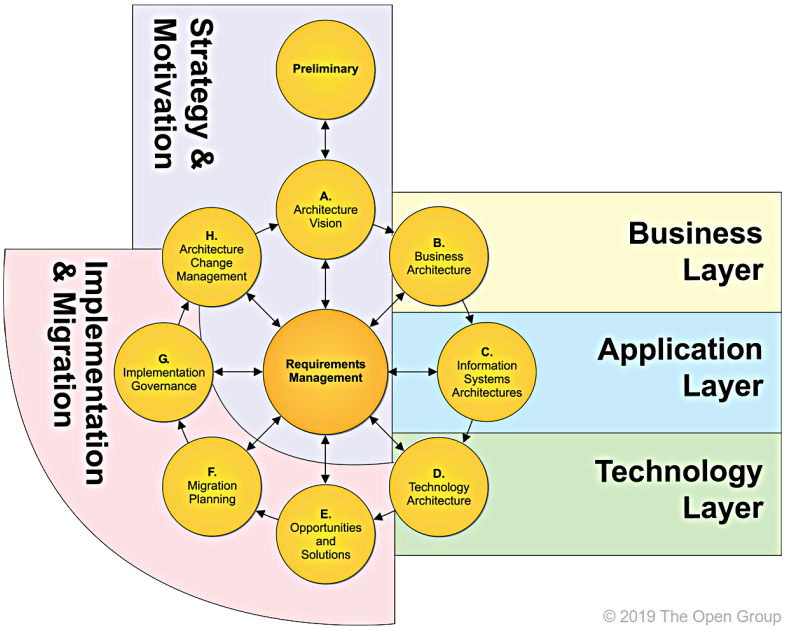


Figure 2.3: ArchiMate to TOGAF ADM mapping [Group, 2019]

Benefits realization from IT investments can be conceptualized as an organizational capability that has the express purpose of ensuring that investments made in IT consistently generate value [Ashurst et al., 2008]. *"Benefits do not simply emerge, as if by magic, from the introduction of new technology; their realization needs to be carefully planned and managed"*. Benefits planning involves strategic decisions and perspective to decide the projects that will be considered to enable innovation [Ashurst, 2012]. Benefits Management as a process has the objective of ensuring that realization of IT investments delivers the promised benefits to the organization. to be materialized, the benefits need to be actively managed during the project lifecycle [Peppard et al., 2007]. The benefits management approach consists of a plan to realize the benefits. Starting on the initial definitions and accurate definition of are the expected benefit outcome for the project, linked across project implementation and post-implementation to guide decisions on how to adjust the project scope, to keep in line with the projected benefits.

On the foundations of Benefits Management are the objectives of strategic IS/IT planning:

- Identifying IS/IT-enabled business opportunities;
- Aligning IS/IT projects with business strategies and priorities;
- Sourcing and implementing IT architectures, infrastructure, applications, and services;
- Developing organizational resources, competences, and capabilities to deploy and utilize the technology effectively.

The starting point of a project is to consider relevant stakeholders and what they are going to do differently because of the investment and the benefits, it will bring for them. The focus on benefits for the customer/stakeholder point of view has become more relevant as IT is at the core of the delivery of products and services and is not just about the automation of internal processes and the replacement of people with technology [Ashurst, 2012].

The Benefits Dependency Network (BDN) framework provides the *"framework for explicitly linking the overall investment objectives and required benefits, with the business changes necessary to deliver those benefits and the essential IT capabilities that enable the changes."* [Ward and Daniel, 2012]
Framework implementation defines the following five iterative steps:

1. Identify and Structure Benefits;
2. Plan benefits realization;
3. Execute benefits plan;
4. Review and evaluate results;
5. Establish the potential for further benefits.

Benefits identification is a critical step in the benefits management process. This process seeks to identify and document the benefits that will be the most relevant and convincing to contextually impacted stakeholders. as it's a key factor for benefits realization to have them involved in the process [Wijesinghe et al., 2016a]

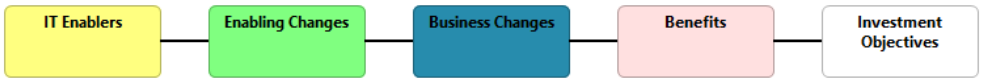


Figure 2.4: Benefits Dependency Network (BDN) [Ward and Daniel, 2012]

2.4.1 The BDN concepts:

In this section, a semantic description of the BDN concepts is provided as it consists of the foundation to obtain an understanding of the relationships with the EA concepts and ArchiMate modeling concepts.

Business Drivers – Issues with executive and senior managers agree that means mean the organization needs to make changes and the timescales for those changes. Can be internal or external but are specific to the context.

Investment Objectives - Statements that describe what the organization is seeking to achieve from the investment. They should be a description of what the situation would be on the successful completion of the investment.

Business Benefit – An advantage of a particular stakeholder or group of stakeholders – that implies that the benefits are "owned" by the individuals or groups who want to obtain value from the investment

Benefit Owner – An individual who will take responsibility for ensuring that a particular benefit is achieved. This involves ensuring that the relevant business and enabling change progress according to plan and are achieved. Due to the need to ensure that things get done, the benefits owner is usually a senior member of the staff.

Stakeholder – An individual or group of people who will receive the expected benefits or are either directly involved in making or are affected by the changes needed to realize the benefits.

Business Changes – new ways of working that are required to ensure that desired benefits are realized – this will be the ongoing way of working in the organization.

Enabling Changes – Changes that are prerequisites for achieving the business changes or that are essential to bringing the system into effective operation within the organization. Enabling changes are "one-off "activities rather than ongoing ways of working. - agreeing on new working practices, redesign processes, change to job roles and responsibilities, training, new business skills.

BDN is defined, as the realization of benefits, depending on changes to business processes and relationships on how individuals or groups work within the organization. BDN network construction, represented in Figure 2.4, is processed from right to left. Starts with the drivers and agree with the objectives for a particular investment that should be identified and described together with the business benefits that will result if the objectives are achieved, following the Business Changes that enable the Benefits, preceded by Enabling Changes consisting in pre-requisites to the Business Changes implementations and finally the Enabling IT structure [Ward and Daniel, 2012]

Executing Benefits Plan

During the project, evolution plans will have to be revised and adjusted as changes on resources or unexpected events or problems that need assessment, the business project manager in coordination with other relevant business managers will need to make appropriate decisions, considering what effect on the benefits and on the capability to achieve them [Ward and Daniel, 2012]. The consideration of the project from the perspective of the stakeholders is relevant for the ben-

Table 2.1: BDN Concept Description

Drivers	The forces internal or external causing the organization to make changes.
Investment Objectives	The agreed objectives for the investment.
Benefits	Identified benefits to be delivered by the project.
Business Changes	Required processes, activities, roles, and responsibilities.
Enabling Changes	Actions required: training, education, information requirements, data migration, business rules, new application. Resource reallocation.
IT Enablers	IT systems to be considered or other technology than IT

efit management by enabling the understanding of what the project will bring for each one. Benefit owners will lead to taking actions to realize the benefits.

Chapter 3

Systematic Literature Review

3.1 Systematic Literature Review

The systematic literature review methodology for this research involved the following actions that were:

- Identification of scientific literature sources relevant to the research;
- Definition of the search keywords and strings to perform the searches;
- Search and selection of articles that were considered relevant based on an initial review of abstract and relevancy based on a defined score.
- A secondary analysis, deeper to evaluate the level of interest and based on score against relevant areas were then performed to reduce to the most relevant sources.
- Data extraction has been performed on the final selected articles.
- With data extracted resulted from the previous action, a review analysis was performed to establish the basis for the research.

The actions performed were supported by the online software tool Parsifal, available in https://parsif.al/
The Systematic Literature Review has been conducted to obtain studies that can support:

- The benefits recognized on EA application in organizations.
- Most relevant EA frameworks.
- ArchiMate core concepts.
- Benefits Management concepts
- BDN Framework

3.2 Literature sources

Parameters to define Population, Intervention, Comparison, Outcome and Con-text were introduced to calibrate the searches for relevant literature. Automatized search was done using Parsifal (www.parsifal.al) and also Google. List of Sources:

- ACM (https://dl.acm.org/)
- Association For Information Systems (https://aisnet.org/default.aspx)
- CiteseerX (http://http/citeseerx.ist.psu.edu/)
- Google Academic (http://https/books.google.pt/)

- IEEE Digital Library (http://ieeexplore.ieee.org)
- Journal of Management Information Systems (https://www.jstor.org/)
- Market Line (http://www.marketline.com)
- Research Gate (https://www.researchgate.net/)
- Science@Direct (http://www.sciencedirect.com)
- Scopus (https://www.scopus.com/freelookup/form/author.uri)
- Semantic Scholar (http://semanticscholar.org)
- Springer Link (http://link.springer.com)
- SSRN (http://https/papers.ssrn.com/)
- TU/e (https://research.tue.nl/)
- Un twente (http://purl.utwente.nl/essays/65421)

3.3 Search strings used

The automatic string generated by Parsifal:

(”ArchiMate” OR ”BDN” OR ”Benefit Dependency Network” OR ”Business Benefits” OR ”Enterprise Architecture” OR ”EA” OR ”Enterprise Architecture ArchiMAte and Benefits Dependency Network”) AND (”Provide a reliable business management tool”)

This string also with relevant keywords was used to perform searches in different sources.

Keywords used for specific searches:

- ArchiMate
- Business Benefits
- Enterprise Architecture
- Enterprise Architecture ArchiMate and Benefits Dependency Network
- ArchiMate Modeling

3.4 Study selection and quality assessment

A total of 83 articles was imported as covering the search criteria used and also imported as a result of identification of primary studies from relevant articles references. The sources for these articles are available in the graph in Figure 3.1.
From this total number of studies imported, 39 studies were accepted and subjected to Quality assessment. The distribution of the accepted articles per source is represented in the graph in Figure 3.2 and the distribution per year of publication is represented in the graph in Figure 3.3.

Selection criteria:

- ArchiMate Relevant
- BDN relevant
- Business Benefits Relevant
- EA relevant
- Publication ranking
- Primary Source.

Research Gate was the main source of articles as it collects openly several relevant journals from IS research area.

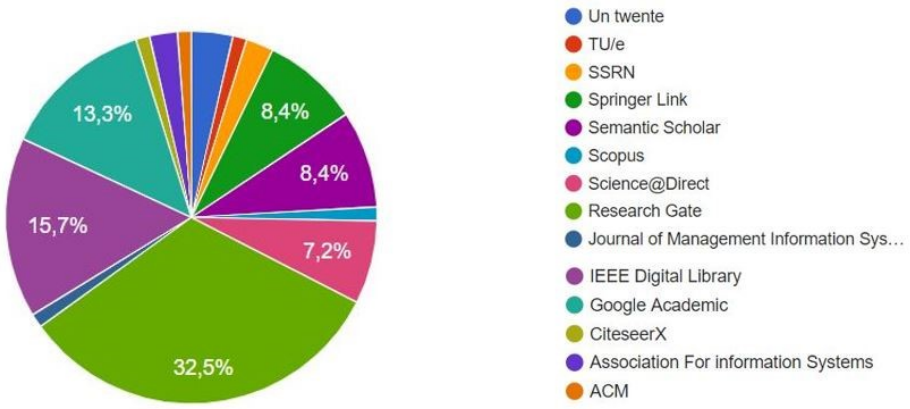


Figure 3.1: Results per Source.

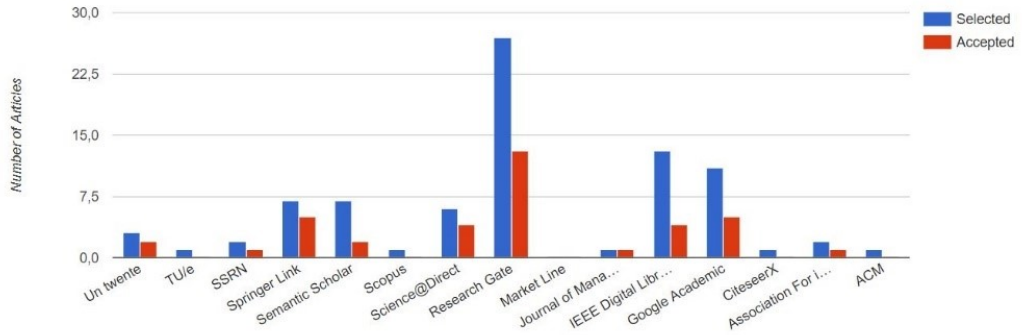


Figure 3.2: Article selection per source.
65

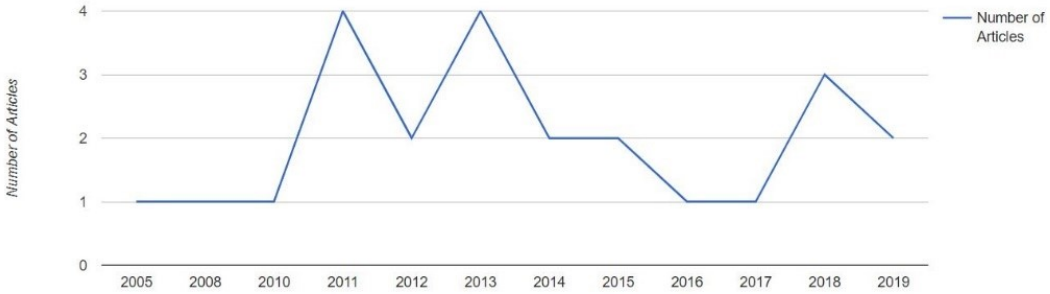


Figure 3.3: Article selection timeframe.

The quality assessment evaluated the relevance of the research based on the following criteria:

- Publication refers to an EA subject relevant for the modeling;
- Publication refers to BDN with relevance for the modeling;
- Benefits Management Relevant;
- ArchiMate modeling relevant.

A score was provided to each article based on the selection criteria and relevance of each topic for the research, as covered by each article.

Assessment Criteria:

- Publication refers to an EA subject relevant for the modeling

- Publication refers to BDN with relevance for the Exercise
- Benefits Relevant
- ArchiMate relevant,

Selection Score:

- Fundamental 1: 80
- Relevant +: 50
- Relevant: 20
- Partial: 10
- Discard: 0

The score results is presented on table 3.1.

3.5 Data extraction

The data extraction process was done over 24 articles that obtained a score above 20 on the data extraction assessment as shown on the table in Annex 2 From these articles a revision to bring the most updated and relevant contributors for the research was taken for those that were more transversal in terms of subjects covered, from the ones involved in the research. This selection pointed to 9 articles that cover EA, ArchiMate, and benefits at a more transversal. The extraction was concentrated on the available literature that covers the research thematic in a more transversal way, with the objective to obtain the most adequate coverage of thematic interaction. These are signaled on yellow in Table 3.2 .

3.6 Systematic Literature Review Analysis

The literature analyzed covers the subject of the research in a fragmented manner.

It was not found relevant literature that covers the full range of modeling benefits on ArchiMate. For this reason, it was the integration of the overlapping areas of the subjects that contribute to the building of the result as an overall approach to this industry context.

The extraction of data is mainly looking at:

- Value of Using EA to manage IS investments;
- Benefit management;
- ArchiMate representations and standards that enable consistency for BDN modeling.

The different literature was classified in terms of areas of coverage, so extraction of each area relevant findings are separated by the subjects that contributed to the research.

Table 3.1: SLR Article Score

Title	**Quality Score**
Enterprise Architecture Model Analysis Using Description Logic	10
Towards a Conceptualization of Architectural Support for Enterprise Transformation	0
Scenarios for the Internet Migration of the Television Industry	0
Options for Formulating a Digital Transformation Strategy	10
Unlocking Sustained Business Value from it Investments	160
Linking Benefits to Balanced Scorecard Strategy Map	160
Project benefit management: Setting effective target benefits	160
The Benefits of Enterprise Architecture in Organizational Transformation	100
How to deliver more business benefits from IT investments	180
Capability-based planning with TOGAF? and ArchiMate?	160
How Does Enterprise Architecture Add Value to Organizations?	180
Enterprise Architecture as Information Technology Strategy	50
Defining the optimal level of business benefits within IS/IT projects: Insights from benefit identification practices adopted in an IT Service Management (ITSM) project	90
Extending enterprise architecture modelling with business goals and requirements.	110
From enterprise architecture to business models and back.	200
Mapping the Business Model Canvas to ArchiMate	120
Resource-Based and Value-Based Extension for Archimate	180
Modelling Strategy with ArchiMate	180
Enterprise Architecture and Enterprise Architecture Artifacts: Questioning the Old Concept in Light of New Findings	0
Achieving benefits with enterprise architecture	150
Business architecture: A differentiating element in the growth of organizations	20
Benefits Management: How to increase the business value of your IT projects (2nd Edition)	160
ANALYSIS OF FEDERATED ENTERPRISE ARCHITECTURE MODELS	70
Deriving Viewpoints for Enterprise Architecture Analysis Deriving Viewpoints for Enterprise Architecture Analysis	0
Business Model Grounds and Links: Towards Enterprise Architecture Perspective	20
The ”how” of benefits management for digital technology: From engineering to asset management	130
A Comparison Enterprise Architecture Implementation Methodologies	80
Better Business-IT Alignment Through Enterprise Architecture: An Actor-Network Theory Perspective	30
Getting Business Transformation Right - Combining BPM and EA	10
Aligning Enterprise Architecture with Strategic Planning	20
Alignment of Business Enterprise Architectures using fact-based ontologies	10
Using Enterprise Architecture Standards in Managing Information Technology	10
Enterprise Architecture: Creating Value by Informed Governance	160
Value cost impact analysis: Estimating the IT cost impact of business developments	110
Essential Skill of Enterprise Architect Practitioners for Digital Era	10
Representation and analysis of enterprise models with semantic techniques: an application to ArchiMate, e3value and business model canvas	170
The Anatomy of the ArchiMate Language	160
Enterprise Architecture design for ensuring strategic business IT alignment (integrating SAMM with TOGAF 9.1)	10

Table 3.2: SLR Article Data Extraction Selection

Title	Quality Score	EA subject relevant for the modeling	BDN with relevance for the Research	Benefits Relevant	Archimate relevant
A Comparison Enterprise Architecture Implementation Methodologies []	80	Yes			
Achieving benefits with enterprise architecture [Shanks et al., 2018a]	150		Yes	Yes	Yes
ANALYSIS OF FEDERATED ENTERPRISE ARCHITECTURE MODELS	70	Yes			Yes
Benefits Management: How to increase the business value of your IT projects (2nd Edition) [Ward and Daniel, 2012]	160		Yes	Yes	
Better Business-IT Alignment Through Enterprise Architecture: An Actor-Network Theory Perspective	30	Yes			Yes
Capability-based planning with TOGAF? and ArchiMate?	160	Yes			Yes
Defining the optimal level of business benefits within IS/IT projects: Insights from benefit identification practices adopted in an IT Service Management (ITSM) project	90		Yes	Yes	
Enterprise Architecture as Information Technology Strategy	50	Yes			
Enterprise Architecture: Creating Value by Informed Governance	160	Yes			Yes
Extending enterprise architecture modelling with business goals and requirements.[Engelsman et al., 2011b]	110	Yes		Yes	Yes
From enterprise architecture to business models and back. [Iacob et al., 2012]	200	Yes	Yes	Yes	Yes
How Does Enterprise Architecture Add Value to Organisations? [Shanks et al., 2018a]	180	Yes	Yes	Yes	
How to deliver more business benefits from IT investments [Ward and Daniel, 2013]	180	Yes	Yes	Yes	
Linking Benefits to Balanced Scorecard Strategy Map	160		Yes	Yes	
Mapping the Business Model Canvas to ArchiMate [Meertens et al., 2012]	120	Yes	Yes	Yes	Yes
Modelling Strategy with ArchiMate [Aldea et al., 2015]	180	Yes	Yes	Yes	Yes
Project benefit management: Setting effective target benefits	160		Yes	Yes	
Representation and analysis of enterprise models with semantic techniques: an application to ArchiMate, e3value and business model canvas [Caetano et al., 2016]	170	Yes		Yes	Yes
Resource-Based and Value-Based Extension for Archimate	180	Yes	Yes		Yes
The how of benefits management for digital technology: From engineering to asset management [Matthews, 2019]	130		Yes	Yes	
The Anatomy of the ArchiMate Language	160	Yes			Yes
The Benefits of Enterprise Architecture in Organizational Transformation	100	Yes		Yes	
Unlocking Sustained Business Value from it Investments [Peppard et al., 2007]	160		Yes	Yes	
Value cost impact analysis: Estimating the IT cost impact of business developments		Yes	Yes	Yes	

3.7 The Value of EA to the Organizations

In a complex business environment with radical changes, organizations need to innovate and adopt proper and effective business strategies. *"But, just only to build business strategies is worthless. Proper business processes should execute the business strategies flexibly, and proper enterprise resources should support the business processes systematically"* [Kang et al., 2010].

At the management level, an adequate instrument is required to sustain the decision-making process in an informed way and in a timely manner, and optimal governance of resources and that also addresses the concerns of stakeholders regarding the transformation processes.

EA, as a systematic process provides *"management with insight and overview to harness complexity. Where classical approaches will handle problems one by one, enterprise architecture aims to deal with these issues in a coherent and integral fashion"* [Op 't Land et al., 2008].

Organizations also need to develop two complementary dynamic capabilities to identify opportunities for organizational change. There are opportunities within organizations for change projects that are IT-driven and others that are business-driven. Both ways of identifying change opportunities will lead to both IT and business benefits at the project level.

The EA service capability needs to be positioned within organizations so that it has the opportunity to advise both IT-driven as well as business-driven initiatives. Organizations, where EA follows the more traditional IT focus, can still gain value but are not using their EA service capability to its full potential. The emerging use of EA within business-driven change projects can lead to significant project and organizational benefits [Shanks et al., 2018b].

Findings:

EA is applicable and benefits organizations that are embracing digital migration projects and that operate in fast-changing and complex business environments.

For EA to deliver benefits to the organization, proper EA capability must be established with full management support, supporting also the integration with other management methodologies.

3.8 Modeling Strategy with TOGAF, ADM, and ArchiMate

Most EA modeling techniques focus on what the enterprise should do by representing 'as-is' and 'to-be' architectures in terms of informational, behavioral, and structural model elements at different architectural layers, e.g. a business, application, and technology layer. Little or no attention is paid to represent (explicitly) the motivations or rationale, i.e. the why, behind the architectures in terms of goals and requirements [Engelsman et al., 2011b].

The "The Open Group Architecture Framework (TOGAF)" provides a method and tools to develop Enterprise Architecture (EA) for organizations. TOGAF views EA implementation as a continual process and it's a de facto standard for EA practitioners.

Architecture Development Method (ADM) is the core of TOGAF and consists of an iterative method to implement EA on an organization and materializes on the Enterprise Continuum, a repository of the relevant Architectural Assets that provide a holistic vision of the organization regarding technology, processes and strategy.

The implementation of IT technology requires an integrated vision on the relation it has with the business and in the way it will support the vision of the organization, to maximize the investment and benefits generated for the business [Group, 2018].

ArchiMate has been developed to address the TOGAF framework, as a graphical modeling language, provides a vision of the architecture representing the distinct elements that assist decision making and stakeholder information. A key element of ArchiMate is the layered view and ability to create distinctively viewpoints, to address each stakeholder requirements, together with the possibility of accommodating extensions to the needs that arise from new concepts [Group, 2019].

Some literature covers modeling strategy concepts in ArchiMate. The relevance of these studies focuses on how to link high-level strategy with the resources and processes in place to achieve the strategic business directions.

ArchiMate is an EA modeling language, intended to design understandable models to the stakeholders by using an easy concrete syntax. However, viewpoints defined in ArchiMate may not be sufficient to model all possible aspects from an EA. The definition of new viewpoints can be an impossible task if the necessary concepts are not included in ArchiMate metamodels. Then, it is necessary to provide a way to extend ArchiMate meta-models, to enable the composition of customized EA metamodel, and a way to design viewpoints based on concepts [Peña and Villalobos, 2010].

By making use of the ArchiMate extensions, we can ensure a smooth transition from operational architecture descriptions to strategic business models using motivation and resource–capability models [Iacob et al., 2012].

By modeling the high-level strategy concepts, the impact of organizational change resulting from new strategies can be easier and more accurately determined than by using a business model. *"By relating strategy to architecture, we open the door to new possibilities such as making impact analyses of strategy on architecture and of changes in architecture on strategy"* [Aldea et al., 2015].

The Open Group's enterprise architecture modeling standard, ArchiMate provides a formal basis for modeling business models in ArchiMate. This facilitates tracking of requirements from business demands down to the design specifications. It helps to discover the effects of business model changes on architectural design [Meertens et al., 2012].

A fundamental challenge resides in defining mapping functions between the schemas that fit the context and purpose of the integration. Defining such functions may prove to be a complex or even unfeasible task depending on the semantic gap between the languages being mapped. Nevertheless, the application of semantic techniques to enterprise modeling brings value to the

enterprise engineering community of practice as it facilitates the integration and analysis of diverse modeling domains [Caetano et al., 2016].
Integration of enterprise architecture design, requirements management, and the application of principles, contributes to close the gap in Business-IT modeling. Architecture models are aligned to the vision, mission, and strategy of the organization by eliciting goals from stakeholder concerns and the organization's business plan which can then be traduced via principles and requirements into products, business services, business processes, and software applications that are implemented to realize the business goals [Engelsman et al., 2011a].

Findings:

ArchiMate is the standard for modeling EA concepts and providing a vision of the distinct dimensions of the organization to the stakeholders.

Modeling of strategy concepts in ArchiMate enables the possibility to analyze the interactions between strategy change and architecture impacts and vice versa.

3.9 BDN - Managing Benefits Realization.

Many expensive IT innovation projects suffer from the fact that the technical solutions they propose never materialize. Considerable research and investments go into the specification and development of yet another information system or prototype proving a novel concept that, eventually, fails to be absorbed into real-life settings. Such projects fail because they are merely the result of a technology push, initiated without a proper analysis of the problem in its enterprise context. To avoid such situations, any architecture change should be first judged from the perspective of its business fitness. To make this possible, a technique is necessary for relating enterprise architectures to business models [Iacob et al., 2012].
Surveys have demonstrated that only on 30% of projects the expected benefits were delivered, either because they were not existing or achievable or in 40% of the cases, they were not managed beside they were feasible. Benefits Management as a process has the objective of ensuring that realization of IT investments deliver the promised benefits to the organization. On implementing changes, these have to be managed to take into consideration that only through successfully managing the change, benefits can be realized [Ward and Daniel, 2013].

Very few of benefits-oriented practices are adopted in development projects, largely because IT professionals still tend to focus primarily on the delivery of a technical solution, on time, on budget, and to specification.IT projects must not be viewed and managed as an island, but rather as part of organizational life. By the establishment of an enterprise-wide, benefits realization capability organizations can rise to the challenge of generating value from their IT investments [Ashurst, 2012].

IT investments don't deliver benefits or create value by itself. Benefits arise when IT enables people to do things differently by performing their roles in more efficient and effective ways.

But, to be materialized, the benefits need to be actively managed during the project life cycle [Peppard et al., 2007].

Benefit management is one of the processes through which effective project governance improves project success. Project governors should champion benefits realization in the project governance system, enabling the development and implementation of a comprehensive benefit management process [ul Musawir et al., 2017, Serra and Kunc, 2015].
The Benefits Management approach involves essential business-related domains.*"Development of the BDN not only enables the knowledge and experience of business managers to be applied more coherently to planning the investment, it creates a clearer understanding of how different groups need to work together to achieve the benefits they and the organization wish to gain"* and provides a process to manage the potential benefits of IT investments. As [Ward and Daniel, 2013] stated, by involving key stakeholders on a benefits realization plan, *"Many organizations that have adopted this approach have not only improved the success of their IT projects but they have also significantly improved the relationship between their business and IT staff."*
Benefits Dependency Network addresses the construction of a benefits realization plan and realizes a framework that links *"the overall investment objectives and required benefits with the business changes necessary to deliver those benefits and the essential IT capabilities that enable the changes"*
[Ward and Daniel, 2013].

Benefits identification is a critical step in the benefits management process, which seeks to identify and document the benefits that will be the most relevant and convincing to contextually impacted stakeholders, these need to be involved in the process is a key success factor for benefits realization [Wijesinghe et al., 2016b].

The benefits management involves 5 stages [Matthews, 2019]:

1. Identifying and structuring benefits;
2. Planning benefits realization;
3. Executing benefits realization plan;
4. Evaluating and review results;
5. Discover the potential for future benefits.

Also in the realization plan and through the investment life cycle, the potential dis-benefits of the system should also be considered, i.e. what adverse impacts on the business organization it could have [Lin and Pervan, 2001, Ward and Daniel, 2012]. BDN acts as a mechanism that maps the changes required for benefits realization. Digital technologies offer new ways of creating and capturing value throughout the life-cycle of an asset and can facilitate pervasive changes to practice. By enabling and subsequently sustaining change the benefits of using technology can be realized [Matthews, 2019].

"Understanding the business context of the investment being considered is critically important. All too often, IT projects quickly become technology projects, rather than primarily business change projects with an IT component, and the context for the investment is soon forgotten" [Peppard and Ward, 2005].

Work produced on linking Benefits to Balanced Scorecard Strategy Map concluded that Benefits Management approach brings to the Strategy Map the process of identifying and structuring benefits, establishing the ownership and determining whether benefits can be managed and measured along their life-cycle [Gomes et al., 2013], this enhances the need to integrate Benefits Management with Enterprise architecture domain.

Findings:

Benefit management provides stakeholders with a process to monitor and manage the realization of projected benefits from IT investments.

IT investments are fundamentally business change projects. By involving stakeholders in the identification of the benefits and on the benefits realization plan, creates the possibility to deliver the projected benefits and discover new benefits during the project life cycle.

BDN presents a graphical model for benefits management that articulates the investment objectives with the enablers to provide them. However, a vision on the aspects of enterprise "As Is" and the "To Be" is lacking to handle them under an view.

Chapter 4

Solution Proposal

4.1 Proposal Development

To develop the proposal an identification and semantic description of the core concepts of BDN has been done.
An analysis of the ArchiMate layer structure has followed to establish which domains are involved to establish a representation of the BDN concept domains.
Having identified the ArchiMate concept candidates, an elaboration of a map between BDN concepts and ArchiMate and a justification for the equivalence. Another area to cover is the concept relationship mapping to represent the BDN concept relationships in ArchiMate. Also in this domain, semantic equivalence as been taken as the driver to achieve a coherent representation. As a final step, the description of the ArchiMate BDN viewpoint is proposed and also a viewpoint proposal.

4.2 BDN and ArchiMate Conceptual domains

The Benefits Management approach involves essential business-related domains."Development of the BDN not only enables the knowledge and experience of business managers to be applied more coherently to planning the investment, it creates a clearer understanding of how different groups need to work together to achieve the benefits they and the organization wish to gain" [Peppard et al., 2007].
The Driver concept relates the issues arising from the context where the organization operates, that executive and senior management identify as relevant to the organization proceed to changes. these justify investment objectives that result from benefits realization.
To achieve benefit realization, business changes are put implemented, enabled by IT/IS implementations.
This describes an abstract structure to explain [Ward and Daniel, 2012]:

- **Why** investment is being made?
- **What** types of benefits is the organization expecting to achieve?
- **How** can a combination of business changes and IT deliver those benefits?

These are questions that resemble the Zachman Framework^{TM} represented in figure 4.1, which " is the fundamental structure for Enterprise Architecture and thereby yields the total set of descriptive representations relevant for describing an Enterprise". The Framework is a generic classification scheme for design artifacts. These provide descriptive representations of complex objects to enable focus on selected aspects of an object, while keeping the contextual, or holistic, perspective [Zachman, 2016].

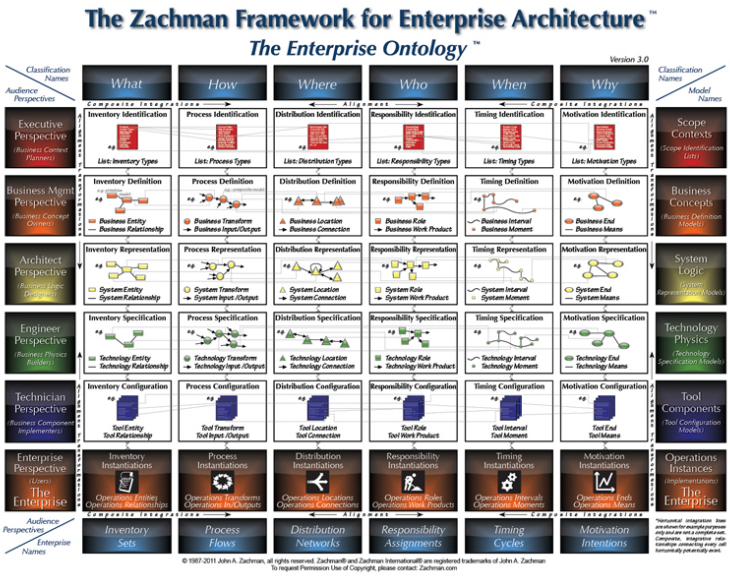


Figure 4.1: Zachman Framework [Zachman, 2016]

Zachman Framework^{TM} can be mapped into the TOGAF ADM to cover the different architectural domains [Group, 2006].

The correspondence regarding the BDN principles to the fundamental EA domain and the TOGAF EA framework is established by analyzing the outputs from the following phases:

- Preliminary Phase - Business principles, business goals, and business drivers as in Zachman Framework Scope/Motivation, Business/Motivation.
- Phase A: Architecture Vision - Plan for the architecture work.Refined statements of business principles, business goals, and strategic drivers.
- Phase B: Business Architecture - Validated business principles, business goals, and strategic drivers. Business processes, including measures and deliverables. Business roles, including the development and modification of skills requirements.
- Phase H Architecture Change Management - Establishing Value Realization process. Monitor business changes which could impact the Baseline Architecture, Monitor Enterprise Architecture Capability maturity, Track and assess asset management programs

The structure of the ArchiMate core language closely corresponds with the three main architectures as addressed in the TOGAF ADM. The strategy, motivation, implementation, and migration elements approximately map onto the remainder of the ADM (although these elements may also be used in Phases B, C, and D) [Group, 2019], as represented in Figure 2.3.

A motivation element represents the context or reason behind the architecture of an enterprise. These motivation aspects correspond to the “Why” column of the Zachman framework. Motivation elements are included in the language: stakeholder, value, meaning, driver, assessment, goal, outcome, principle, and requirement [Group, 2019].
The strategy elements are typically used to model the strategic direction and choices of an enterprise, as far as the impact on its architecture is concerned. They can be used to express how the enterprise wants to create value for its stakeholders, the capabilities it needs for that, the resources needed to support these capabilities, and how it plans to configure and use these capabilities and resources to achieve its aims [Group, 2019].
The complete ArchiMAte framework integrates the motivation and strategy elements as represented on Figure 4.2.

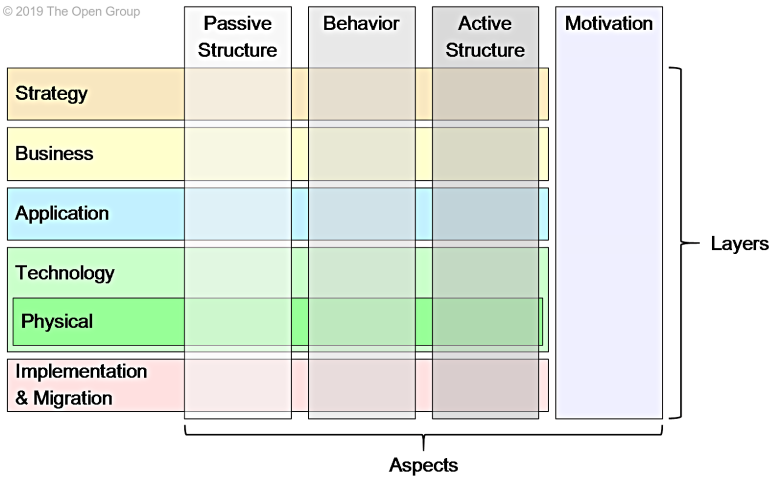


Figure 4.2: ArchiMate full framework [Group, 2019]

4.3 BDN and ArchiMate Elements

The core of ArchiMate metamodel is composed of 2 main models: Structure and Behavior. Also, the structure elements are divided into Active Structure and Passive Structure. Being the first, elements tat can perform a behavior and the passive elements where a behavior is performed. Behavior elements are designated by verbs and define actions that can be either internal or external to the organization and therefore be performed using an active or over a passive structure element. Behavior elements refer to processes, functions, interactions, or services when exposed to the exterior.
While these core elements cover the descriptions of the enterprise systems, they are not covering the aspects related to elements that are driving the design of the system, answering the

”Why” that we find on the Zachman Framework and as well as on the BDN Benefits planning. These are covered by the Motivation Elements on ArchiMate.
Motivation elements included in ArchiMate are stakeholder, value, meaning, driver, assessment, goal, outcome, principle, and requirement These are intrinsically aligned with the concepts: Stakeholder, Driver, Investment Objectives, and Benefits.
ArchiMate includes the Strategy layer that enables to model the strategic direction and choices of an enterprise, as far as the impact on its architecture. Strategy elements can be used to express how the enterprise wants to create value for its stakeholders, the capabilities it needs for that, the resources needed to support these capabilities, and how it plans to configure and use these capabilities and resources to achieve its aims. These include both Behavioural elements as Capability, Value Stream, and Course of Action as well as one Structure element: Resource.
BDN elements as Business Changes and Enabling Changes are mainly focused on how the enterprise is configured to achieve the investment goals and realize the benefits. These are behavioral elements that respond to the How question that figure either on Zachman framework as well as on the BDN Benefits realization plan.
BDN Benefits Realization Plan includes the element Technology Enabler this is a core structural element that can either perform behaviors or where behavior is performed either to the interior or exterior of the enterprise. These align with the Structural element of the ArchiMate, Strategy layer.

4.4 BDN and ArchiMate concepts

To model BDN in ArchiMate the semantics of each BDN concept is compared with the semantics of ArchiMate concept that integrates a layer coherent with the concepts considered in the Benefit Realization framework. The correspondence of concepts is summarized in Tables 4.1 and 4.2 for concepts and relationships respectively.

4.4.1 BDN Business Driver Concept

BDN Business Drivers: Issues with executive and senior managers agree mean the organization needs to make changes and the timescales for those changes. Can be internal or external but are specific to the context [Ward and Daniel, 2012].
ArchiMate Drivers: *”A driver represents an external or internal condition that motivates an organization to define its goals and implement the changes necessary to achieve them.”* The factors which influence other motivation elements. They can originate from either inside or outside the enterprise [Group, 2019].

Justification: Clear semantic alignment between TOGAF and ArchiMate **Driver** concept with the **Business Drivers** on BDN. The Driver has no representation on BDN, however is a

Table 4.1: BDN to ArchiMate Concept Correspondence

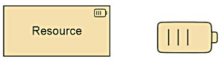
BDN Concept	BDN Description	ArchiMate Concept	ArchiMate Description
Business Driver	Issues with executive and senior managers agree mean the organization needs to make changes and the timescales for those changes. Can be internal or external but are specific to the context.	Driver 	A driver represents an external or internal condition that motivates an organization to define its goals and implement the changes necessary to achieve them. the factors which influence other motivation elements. They can originate from either inside or outside the enterprise.
Investment Objectives	statements that describe what the organization is seeking to achieve from the investment. They should be a description of what the situation would be on successful completion of the investment.	Goal 	A goal represents a high-level statement of intent, direction, or desired end state for an organization and its stakeholders.
Business Benefit	An advantage of a stakeholder or group of stakeholders that implies that the benefits are owned by the individuals or groups who want to obtain value from the investment.	Outcome 	Outcome represents an end result. Outcomes are high-level, business-oriented results produced by capabilities of an organization, and by inference by the core elements of its architecture that realize these capabilities.
Business changes	New ways of working that are required to ensure that desired benefits are realized This will be the ongoing ways of working in the organization.	Value Stream 	Represents a sequence of activities that create an overall result for a customer, stakeholder, or end user.
		Capabilities 	A capability represents an ability that an active structure element, such as an organization, person, or system, possesses.
Enabling Changes	Changes that are prerequisites for achieving the business changes or that are essential to bring the system into effective operation within the organization. Enabling changes are one off activities rather than ongoing ways of working. - agreeing new working practices, redesign processes, change to job roles and responsibilities, training, new business skills.	Course of Action 	Represents an approach or plan for configuring some capabilities and resources of the enterprise, undertaken to achieve a goal.
IT Enablers	information systems and technology needed to support the realization of identified benefits and to enable changes	Resource 	Represents an asset owned or controlled by an individual or organization.

Table 4.2: BDN to ArchiMate Relationship Correspondence

BDN Connections	Justification	ArchiMate Relationship	ArchiMate Description
Business Changes-Business Benefits.	Business Benefits is a result of realization of the precedent concept.	**Realization** 	The realization relationship represents that an entity plays a critical role in the creation, achievement, sustenance, or operation of a more abstract entity.
IT Enabler - Enabling Changes	In order too respect the ArchiMate Ontology when used in design tools as Archi this was the relationship used to connect IT Enabler and Enabling Changes	**Association**	The Association Relationship represents relationships that are unspecified or one that is not represented in ArchiMate.
Enabling Changes - Business Changes	Enabling Changes serves the Business Changes so Serving relationship is applied on the model.	**Serving** 	The Serving Relationship represents that an element provides its functionality to another element
Driver - Investment Objectives	he Driver Concept has no representation on BDN , however is a fundamental element on he benefit realization plan and can, if required, be represented on ArchiMate.The BDN Driver influences the definition of Business Objectives,	**Influence** 	The influence relationship represents that an element affects the implementation or achievement of some motivation element

fundamental element on the benefits realization plan.

4.4.2 BDN Investment Objectives Concept

BDN Investment Objectives: Statements that describe what the organization is seeking to achieve from the investment. They should be a description of what the situation would be on the successful completion of the investment [Ward and Daniel, 2012].
ArchiMate Goal: ”A goal represents a high-level statement of intent, direction, or desired end state for an organization and its stakeholders. Goals are typically used to measure the success of an organization” [Group, 2019].

Justification: ArchiMate **Goal** is semantically aligned with BDN **Investment Objectives**

4.4.3 BDN Business Benefit Concept

BDN Business Benefit: An advantage of a stakeholder or group of stakeholders – that implies that the benefits are “owned” by the individuals or groups who want to obtain value from the investment [Ward and Daniel, 2012].
ArchiMate Outcome: An outcome represents an end result. Outcomes are high-level, business-oriented results produced by capabilities of an organization, and by inference by the core elements of its architecture that realize these capabilities. Outcomes are tangible, possibly quantitative, and time-related, and can be associated with assessments. An outcome may have a different value for different stakeholders.

Justification: ArchiMate **Outcome** concept is semantically aligned with BDN **Business Benefits** concept.

4.4.4 BDN Business Changes Concept

BDN Business Changes: New ways of working that are required to ensure that desired benefits are realized – this will be the ongoing way of working in the organization.
ArchiMte Value Stream and Capabilities: ”The strategy elements are typically used to model the strategic direction and choices of an enterprise, as far as the impact on its architecture is concerned. They can be used to express how the enterprise wants to create value for its stakeholders, the capabilities it needs for that, the resources needed to support these capabilities, and how it plans to configure and use these capabilities and resources to achieve its aims.” If multiple actions need to be put in place to achieve a benefit, a value stream can be used for modeling the business changes as ”Value stream represents a sequence of activities that create an overall result for a customer, stakeholder, or end-user”. ”Value streams are combined by

capabilities alignment, a capability represents an ability that an active structure element, such as an organization, person, or system, possesses."

"Capabilities are expressed in general and high-level terms and are typically realized by a combination of organization, people, processes, information, and technology" [Group, 2019]. Benefits realization from IT investments can be considered as a result of an organizational capability that ensures that investments made in IT consistently generate value [Ashurst, 2012].

Justification: ArchiMate **Value Stream** and **Capability** concepts are used in conjunction to align with concept BDN **Business Changes**

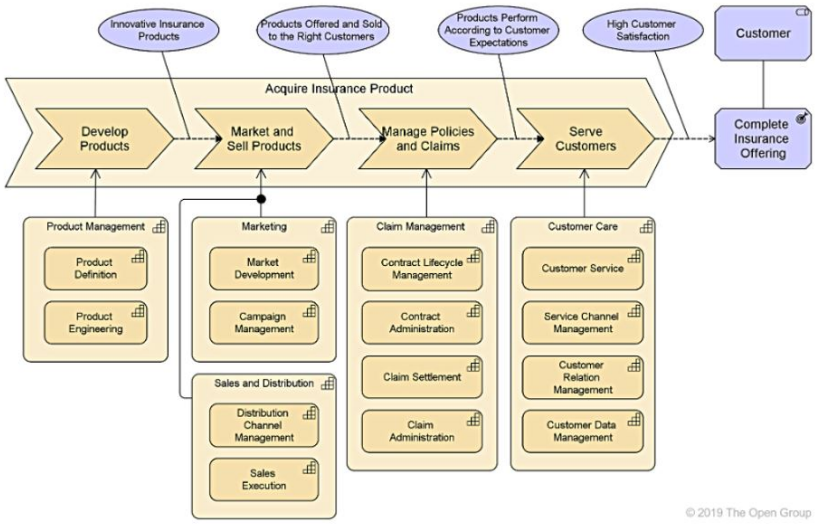


Figure 4.3: ArchiMate Value Stream and Capability integration [Group, 2019]

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4.4.5 BDN Enabling Changes Concept

BDN Enabling Changes: Prerequisites for achieving the business changes or that are essential to bringing the system into effective operation within the organization. Enabling changes are "one-off" activities rather than ongoing ways of working. Agreeing on new working practices, redesign processes, change to job roles and responsibilities, training, new business skills [Ward and Daniel, 2012].
ArchiMate Course of Action: "A course of action represents an approach or plan for configuring some capabilities and resources of the enterprise, undertaken to achieve a goal" [Group, 2019].

Justification: The BDN concept relates to an action that becomes an IT enabler and represents the Behavior element which is defined for the ArchiMate Course of Action concept which

defines an action that involves resources, defined on a plan to configure other capabilities. ArchiMate **Course of Action** concept was adopted on this model to represent the BDN **Enabling Changes** concept.

4.4.6 BDN Enabling IT Concept

BDN Enabling IT: Information systems and technology needed to support the realization of identified benefits and to enable changes. The IT enabler is defined as a structure element [Ward and Daniel, 2012].
ArchiMate Resource: "A resource represents an asset owned or controlled by an individual or organization. Resources can be classified in different ways: tangible assets, intangible assets, and human assets" [Group, 2019].

Justification: ArchiMate **Resource** concept from Strategy elements is the representation of a capability provided by structural elements. Very broaden in the type of elements that can represent, provides the BDN **Enabling IT** concept with different possibilities to extend to other types of structural elements.

4.5 Relationships

BDN Network uses arrows that are drawn from objectives to benefits - each investment gives rise to one or more benefits. Each connection consists of the realization of each step. The correspondence representation and justifications are present in Table 4.2.

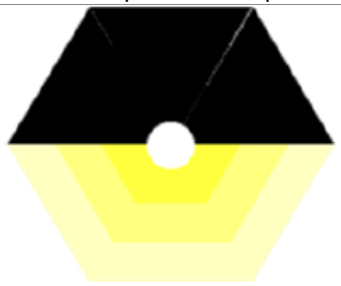
4.6 The BDN to ArchiMate Correspondence Tables

The BDN Concept and Relationships alignment with ArchiMate Concepts and Relationships are summarized in Tables 4.1 and 4.2.

4.7 The Benefits Management Viewpoint

In Table 4.3 is presented the Benefits Management Viewpoint Description and in Figure 4.4, the implementation of the proposed concept alignment and connections to represent the BDN Network. The viewpoint incorporates concepts that are intrinsically related to motivation and strategy concepts.

Table 4.3: Viewpoint Description

Viewpoint Description	
Stakeholders	Stakeholders, business managers, enterprise and ICT architects, business analysts, CxOs, business managers.
Concerns	Business-oriented results, Architecture strategy and tactics.
Purpose	Designing, deciding, informing
Abstraction Level	Overview, Coherence, Details
Layer	Business, Application, and Technology layer.
Aspects	Motivation, Strategy

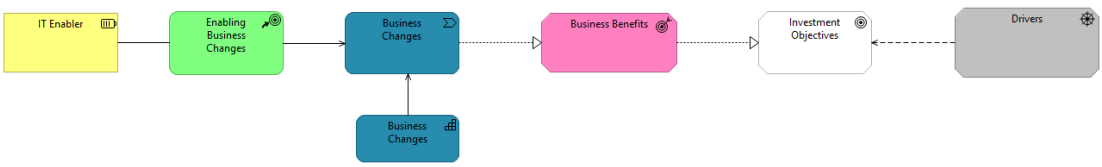


Figure 4.4: BDN Viewpoint

Chapter 5

Demonstration 1
Music Hall Use Case

5.1 Music Hall Project Description.

Founded for the event Porto European Cultural Capital 2001, the Music Hall for this use case is a cultural institution with an activity-oriented for music performance and education. Based in Porto center, in a landmark building where invited artists, from distinct music genres, perform music shows to their audiences.

The auditoriums can record the performances and register audio and video.

The audiovisual content recorded has been archived in standard IT storage. With the growing volume of assets,the management of content became complex as there was no structured application to manage and find content that had a monetization potential.

In 2015, the Music Hall management launched a project to implement a platform that could handle and manage the multimedia content with the objectives of:

- Be able to access the audiovisual content to select relevant parts and export them in different formats to supply or sell to external entities.
- Be able to add metadata with relevant aspects of the content: artists, musical genres, descriptive text, formats, and customized tags.
- Connect the audiovisual Archive with the external web site, enabling external entities to perform searches and find content based on selected metadata fields.
- Enable selected content to be used by external collaborators to be able to produce the finished product of shows.
- Enable backup storage that could not be affected by IT operations or accidents/incidents as Ransomware or other virus attacks.

The main business drivers were safeguarding the assets existing in house, be able to monetize them, and contribute to show to the stakeholders (Governmental entities, Sponsors, and the general public) the cultural value generated by the Music Hall since the time of its foundation.

After evaluating different solutions available in the market, Music All management implemented Navigator X a media asset management platform. Also, it enables the creation of automatic workflows to process content conversion, deliveries,and contribution to the external portal team, integration with Cloud Platforms, to use external collaborations to produce finished content from the raw recordings. Additionally, Music Hall management adopted the Sony Optical Disk Archive (ODA), archive solution, for the backup of the content, which directly interfaced with the Sony Navigator X platform.

The decision was based on the analysis of the technical and operational analysis from the technical and operations team, and from the typical financial decision with main drivers being Return On Investment (ROI) and Total Cost of Ownership (TCO). Benefits evaluation required difficult assessment taking into account the resources available.

The presentation of how BDN benefits management framework integrates with an EA framework based on ArchiMate was performed for this use-case, as the project insight information was available.

5.2 The EA ArchiMate Model Applied to Music Hall.

"The task of EA is to translate the broader principles, capabilities, and goals defined in the strategies into systems and processes that enable the enterprise to realize these goals" [Tamm et al., 2011]

. The first step consisted of an approach to a layered concept of services that Music Hall provides either internally or to its customers. The architecture of services, by different nature, are separated into technology, application, and business viewpoints, enabling that stakeholders with different motivations can look into each area of interest.

A layered viewpoint provides stakeholders with a holistic view of the different service layers and their interconnection points.

For constructing the EA model for this case study, ArchiMate was used, as it contributes with a framework that provides a structure that enables similarity between models used on the different layers, so they can align with each other.

The Motivation layer:

This layer models "the motivations or reasons, that underlie the design or change of an enterprise architecture" [Lankhorst, 2017b] On this model, represented in Figure 5.1, the definition of stakeholders, value, goals, requirements, assessments, and their inter-dependencies are presented to enable a vision of project reasons from a top management viewpoint.

The Business Viewpoint:

On this layer, represented in Figure 5.2 the viewpoint illustrates the organization structure in terms of processes, their interrelation, and their relation to actors involved. This contributes to a viewpoint for stakeholders related to the operations to deliver the services provided by the Music Hall.

Business-Application Alignment Viewpoint:

Application components encapsulate functionalities that are exposed as services that serve business layer. On this viewpoint, represented in Figure 5.3, a model of how the business is enabled by the applications provide either business or technology stakeholders with a more granular vision of how alignment between technology services and business behaviors.

However, the connection between projected benefits and technology infrastructure is not obtained, and how technology changes interact with different benefits. This demonstrates that an EA response to support benefit management is an extension that would enrich the framework.

Technology Usage viewpoint:

This viewpoint, represented in Figure 5.4, illustrates how applications that enable business processes are supported by software and hardware infrastructure and provides a vision for scaling the physical elements of the project in order to achieve the required performance.

Layered Viewpoint:

This viewpoint, in Figure 5.5, enables stakeholders to be provided with a holistic vision of how business processes and technology are aligned in order to meet the goals defined by the motivation layer.

Findings:

The application of the different viewpoints provides stakeholders with relevant information regarding:

- Motivation for the investment, and business process transformation;
- Business processes;
- The connection between business process and applications;
- Technical infrastructure to support the business processes;

5.3 The Benefits Management Framework applied to the Music Hall.

The benefits management approach consists of a plan to realize benefits starting on the initial definitions and accurate definition of are the expected benefit outcome for the project but linked across project implementation and post-implementation to guide decisions on how to adjust project scope, in order to keep in line with the projected benefits.

The Benefits Dependency Network (BDN) provides the “framework for explicitly linking the overall investment objectives and required benefits, with the business changes necessary to deliver those benefits and the essential IT capabilities that enable the changes” [Ward and Daniel, 2013]

The framework implementation defines the following five steps:

1. Identify Structure Benefits;
2. Plan benefits realization;
3. Execute benefits plan;
4. Review and evaluate results;
5. Establish the potential for further benefits.

These are iterative at some stages, namely: 2 and 3, 3 and 4, and 2 and 4.

The Benefits Realization Plan methodology was applied to identify the specific business elements that align with each of the BDN concepts in Table 5.1 to create the view in Figure 5.7. The Benefits Management application to this case was based on the knowledge of the project, and not as a process taken formally for the project. Following the Benefits Realization Plan process: Drivers, Investment Objectives, Benefits, Business Changes, Enabling Changes, and Enabling IT are identified and are summarized in Table 5.1, and explained as follows:

- **Project Drivers:** Preserve the activity of the Concert Hall as a cultural asset, Reduce the dependency of financing from external stakeholders and Provide visibility of the activities to stakeholders and society, to demonstrate the value of the institution as a cultural asset.

- **Investment objectives:** Content preservation, content monetizing, and an automated workflow to not increase the headcount, and as well as minimize workload impact on the existing staff.

- **Business Benefits:** Content archive availability to be used either for production as well as for the historic preservation, the enabling of revenue from content production, and automation of the content production workflow to use fewer resources in terms of headcount and processes.

- **Business Changes:** Where mainly the definition of new workflows to produce content, manage the content archive, and integration with the web portal platform, involving the definition of roles for the different areas to provide each of the services.

- **The Enabling changes:** Focused on workflow, role definitions and training.

- **IT Enabler:** Consists of a content management system which integrates a workflow management tool that enables the digital processing of content from the acquisition of content during events, thorough content post-production using outsourced production, via an application on the cloud interfacing with the on-premise system, and interfacing with Web Portal management and with an archive workflow. The business processes design focused on maximizing the operational efficiency through the use of the technology and enabled by workflow design and role definitions for each of the production roles. Technology enabler is provided by the Sony Navigator X platform, that interfaces with Sony Ci Cloud and Optical Disc Archive system, and also by the design of scripts to interface with the institution's web portal.

The application of the BDN framework to the case is expressed in Table 5.1 and the graphical representation following the framework is represented in Figure 5.6. In Table 5.1 is expressed the application of the BDN framework to the case. Figure 5.6 exhibits the graphical representation resultant from the framework.

Table 5.1: Music Hall BDN Concept Identification

Drivers	
	Provide Stakeholders (Patrons and State and Community) with visibility of the activity.
	Preservation of history of the Institution.
	Reduce dependence of external financing by self financing.
Investment Objectives	
	Content Monetizing.
	Content Preservation.
	Automated Workflow
Benefits	
	Content Sales Revenue.
	Archive Availability
	Cost reduction of Content Production
Business Changes	
	Sales Portal Integration
	Content Management Automated Workflow.
	Archive Workflow
	Content Transcoding Automation
	Automated external post production workflow.
Enabling Changes	
	Define Content Management Workflows
	Define Content Management Roles
	Training for Content Management Applications
	Platform administration training
	Workflow design for Nav X platform
IT Enablers	
	Navigator X Application suite
	Sony Ci Cloud platform
	Archive Solution based on Sony ODA drive

5.3.1 Value provided by integrating BDN with Archimate

The development of the architectural aspects of the solution, using ArchiMate provides stakeholder views concerning all core project aspects of technology, application usage, business roles.

Through the Motivation Elements, is also possible to achieve a representation of the elements behind the project drivers and realization.

The benefits realization management concept is not present in the ArchiMate extensions as well as the architectural views are not present in the BDN framework.

Creating a viewpoint for the effect of benefits management follows the guidelines expressed for using viewpoints [Lankhorst, 2017a]:

- **Scope:** as it selects the appropriate domain that needs to be represented or modeled, in this case the BDN domain;
- **Creation of views:** as it creates or selects the actual content of the viewpoint to create a selection or part of the larger pre-architecture model;
- **Validation:** this is still work in progress to obtain an agreement that the model is representative of the actual or intended situation. The purpose of this work is to provide stakeholders with the tools for the benefits realization inside the architectural domain;
- **Obtaining commitment** about this model is the following step after validation that ensures that a commitment about the impact of what is described on the view;
- **Informing:** other stakeholders not directly involved in plans and impact.

As also defined [Lankhorst, 2017a], the creation of composite viewpoints is relevant to fit with the intended audience and need not to stick with the standard ArchiMate notation which allows the definition of new viewpoints.

By providing the Benefits Management viewpoint on ArchiMate, is possible to establish the link with views covering different domains of the Architecture.

This supports the understanding of how specific aspects of the business or technical viewpoints can affect benefit realization.

To provide a specific view of how IT Enablers relate with the Technology, application, business roles, and services of the Concert Hall a layered view of the specific viewpoint was created and represented in Figure 5.8.

The representation of the integration of the BDN ArchiMate view with other architectural domains for the Concert Hall case is present in Figure 5.9. On the left section of the model is present the Technology and Business domains representation, for this case, and by the integration of BDN in ArchiMate, these domains can be related to the appropriate BDN concepts for the benefits realization management.

The possibility to address BDN via an ArchiMate representation, as provided in figure 5.9 enables the modeler to provide the same conceptual scheme that is established in the original BDN Benefit realization plan and therefore be integrated into the Benefits Management framework.
The advantage for the ArchiMate representation is that it can be used to address the different stakeholders providing a holistic view of how other architectural layers have relationships with the benefits and investment objectives as in the figure.

Specific views to address particular stakeholders like the one provided by figure 5.10 to address the Archive technology resources realize the capabilities and Value Streams to deliver the planned benefits.

On this representation, the specific area of the Archive is represented. It connects with the business changes and benefits to be realized by this investment.

The viewpoint intends to relate the Resources (IT Enablers) with the Capabilities associated with the Benefits realization.

5.4 Demonstration Results

The application of the proposed solution to the Concert Hall use-case evidence that the concepts are aligned with the ArchiMate concepts to provide a coherent representation of either the BDN framework as well as integration it with different architectural domains.
The use of the concepts present in the ArchiMate framework revealed that both frameworks can be related in the context of the Media Production to manage benefits realization from technology investments.

By relating them with other layers of the technology and business configurations enables different levels of abstraction to address requirements from different stakeholders.

In this context, there are still areas of Benefits Realization Plan that require integration on the model to fully complete the Benefits Realization framework.

The data related with Business Changes Owner and Benefits Owner was not available as well as the quantification of the benefits to be realized, therefore, for the BDN concept application a simpler approach was considered on a first phase to provide an initial understanding of the coherence.

An application to a project portfolio management is also required to obtain a broader approach evaluation of the BDN application on an architectural domain.

With the leanings obtained on this demonstration ta second demonstration was realized, involving a larger scale project to consolidate the concept applications.

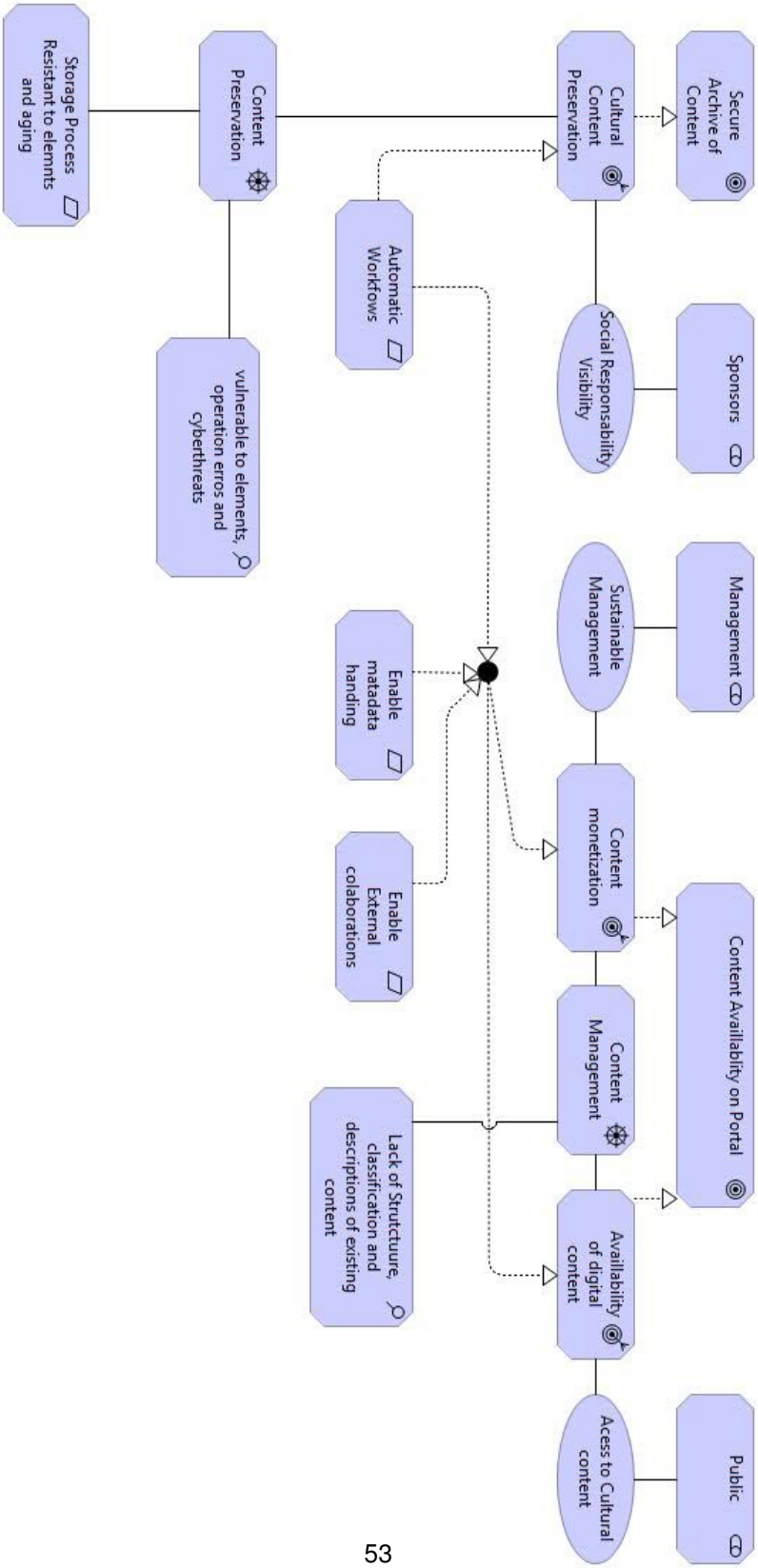


Figure 5.1: ArchiMate Motivation Viewpoint

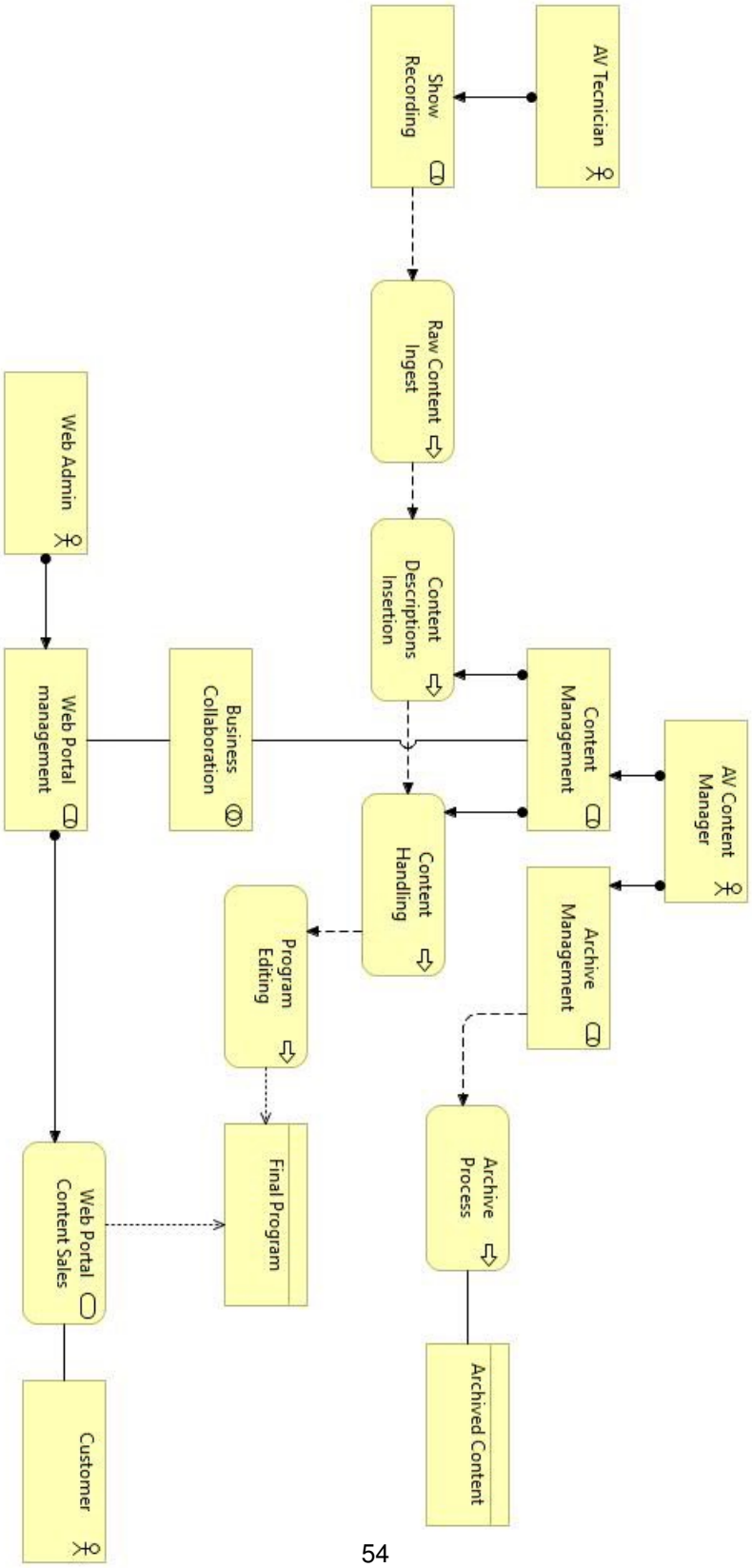


Figure 5.2: ArchiMate Business Viewpoint

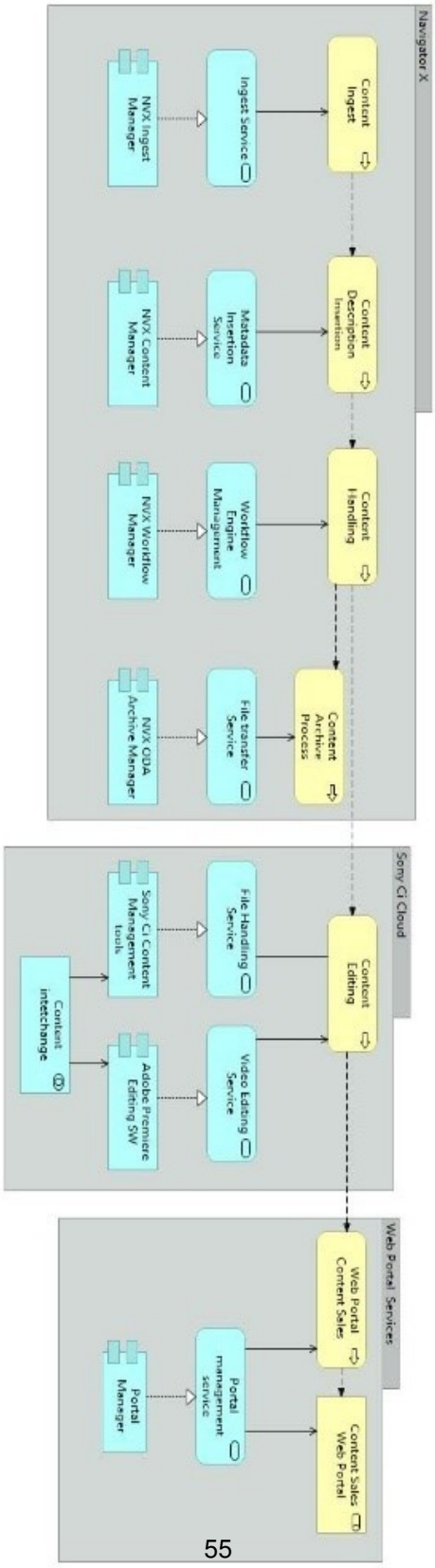


Figure 5.3: Application Usage Viewpoint

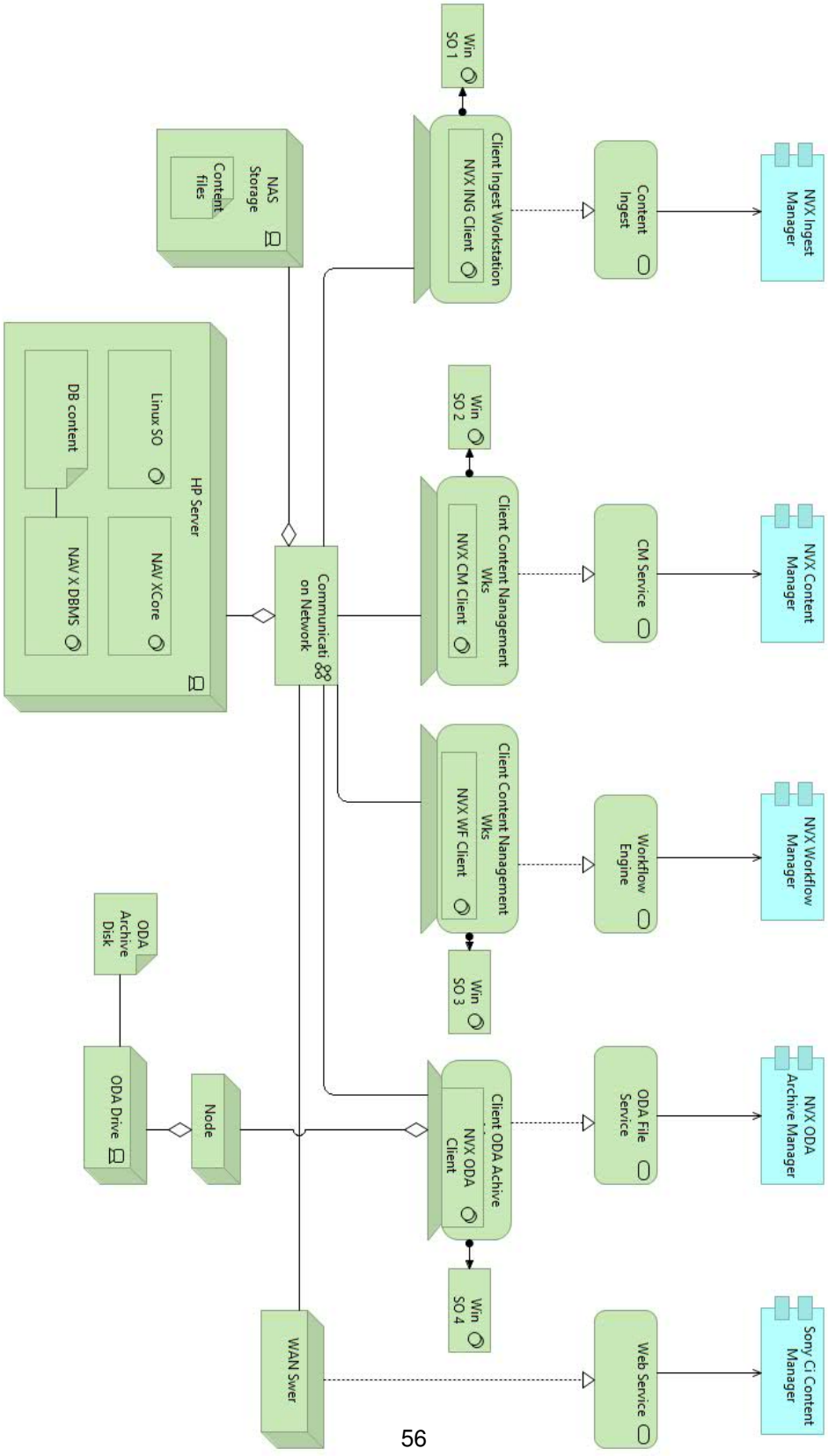


Figure 5.4: Tecnology Usage Viewpoint

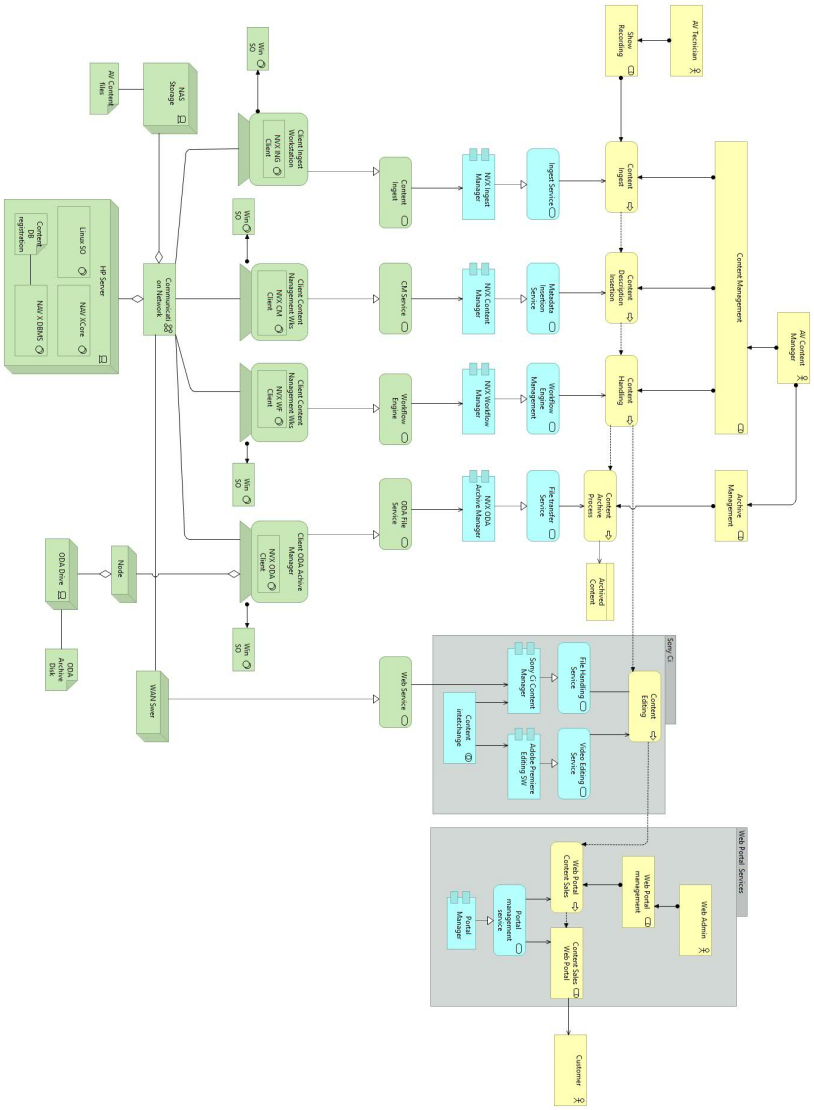


Figure 5.5: Layered Viewpoint

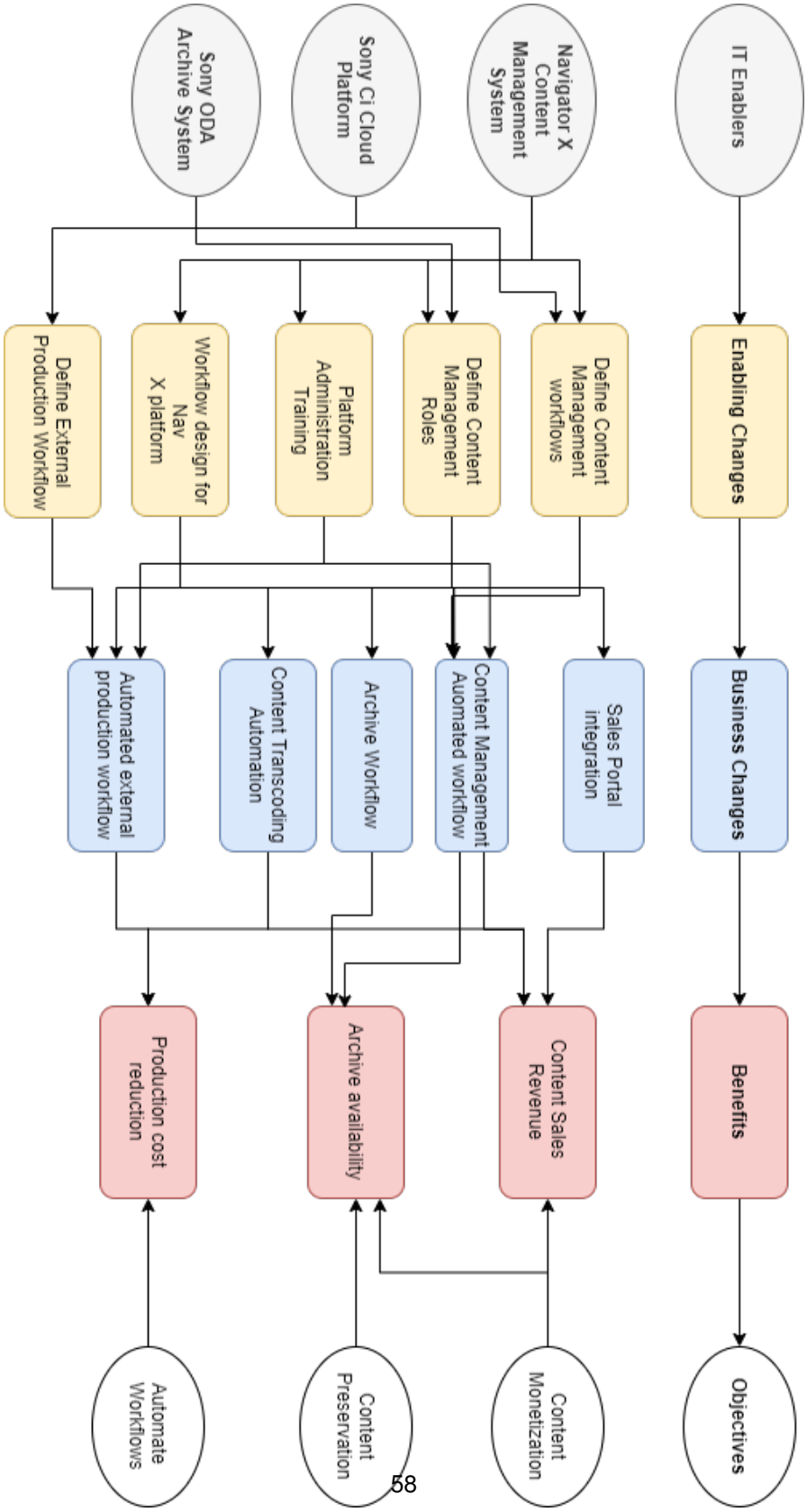


Figure 5.6: ArchiMate Model for Concert Hall BDN Viewpoint

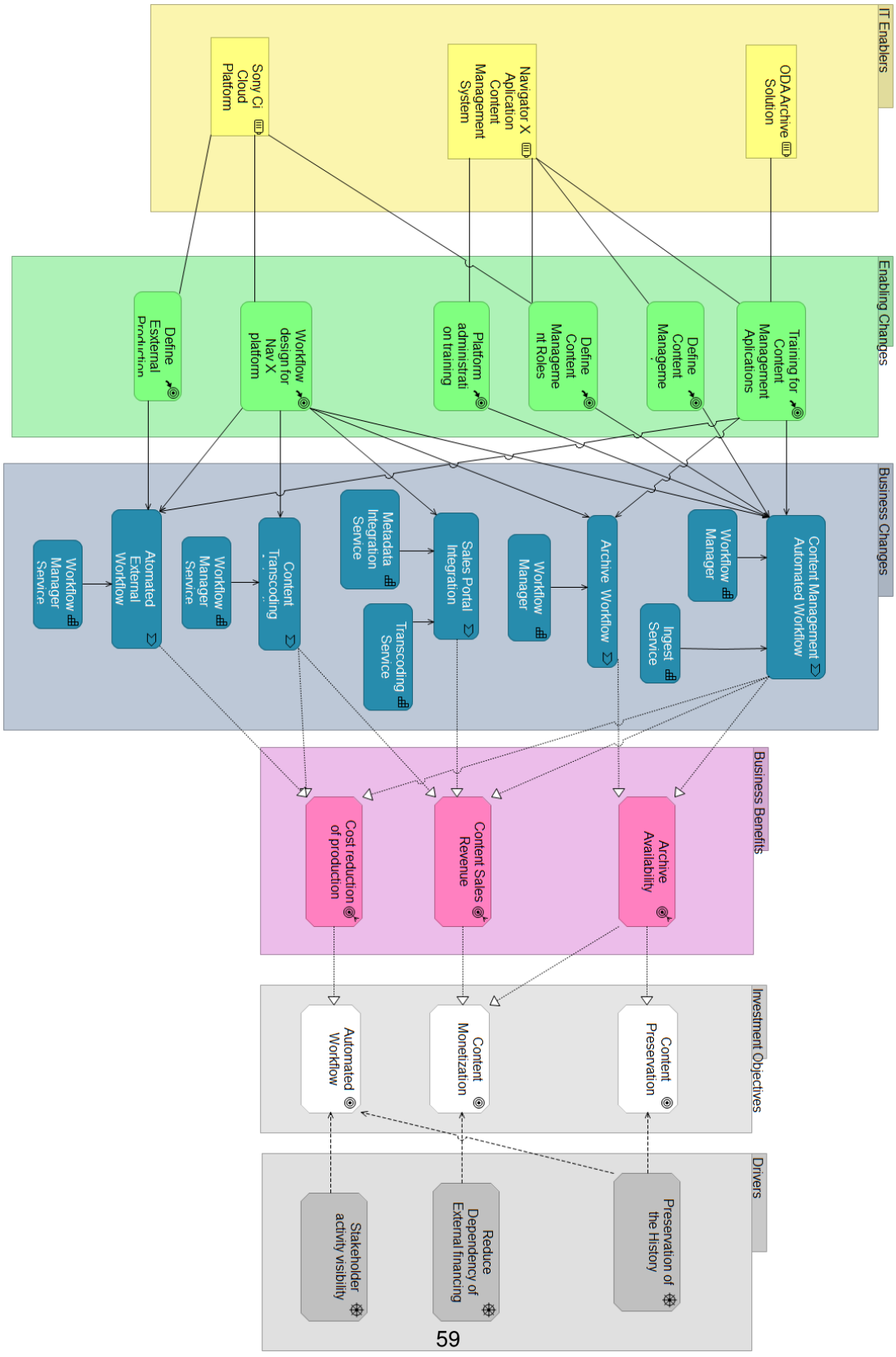


Figure 5.7: ArchiMate Model for Concert Hall BDN Viewpoint

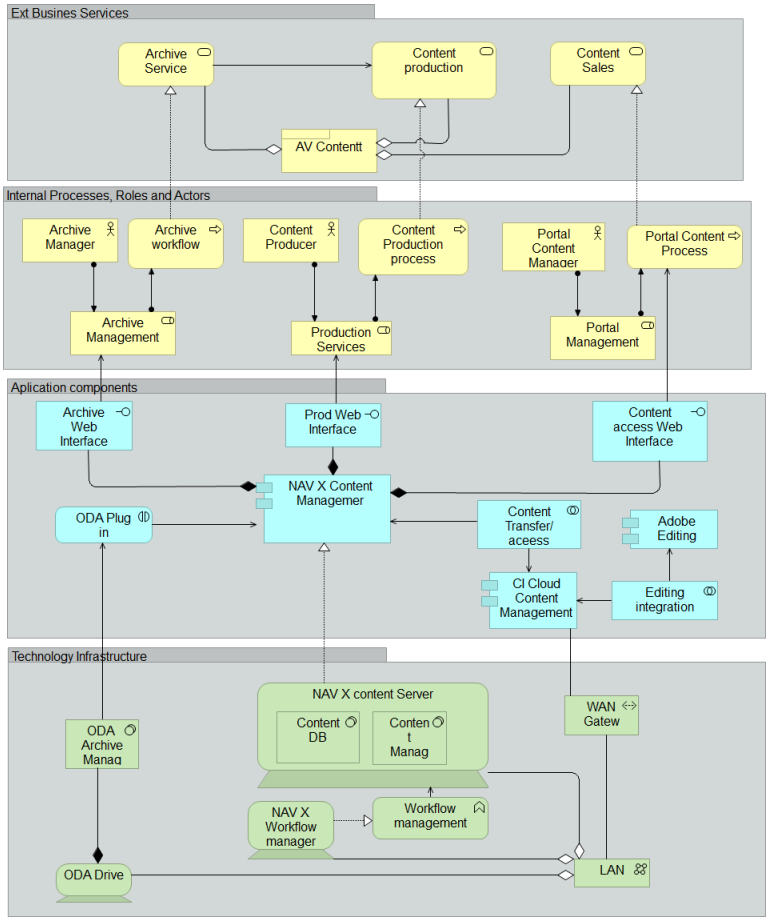


Figure 5.8: Layered view of Concert Hall Content Management

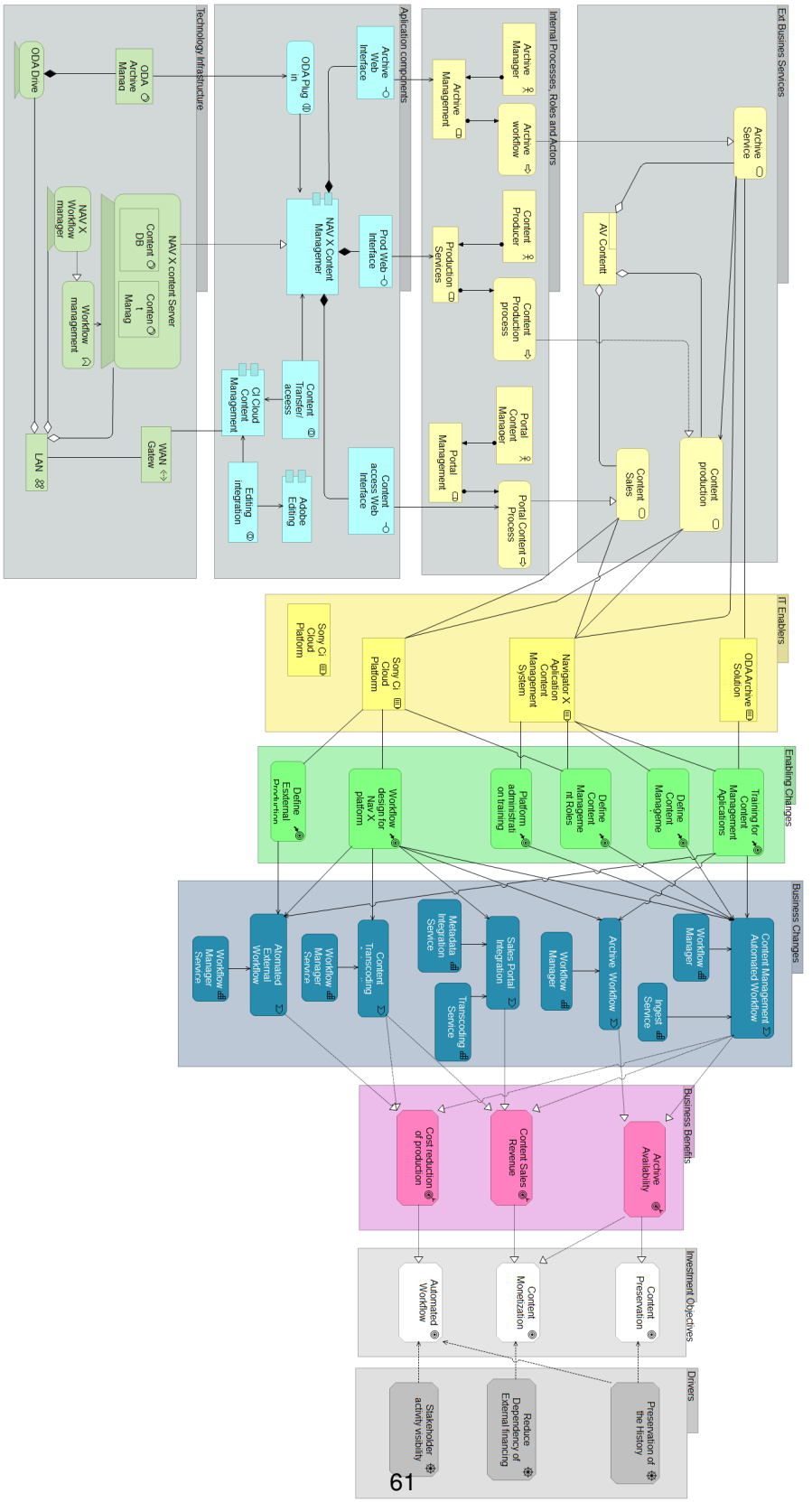


Figure 5.9: Architecture layers relationship with BDN Viewpoint

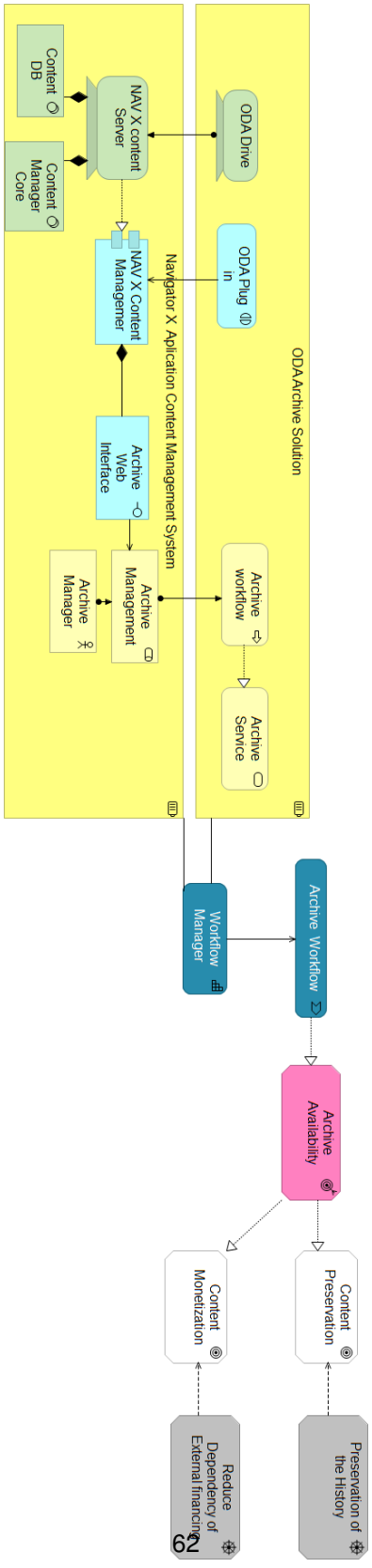


Figure 5.10: Architectural view in relation to Benefits BDN Viewpoint

Chapter 6

Demonstration 2
SIC Use Case

6.1 Demonstration Objective

The work developed on the solution proposal developed in Chapter 4 and its application on a project related to a technological investment for media production presented in Chapter 5, the applicability to the particular media context was achieved. Also the proposed solution for benefit management proved feasible using ArchiMate.

Considering low scale project mapped in Chapter 5, the scalability of the proposed solution needs to be verified.

The motivation to develop a demonstration based in an industry case in the area of the TV broadcast industry is looking at the scalability of the solution proposed. Furthermore, to validate further the application of concepts to an industry facing a fast-changing environment and a technology-intensive investment requirement to stay competitive. Previous work on benefits realization in IT-enabled investments, was mainly focused on specific projects and programs. However, issues related to the overall portfolio of investments must be considered. The portfolio perspective allows organizations to deliver rapidly and incrementally. Taking a portfolio perspective to benefits review can provide assurance of the coherence and achievable of the overall plan, and facilitates a phased approach which reduces the risk from individual projects. A key aspect of benefits planning is the strategic alignment of the project portfolio[Ashurst, 2012] In this demonstration, a use case, based in portfolio management is undertaken to argue the application of the BDN representation in ArchiMate to a benefits realization management on a *programme* or portfolio perspective. A *programme* can be defined as a collection of related projects, that are combined to achieve organizational objectives and outcomes, and can include the creation of new capabilities. A portfolio consists of a set of related and unrelated projects and *programmes* that compete for an organization's resources and funds [Ward and Daniel, 2012]. The allocation of investment is considered as per the portfolio investment analysis as described in Figure 6.1.

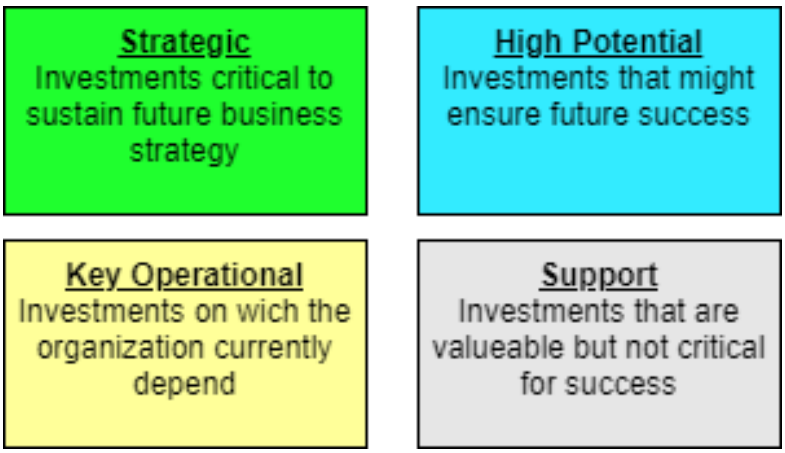


Figure 6.1: Portfolio Investment Analysis Criteria

For this demonstration is required to understand how BDN can address a program or a portfolio management environment. The interrelationships between different projects can be expressed in a *Programme* dependency Network, as represented in Figure 6.2 which can express planned and emergent *programmes* [Ward and Daniel, 2012]. It's important to understand that:

- Benefits of a project taken in advance can become an enabler for a later project;
- Benefits from a project can improve the organization capabilities for a later project;
- Change on a project might be required to enable a change on a later project;
- An IS/IT developed in an earlier project can be a prerequisite for a later project.

This reinforces the original statement that motivates this research which is the possibility for stakeholders to have a holistic view of the organizational situation, and therefore by representing the BDN in ArchiMate will enable to represent the *programme* or the portfolio benefit dependency network in order to make the best-informed decisions.

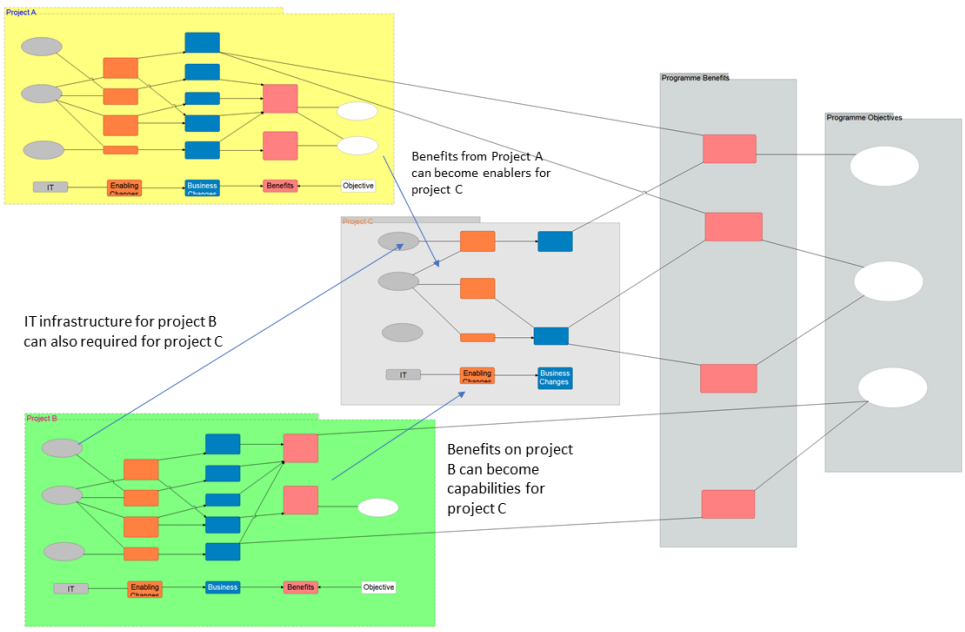


Figure 6.2: *Programme* Benefits Dependency Network [Ward and Daniel, 2012]

6.2 Industry Background

Technological convergence is the driver that is changing how consumers use communication services and consume content, as it is available on new platforms and various wireless portable

devices. This is impacting the television and broadcasting sector which has been undergoing significant technological and structural changes to keep up with the market demands and competitive landscape [OECD, 2013].

A report from BCG Group [Aggarwal et al., 2016] represented in Figure 6.3, points the incremental evolution of technology in this industry, that went from black and white TV, color TV, flat screens, high definition, and later the connected mobile appliances that enable connected and nonlinear consumption of content at the highest quality anywhere and anytime. BCG points this as the most disruptive evolution in the industry.

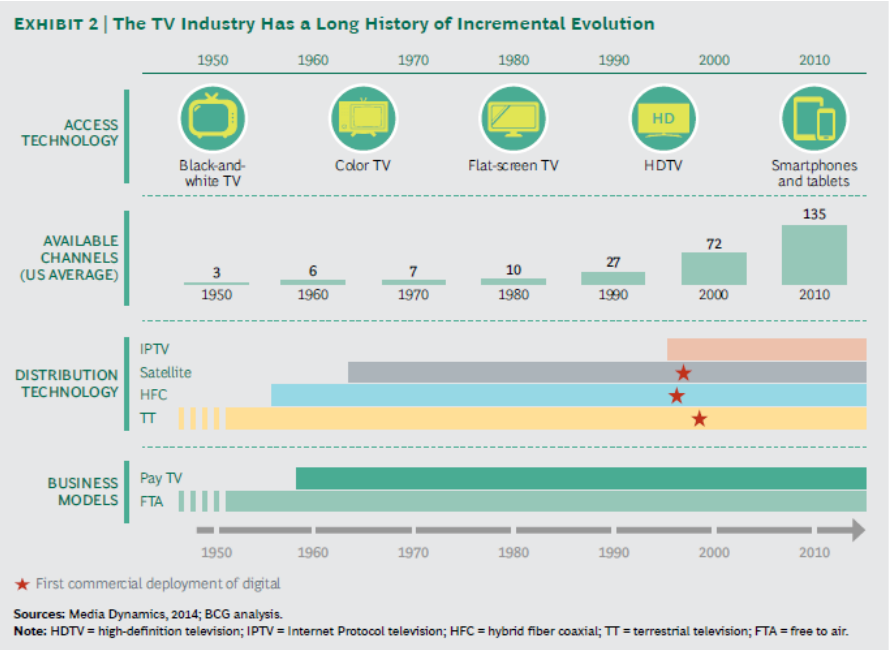


Figure 6.3: Technology incremental evolution on TV industry [Aggarwal et al., 2016].

The fact that *"broadcasting industry is confronted with fast changes which involve content, hardware, and software"*, are taking to developments that lead to reshaped innovation processes and substantial investment in the platform, as the way to stay in business [Milshina and Vishnevskiy, 2017]

Digital Transformation has become a high priority and therefore *"integrating and exploiting new digital technologies are one of the biggest challenges that companies currently face."* In the case of ProSiebenSat.1 Media SE (P7S1), a large TV broadcaster in Germany, managers recognized the potential of digital technologies, leading to *"digitally enrich the company's TV portfolio" and to "seek out new digitally enabled business models"*, advancing on the strategy from previous years where *"digital technologies primarily had a supporting function at P7S1 and were mainly used to optimize business processes and provide an efficient infrastructure". "The impact of digital technologies has been mainly on P7S1's products and services, especially its TV business"*. Also, the production processes have become digital. Today, *"P7S1 generates*

revenues from its digital products and services". However, *"companies with an enabling perspective of IT must carefully monitor digital technologies and identify their potential to boost current business operations or enable the creation of new products and services."* The complexity of digital transformation in this industry requires *"a systematic approach to formulating a digital transformation strategy is crucial for success"* [Hess et al., 2016].

Also, the European Broadcasting Union (EBU) identified that *over the last decade, one of the most significant audience migrations in history has occurred: the shift from television, radio, and newspapers to mobile. From watching live to on-demand"* and recognize that the digital migration has already happened and that it will only increase, concluding that is a better way to work with the situation as it is, as various EBU members have successfully done using different strategies.[Jääskeläinen and Olij, 2018].

In line with the P7S1 case, the adoption of technology on the industry as revealed in IABM research have the following top 3 priorities: Multi-Platform Content Delivery, 4K/UHD Production / Delivery, IP infrastructure [IABM and Industry, 2019].

Relevant market drivers are also motivating a technology approach by the media industry as identified by different studies by Boston Consulting Group, addressing the Media Sector.

The mobile device penetration increase is moving the Television industry to address this area, as expressed in Figure 6.4 [Samtani and Jindal, 2018].

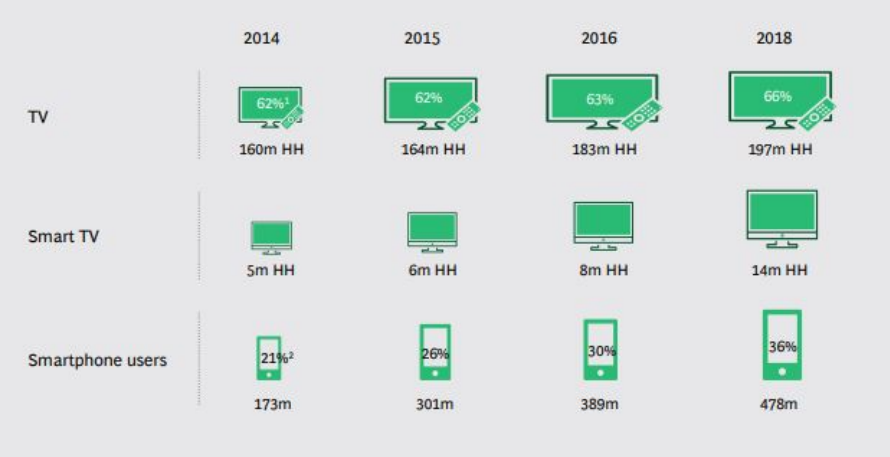


Figure 6.4: Mobile device market penetration for multimedia consumption [Samtani and Jindal, 2018].

Another area of change is the augmented reality penetration in the multimedia segment which brings new consumer demands for on screen content. Again this is present on Boston Consulting Group insights for the media industry. In the case, as it becomes an advertisement key element to attract consumers [Bona et al., 2018]. Figure 6.5 represents the trends of Augmented Reality in different sectors of advertisement.

This market situation is finally translated into the priorities recommendations for the me-

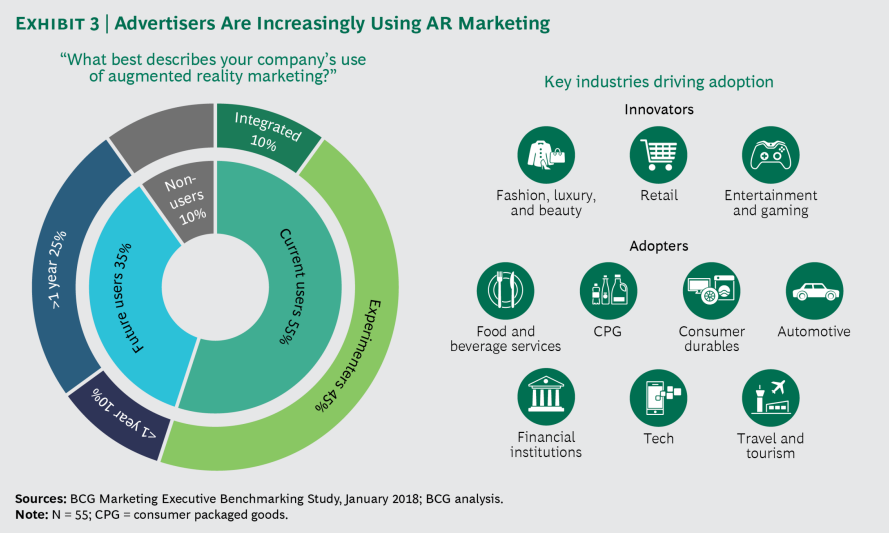


Figure 6.5: Augmented Reality users in the advertisement market [Bona et al., 2018].

dia industry towards the adoption of a digital strategy. Five priorities are proposed based on Return on Investment and also on Ease of Implementation as expressed in Figure 6.6 [Michaelis et al., 2017].

6.3 SIC Project Description

Impresa Group is one of the largest media groups in Portugal. Its activity is split into several business units, where the major ones are related to television broadcast and publishing, with economic interests that include a free to air TV channel, several cable TV channels, a large portfolio of magazines and a weekly newspaper. The project consists of the re-foundation of SIC Television based on the following reasons:

- New location in a reconstructed building, adapted to accommodate all the companies and activities of Impresa Media Group;
- New technical infrastructure, planned, designed, and implemented from scratch;
- New technological paradigm, related to the evolution of Television Station Cores to IP based infrastructures.

SIC team evaluated and analyzed the various technical possibilities offered by the industry for the future core of its new TV and Multi-media Production Centre. And as a result, was found that they were in a challenging time to make technical choices once there is a gradual movement towards "IP", a technology that is still in consolidation for broadcast infrastructure, both in the

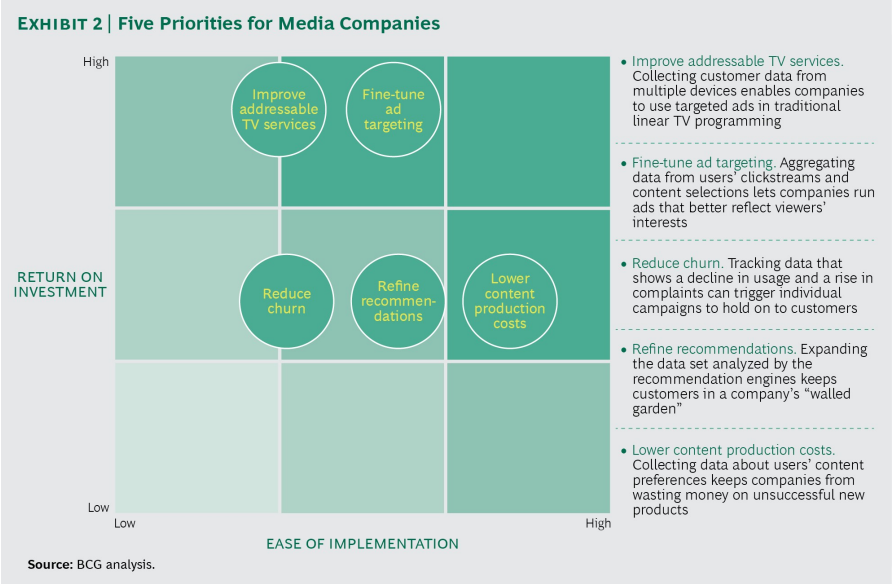


Figure 6.6: Investment Priorities [Michaelis et al., 2017].

standards domain and regarding the technology development to be accommodated in this new reality of a TV Station Core. Key requirements for the technology were defined:

- Flexibility to enable the combination of resources and accommodate different production needs:
- Robustness by using tested components that ensure seamless integration and operation;
- Reliability, redundancy, and automatic failover to ensure ”No Downtime”;
- No technological disruption during technological updates;
- Compliance with industry standards;

From the strategic business point of view, Impresa being in the business landscape referred on Section 6.2 takes the opportunity to address the drivers that emerge from the context.

As reported [Cabrera et al., 2017], programmes are the main component of the growing competition between channels, distributors, and new platforms. TV channels, with their replay offerings, have at their disposal captive services capable of generating additional demand, which may at the very least maintain their audience and, perhaps, their advertising revenues. Incumbent TV distributors can expand their services to consumers thanks to the new on-demand services.

Broadband Internet access, fixed, wireless, and mobile is certainly instrumental in enabling online video. Four key enablers converge to install the Internet as a new self-standing distribution channel [FONTAINE et al., 2010] and also become a driver for SIC technology investment:

- Consumers appeal for Internet video;
- Premium content legitimately available on the Internet;
- Connection of the TV set to the Internet;
- Service providers candidates emerging from the non-broadcast industry;

The need for more quality content, going toward High Definition (HD) and Ultra High Definition (UHD) drives also that the future for the broadcasters is the platform. The shift towards Internet Protocol (IP) based networks is replacing Serial Digital Interface (SDI).

Benefits of IP include the ability to react more deftly to changes of resources required for program production with more flexible use of assets and content [Pesocolido and Bridges,].

From the above, we can obtain the drivers and expected benefits that were present on SIC renovation project. For this as studio complete new installation, emerged five projects, that became the project **programme** considered in this demonstration:

- Production Studio;
- News Production System;
- Studio Automation System;
- Graphics Production System;
- Over The Top (OTT) Distribution System;

These projects are in part competing for the company resources and interrelated so they could figure a portfolio program. There is a mix between the classification of Key operational or support and strategic or high potential, as the ”as is” situation require that investments enable Strategic and High Potential elements are also key to enable Key Operational and Support to current business improvements, as per the portfolio investment analysis described earlier in Figure 6.1

The allocation of resources to address the phasing of projects was taken after analyzing the real value-added from each one and how each phase would unlock the value of others, based on this the investment taken into the Studios was essential to take forward and adding on that the Graphics Production and News production. Studio automation and OTT were left for a later phase as they would require the first phase to be implemented and in production to deliver incremental value.

6.4 SIC Benefit Management Demonstration

Following the Benefits Management realization plan, the first step is to understand the drivers for the technology investment. In Section 6.2 there were pointed market conditions that influenced

Impresa Group to decide to concentrate the operations in the same building and also joining the journalist teams from different platforms. The economies generated by the building move and the synergies that can be obtained from different teams working together in a business that is becoming multi-platform oriented with newspapers taking the position in digital space, Video coming to the internet and content crossing borders to television generated the main driver for the move. The need to produce more with less to deliver content to more platforms and also the need to have a differentiation on the quality level of the television product by upgrading to HD and being ready to follow the next generation of Television products in terms of quality as other platforms already deliver in UHD.

The programme investment drivers are:

- Increase the profitability of the television business.
- Improve the quality of TV products.
- Increment multi-platform penetration.

The investment objectives for the investment programme can be defined as:

- Increase content value.
- Increase content sales.
- Increase Studio Operation Profitability.
- Reduce Operators Dependency.
- Establish a Production Structure for Multi-platform.

The *Programme* Benefits identified:

- Increase content production.
- Innovative branding.
- Multi-platform Operation.
- Reduce production costs.

The transfer of operation to another building, without any operation disruption, was providing the opportunity to start from a greenfield situation where no legacy and to operate a complete architecture and technology renewal, so it was considered as a complete Green Field situation where anything could be considered.
To achieve this, a series of projects were identified as fundamental:

The projects were defined were:

- Studios for news and daily programs - Involves the installation of studios and all the equipment to be able to produce TV programs;
- Graphics Production platform.- Graphics creation and playout system to incorporate on studio production and also on the studio screens.
- Automation systems for studio production.- Automation system that can replace human intervention on program production, valid for simpler programs.
- News Production System. - Dedicated system based on It to produce news bulletins and broadcast them.
- OTT Distribution Platform.- Platform to integrate content on the internet and minimize dependency from the operators.

From each project, a BDN can be established as well as the linking between them in the complete *programme*. In table 6.1, the specific elements associated with each project are enumerated.

On the table, each column establish the BDN concepts that are specific to each project, these are then related to the **programme** investment benefits and objectives.

Each project establishes it's own area of intervention and when looked at in an integrated way there is a contribution to the overall objective as well as it's understood the interrelations between them.

All concepts were raised from the elements that either the tender specifications for each project as well from the project development meetings that occurred during negotiation and implementation.

As a first step, the for the *Programme* was designed where all the definitions where integrated, this is represented in Figure 6.7.

From this point, the representation of the *Programme* using ArchiMate is performed using the proposed solution to understand how the inter-project dependencies can be represented and to induce the evaluation about:

- Is this representation providing stakeholder with a holistic view of the interactions of benefits between projects?
- Can this representation constitute a baseline for developing specific stakeholder views?

For each project, the concepts are adopted using the representation in ArchiMate and than using the concepts that are common to each project and based on the *Programme* and connections must be established coherently with ArchiMate language to relate inter-project dependencies and provide the same level of information as the BDN representation in Figure 6.7.

The representation of SIC BDN for the *programme* is represented in ArchiMate on Figure 6.8 and using all the concepts that were identified under the *programme*.

Table 6.1: BDN concepts applied to SIC Programme

Studio Project	**Graphics project**	**Studio Automation System**	**OTT Distribution**	**News System**
Investment Objectives				
Produce Programs for multiplatform	Increase Graphics usage to value content			
				Establish News System at Studios start
Benefits				
Reduce Stdio Configuration Process	Reduce the Number of Production Processes		Enable Content Distribution on Internet	System operationalization in 2 months
Studio Interoperability with Resource Sharing				Centralize Core system with high redundancy
Open Industry Standards to adapt to new business cases	Enable Augmented reality production			Multi Format operation
HD production and UHD ready				Possibility o develop new apps to address new business requirements
Business Changes				
HD Program workflow	Graphics workflow	Studio Automated process	Content Packaging workflow	Operation Similarity with previous system
IP Workflow	Augmented reality Workflow			Integration with Editing Platforms
Studio Management				New Business ops awareness
Studio configuration Process				Archive workflow integration
				Porto Operation workflow
Enabling Changes				
Operational Training Studio	Production Training	Operational definition	Operation dependencies definition	Definition of editing workflow
Broadcast Engineering and IT Teams Support	Workflow design	3rd Party integrations		Adjust GUI to previous operation
IP Training				develop Scripts for Archive integration
Production training				Virtualize Porto operations
IT Enablers				
		ELC Automation System	OTT Core platform	Hyper convergent nodes
IP core Network for Production	Graphics production core			Micro Services platform
VSM Studio Control System	Augmented reality engine			Hive News prod Software
IP 2110 Standard Audio and Video equipment				

6.5 SIC Use Case Findings

SIC *Programme* BDN concepts were developed under the Benefits Realization Plan Framework and then applied the concepts also established for *Programme* and Portfolio approach [Ward and Daniel, 2012].

The nature of this demonstration consists mainly in terms of the scalability of the proposed solution. By providing a holistic view of the enterprise projects that can lead to the benefits realization of the complete project, the identification of key processes and support process, enables stakeholders to concentrate on the key processes to deliver value and on the support processes that deliver a stable enterprise functionality and to support the performance of key processes that cover the business case end to end [Svatoš and Řepa,].

The management of the portfolio or **programme** becomes a key driver for benefits realization since it links strategy and implementation. Phasing benefits delivery can be analyzed via the model and in that matter the allocation of funding can also be planned as well as the resourcing of funding along the complete *programme* or portfolio execution as well as enables a way to address the management flexibility that can be derived from circumstances that affect drivers influencing the overall objectives [Ashurst, 2012].

By adopting a different level of abstraction specific views can be obtained from the *programme* management as taking an approach to the Capabilities provided by the IT Enablers associated with the Business changes as to how a Resource is associated to a Capability that Serves a Value Stream and how this is shared by different projects as demonstrated in figure 6.9, where the IP Core Network as a technology enabler establish the IP regie as a capability that can address business Changes on distinct projects.

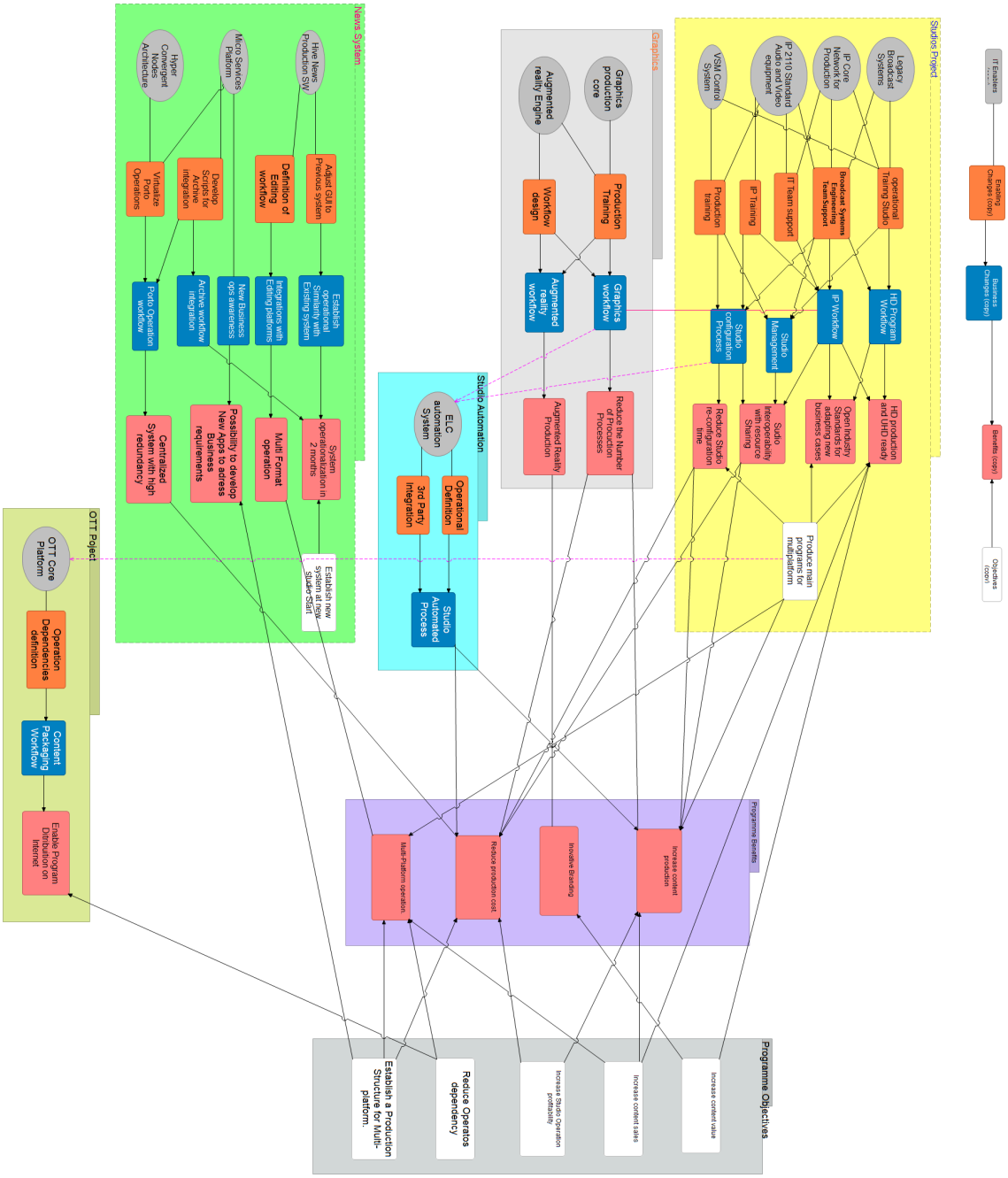


Figure 6.7: SIC *Programme* BDN.

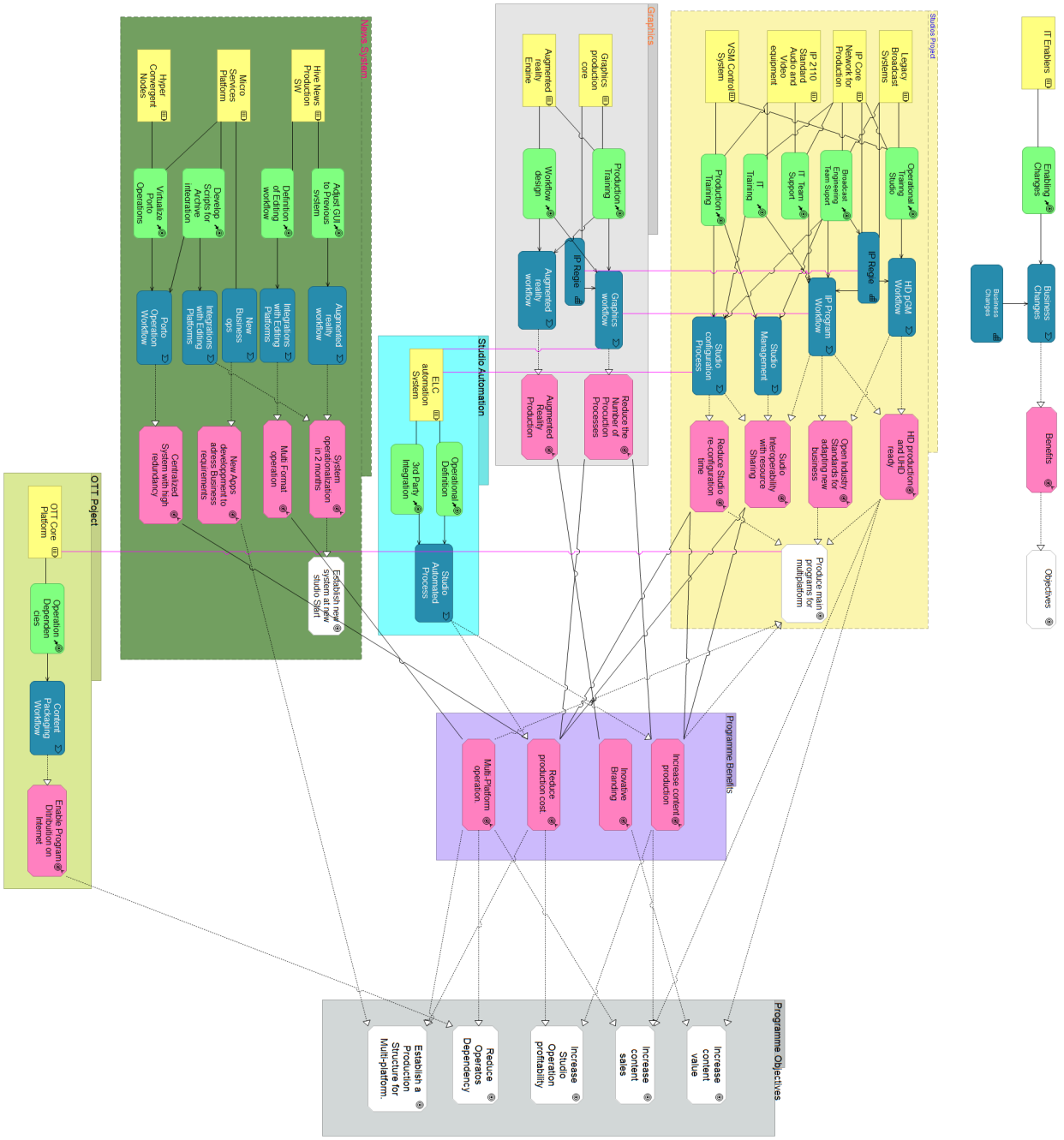


Figure 6.8: SIC BDN *Programme* Represented in ArchiMate.

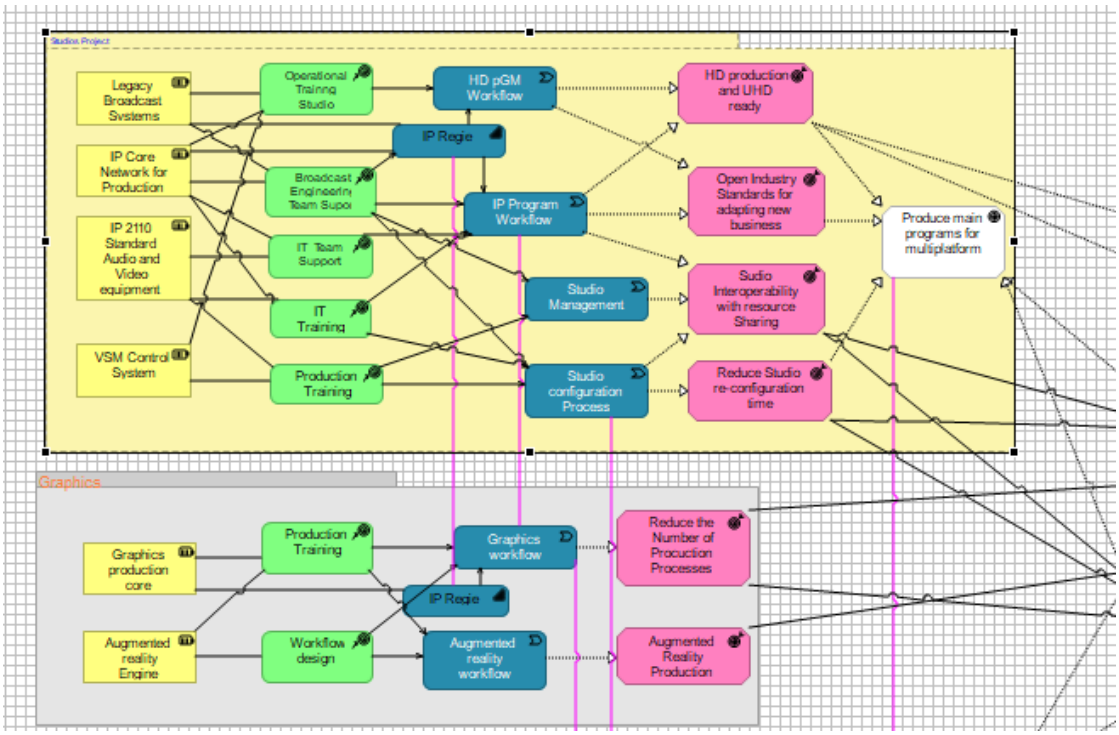


Figure 6.9: Association between IT Enablers, Business Processes and interactions between projects.

Chapter 7

Demonstrations Comparative Analysis

7.1 Demonstrations Review

The demonstrations provided in Chapters 5 and 6 have provided some learning's on the application of BDN in an EA environment using ArchiMate.

As a first step is relevant that the BDN Realization Plan framework is taken to identify:

- Drivers;
- Investment Objectives;
- Benefits;
- Business Changes;
- IT Enablers.

Departing from the BDN concept identification established for each project demonstrations in Chapters 5 and 6, the ArchiMate representation of the BDN was than possible using the solution proposed in Chapter 4.

From this point was the possibility do develop different levels of abstraction that link to different architectural domains was also possible to demonstrate and establish a relation between the BDN architecture layer and other layers.

An important point at this stage is the Stakeholder identification, that is crucial to develop the specific views required either for informational purposes as well as for decision support.

From higher levels of abstraction is possible to obtain a holistic view of the benefits realization in a project which was the main purpose when the Concert Hall demonstration in Chapter 5.

However, considering an environment where a technology-intensive approach is required to face developments and market context changes, the challenge to the Stakeholders to have the vision of the complete project portfolio and benefits realization becomes even more relevant. With the SIC use case demonstration on Chapter 6 it was possible to evaluate how the model could be applied to a large scale environment as a *Programme* or Portfolio management context.

On both demonstrations, the proposed solution was applied using the same concepts and no need to further concept integration on ArchiMate was required.

Linking the Strategic Business vision with the business processes, people and technology is a clear objective of the EA discipline. BDN is a framework that pursues the objective of managing technology implementations by adapting the correct business environment to the technology as a way to ensure that benefits realization is obtained and therefore investment objectives are achieved. By taking this approach to real use scenarios and integrated them in an EA approach, enabled to verify that BDN and EA are closely tight, and that for the Benefits Realization Plan is possible to have a representation in ArchiMate that can be used along the investment cycle and support the stakeholders by providing views adapted to their requirements.

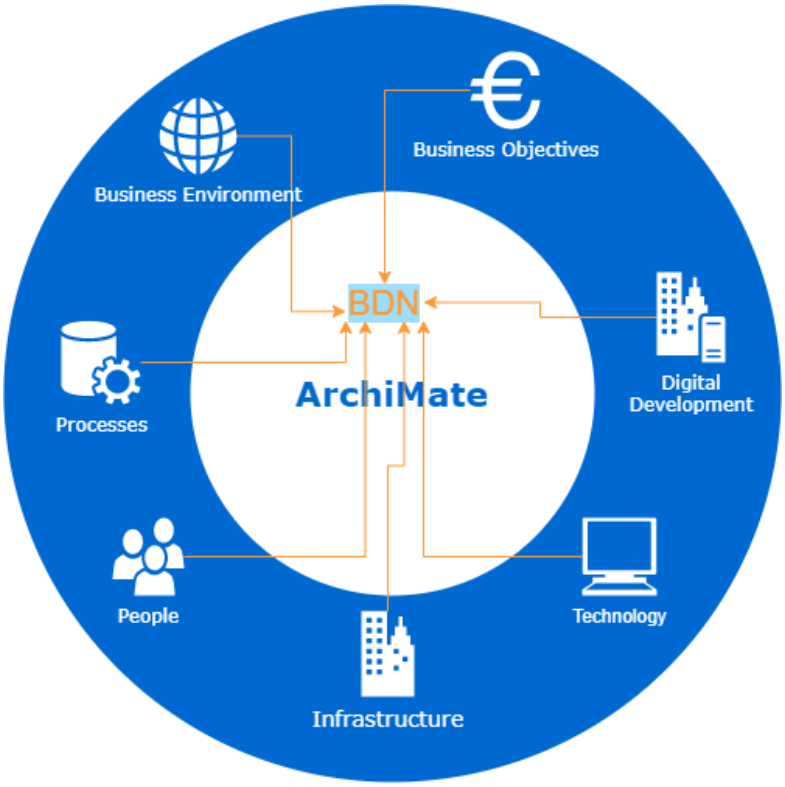


Figure 7.1: BDN integration with ArchiMate

The environment of multimedia production is particularly facing fast and strong technology convergence through innovative processes that require digital migration awareness to obtain real benefits of technology.

In the case of the Concert Hall demonstration, the use of Cloud infrastructure to include in the content production domain as well as the approach to integrate content production with automation projects is relatively recent to the multimedia production context. By integrating the Benefits approach with the architectural approach provides stakeholders the exact view of how technology impacts the company and how it needs to be organized to structure benefit realization in all dimensions of the organization, as represented in Figure 7.1. In this figure BDN, through the modelation in ArchimAte are at the central core to link the distinct areas of an investment project:

- Business Environment is captured via BDN Drivers concept and represented in ArchiMAte;
- Business Objectives are represented via Investment Objectives and also represented in ArchiMAte
- Processes and People are represented via Value Stream and capabilities and Business

Enablers;

- All technology, Infrastructure, and Digital development are represented as resources that can constitute capabilities through the combination with processes and people, and can be represented in the BDN modelation in ArchimAte.

From the Core of the circle departing from the BDN concept's the view can be expanded to enable more detailed views to more detailed aspects of each interest area or combining different areas according to stakeholder interest. This is possible by bringing each element represented into a BDN concept represented in ArchiMate.

7.2 Demonstrations Evidences

Regarding the evidence for the demonstrations that support the ArchiMate concepts adoption to integrate BDN, in both demonstrations all the concepts were applied coherently with the proposed schema. Beside in both cases there as not a BDN approach from the beginning, all of the definitions had to be taken based on the documentation used for the real projects.

The adoption of already existing concepts available in ArchiMate in the Strategy layer as well as on the Motivation Aspect has facilitated the representation of BDN as the identified concepts to construct BDN in both cases was transposed in a straightforwardly.

The change of level of the abstraction to provide a view relating specific concepts with technology infrastructure was evidenced in the Concert Hall project as per the representation of Business, application and, technology layers in connection with the Strategy and Motivation that were representing the BDN concepts. The evidence for this was mainly provided the layered view in Chapter 5 in Figures 5.9 and 5.10.

The scaling of the model to a bigger scale project as applied in Chapter 6 provided the understanding that not only the model can apply to other scale but also that this representation can provide the a graphical view to evaluate project interactions not only in terms of Benefits Realization but also in terms of interdependence between Business Changes and the associated capabilities as expressed in Figure 6.9.

A difference between both demonstrations is the representation of the Drivers concept that an element on the Benefits Realization Plan but in fact, is not graphically represented on BDN in most cases but on the proposal of the model in Chapter 4, the possibility to represent Driver Concept was provided, since it's available on ArchiMate and using the same semantic description in both frameworks.

For the Concert Hall demonstration on Chapter 5 was applied the Driver concept in the BDN ArchiMate representation in Figures 5.7 and 5.9, since it was available and could provide an enrichment of the level of information visually available to the stakeholders.

The decision of using it on the representation is an option on how relevant is this information for the use of the model by the stakeholders.

In the Demonstration in Chapter 6 the decision of not applying the Driver concepts to the representation, besides they were identified for the effect of the BDN construction, was taken as the technology investments occur in an environment where stakeholders are aware of the market Drivers as well as the technology application for the effect of the investment objective, and also because as the dimension of the Programme representation could introduce an element of visual complexity that was not favoring the overall understanding of the representation. However, the possibility of using the Driver concept was available and could be used without any limitation.

From the Benefits Realization plan application to the projects there is a subsequent step that is also used in BDN representations, that refers to the Benefit and Business Changes and Business Enabler owners. The literature [Ward and Daniel, 2012] uses the same Graphical representation but replaces the concepts whith the roles related to the ownership for each one as represented in Figure 7.2

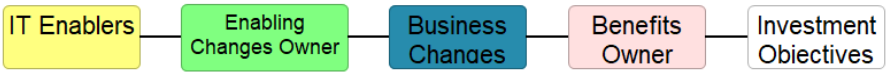


Figure 7.2: BDN Owners Representation

The figure of the owner is related with the role of someone who has an interest in the desired outcome or in the process [Ward and Daniel, 2012], and that can influence the actions necessary to ensure Business Changes, the Enabling Changes, or the Business Benefits are realized.

The representation of this step of the Benefits realization Plan can perfectly bee used with existing Stakeholder concept on ArchiMate Motivation Elements as well as with the Actor on the Business Layer.

According to the stakeholder concept definition: *"The role of an individual, team, or organization (or classes thereof) that represents their interests in the effects of the architecture"* [Group, 2019]. In the benefits realization plan the "owner" role is attributed to an actor in a position to act to perform the behavior, so it's in line with the Actor ArchiMate definition: A business entity that is capable of performing a behavior.

The relationships are established by the Association relationship.

The representation of this aspect of the business realization can be proposed using these concepts together with the already proposed scheme in Figure 7.3

For the demonstrations this step was not taken into consideration as per the Concert Hall there was not a BDN realization plan and also the project team was very reduced and being just concentrated in a very limited team of one person in terms of the project management role and associated also with the ownership roles of all aspects of a Benefits Realization Plan. But the same scheme could be applied.

Regarding the SIC use case, the scale of the programme with different projects involved

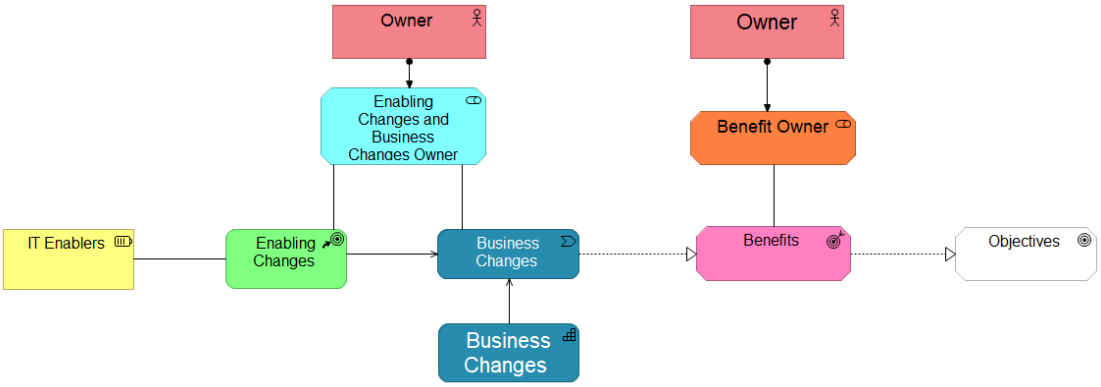


Figure 7.3: BDN Owners Representation in ArchiMate

several areas of the company with several people that were deeply involved in managing aspects of the project implementation and development, but a formal Benefits Realization Plan was not put in place, so it was not possible to represent it in a way that could resemble the reality as well as it is not in the scope of this research.

Another aspect that is present on the benefits realization plan is that all benefits and objectives must be quantified, otherwise can't be considered. The representation of values in ArchiMate has been found in the literature with solutions proposed already. BDN requirements in terms of Value presentation are rather a simplistic one, consisting of target value and a deviation value. The representation of the value is not in the scope of this project, distinct solutions that can be evaluated in future work to establish which ones can address the purpose of this model. As an example, was taken an approach to represent values that can apply to the BDN representation is the one taken to incorporate costing [Miguens et al., 2018], by proposing the use of the properties field from the concepts used, the same approach can be applied.

The value is incorporated in the modeling tool in the properties fields do the concept as proposed by the author [Miguens et al., 2018] and exemplified in Figure 7.4.

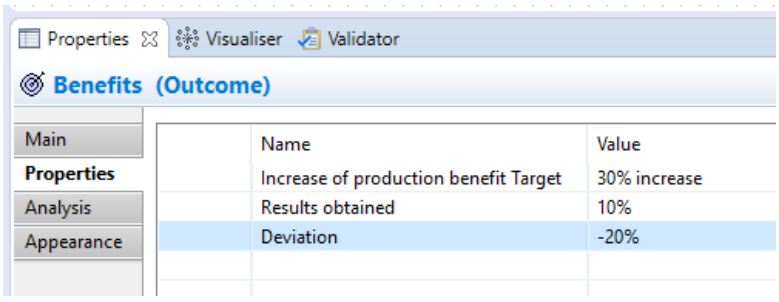


Figure 7.4: Value registration [Miguens et al., 2018]

For the purpose of representation to the appropriate stakeholders, in this case, the Benefits

Owner viewpoint is clearly of interest to obtain this view, the Value concept on Archimate was used by the author [Miguens et al., 2018] and is fully aligned with the need to represent Value on this BDN view as the Figure 7.5.

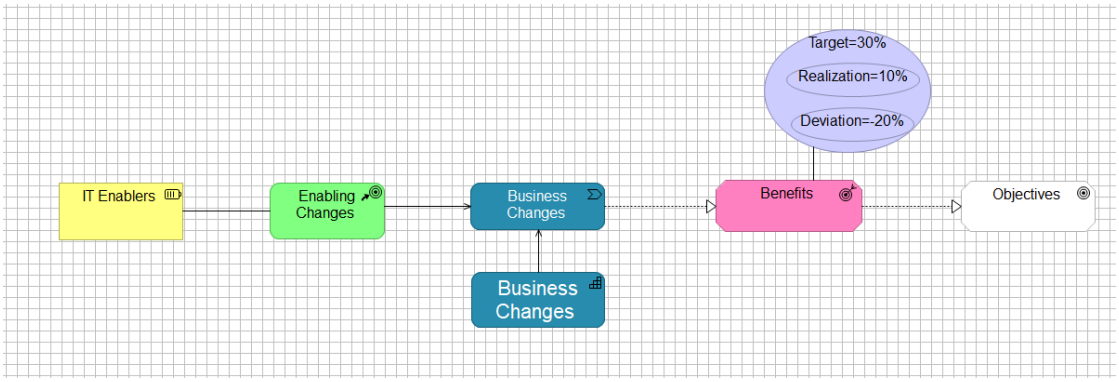


Figure 7.5: BDN Benefit values representation in ArchiMate [Miguens et al., 2018]

The Value concept associated is representing per definition: *"The relative worth, utility, or importance of a concept* [Group, 2019], and as expressed is representing the worth of the associated concept.

Also, the value representation was not in the scope of this research.

Chapter 8

Evaluation

8.1 Wand and Weber

An evaluation was performed by applying the Wand and Weber method, where two languages are compared to identify the existence of ontological deficiencies: Incompleteness, Redundancy, Overload, and Excess [Burton-Jones et al., 2009].
For this evaluation is used Table 4.1, constructed to map the correspondence of concepts.

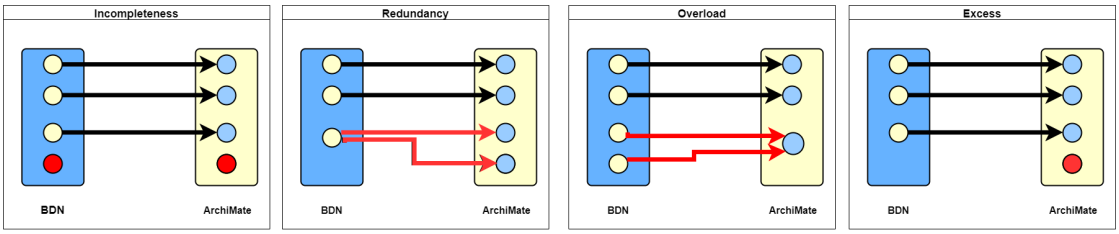


Figure 8.1: Ontological Deficiencies Wand and Weber[Burton-Jones et al., 2009].

Completeness analysis:
In terms of completeness the analysis of Table 4.1 evidences that all BDN concepts have a direct representation of the ArchiMate concept, using concepts available on: motivation and strategy elements.
The Business Changes BDN concept is mapped into the ArchiMate concept Value Stream that is realized by the Capabilities concept, there is no direct relationship between Business Changes and Capabilities as Value Stream incorporates the Capability realization required to deliver the results required to the Business Changes.
Therefore, we can conclude that there are no deficiencies related to this analysis. However, this is only valid when mapping BDN to ArchiMate, the opposite is not valid as ArchiMate incorporates the possibility of representing other aspects of reality using a vast number of concepts that are not applied to the specific context of Benefits Management.

Redundancy Analysis:
All BDN concepts are mapped into only one ArchiMate concept. In the opposite direction, not all Archimate concepts are to be mapped into BDN, taking into consideration the wide coverage of areas of the ArchiMate language.However, a set of Archimate concepts proposed to map BDN concepts, and each one covers only one BDN concept.
The Business Changes BDN concept is mapped into the ArchiMate concept Value Stream that is realized by the Capabilities concept. There is no direct relationship between Business Changes and Capabilities as Value Stream incorporates the Capability realization required to deliver the results required to the Business Changes. Again, there is no deficiency revealed in this analysis.

Excess Analysis:
All BDN concepts have a representation in ArchiMate. Again in this analysis, we find that many ArchiMate concepts are not mapped into BDN. The reason for this is again the coverage of wider coverage provided by ArchiMate. But the ArchiMate concepts covered by the mapping also are covered by the BDN concepts.

Overload Analysis:
All BDN concepts point only to only one distinct ArchiMate concept so there is no Overload deficiency. Again, the BDN Business Changes Concept is mapped into the ArchiMate Value Stream Concept. Being the secondary relation between Capabilities and Value Stream concepts to express the realization of the Value Stream that provides the Business Changes required for the Benefits realization. Also reverting the map, different ArchiMate Concepts used, are not mapped to more than one BDN concept.

8.1.1 Wand and Weber Evaluation Results

The analysis of Table 4.1 as well as Figure 4.4 can support the results described in the evaluation results. By this analysis, we can verify that no concepts are missing in terms of representation between both languages. There is no lack of clarity as all BDN concepts can be only mapped into only one concept in ArchiMate as well as each concept is mapped into only one different concept. This prevents ambiguity and provides clarity on the mapping definitions. Also, the results offer evidence that reversing the mapping from ArchiMate concepts to BDN provide the same results.

8.2 Experts Interview Methodology

A series of interviews with industry experts were conducted to validate the model proposed in different perspectives;

- The value provided by the model to the EA discipline;
- Areas where it can provide additional interest:
- Quality of the conceptual integration;
- Usability and readability either from the modeling point of view or the stakeholder point of view;
- Identification of areas for future work to enhance the value provided by the model:

Table 8.1: Quantitative Evaluation Scale

Value	Rate
1	Extremely Poor
2	Poor
3	Fair
4	Good
5	Excellent

The interview was conducted in the form of a structured interview with open questions to be able to gather quality aspects considered from the evaluation model.

A quantitative evaluation has been applied to establish a rate regarding:

- The quality of the model to evaluate the coherence of the concept mapping;
- The readability when applied to a real-life use case.

For the quantitative evaluation, a value scale was established and included as part of the answer to the relevant evaluation questions, to rate each of the items being evaluated as represented in Table 8.1.

For the interview was selected a group of experts in the field of EA, ArchiMate, and BDN. with profiles as bellow specified

- IS Consultant and a Senior Architect working in the area of IT architecture as Senior Architect with Experience in the field of modeling with BPMN, Archimate, UML, and other languages;
- Academic, University teacher with works published in the field of IT modeling with BPMN, UML, and ArchiMAte;
- IT Consultant and Archimate Expert involved in the Open Group Forum;
- Data and Digital Intelligence Engineer, and Consultant and IT Governance researcher with experience in modeling with BPMN, UML, and ArchiMAte ;
- Academic, University teacher, Consultant, and Technology Analyst with published works in the area of Enterprise architecture with knowledge in ArchiMate, BPMN, UML, BMC;
- Academic, University teacher with works published in the area of Benefits Management and BDN and business consultant;
- Ph.D. Computer Science and IT Governance with knowledge in BMC, BPMN and ArchiMate working as Product Owner, and Software Developer;
- Academic and University teacher in the area of Industrial Engineering and Business Information Systems with works published on BMC and ArchiMate.

The interview outcomes are summarized in Annex A and provide relevant observations from the interviewed experts.

Interviews were conducted mainly via online resources: Skype, Teams, and chat applications.

The evaluation process was preceded by sending a description of the conceptual model and the demonstration of a use case of the Concert Hall to the interviewed experts, followed by a personal interview to discuss and obtain the feedback relevant to the evaluation.

From the interviews, the discussion topics were centered on the value of the BDN into EA and the results, the Wordcloud application offers a visual result of the words used on the responses as represented on Figure 8.2, where the frequency of the words used during the interview has a predominant size as the frequency is higher.

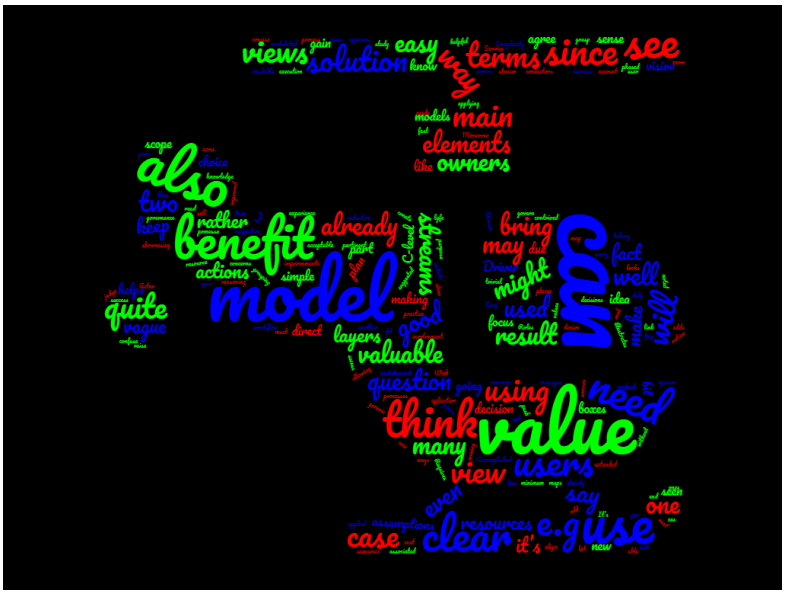


Figure 8.2: Word cloud representation of the terms used by the interviewed experts.

8.3 Interviews results

Complement and added value that BDN brings to EA

Regarding the evaluation of the complement offered by BDN to the EA perspective, 71% of the interviewed agreed that the model brings a complement and adds value to the existing EA approach.

From the interview, experts considered that ”The focus on the benefits can provide stakeholders with a holistic view of investments” an that the approach ”Provides focus on the business objectives and not just on the solution”. The model also enables ”an approach to manage the

life-cycle and changes required" and in a project management environment "The focus on Benefits is relevant to programe or portfolio project management as it can enable stakeholders to enable more business benefits by not addressing all projects as separate."

One of the interviewed considered that the BDN concepts involved in the model are included in ArchiMate Motivation Elements in a broader definition, so the value added depends on the scope of the EA definition.

One of the interviewed also considered that a model with a reduced number of concepts would provide a simpler approach to manage the project's success in this aspect.

The value-added by connecting the BDN to the elements involved was recognized by 80% of the respondents and considered relevant to enable the vision of the management of the benefits and technology investments to C Level management and also to business profile stakeholders. However, was pointed out that the use of this approach needs to be adapted and managed following the reality of the organization and stakeholders, as it can introduce complexity. One interviewee stated that in many cases a cross-cutting perspective with few concepts that enable project success measurements, brings more simplicity would be more valuable.

Regarding the model provided to map the BDN Concepts into ArchiMate and the relationships between them, was considered correct besides being pointed out that the concepts Value Streams and Capabilities to map the BDN Enabling Changes concept and Resource to map IT Enablers were pointed as having a possibility to represent a brother number of elements as the ones that ArchiMAte specifies. The mapping of relationships was considered by the experts that could use more flexibility depending on the type of relationships being used between concepts and also one of the interviewed experts considered that ArchiMate as a week representation of relationships, that could not fully translate the BDN concept relationships.

Coherence and quality of the model regarding the correction of the concepts and relations adoption and correspondence.

All of the interviewed agreed that the model adopts a logical representation of the concepts and relationships to a great extent. Observations regarding possible alternative representations were pointed as different stakeholder or modelers could have different interpretations and one of the interviewed pointed that "ArchiMate is a complex and somewhat confusing language of EA as it involves too many terms, often quite vaguely defined".

To have a quantitative assessment of the model concerning its quality, a scale to rate the quality of the conceptual model based on the values provided in Table 8.1.

The rate obtained for the conceptual model quality is "Good" , and the rate values are expressed by:

- Median of 4 ;
- Standard Deviation of 0,92.

Based on the standard deviation it reflects that a consensus about the rating of the model was obtained.

Evaluation of the demonstration of application of the model to a real life case

The demonstration to provide a real world scenario of how the model is applied and a vision of what can be obtained by providing the BDN representation on an EA language and environment had different evaluations depending on the profile and background of the interviewed experts.

The application of the model was considered to be correct by 85,7% beside one of the experts considered the project as not the best fit for the demonstration.

A quantitative evaluation based on the rates valued on Table 8.1 was performed for the evaluation of the success of the model applied to the use case.

The rates were based on the values provided in Table 8.1 and the results obtained was rated as Good, with:

- Median of 4;
- Standard Deviation of 1,0.

Also on this evaluation, the standard deviation value reflects a significant consensus regarding the rate of the application of the model.

Readability for stakeholders and ease of understanding for either modelers or stakeholders

Experts pointed out that if the number of concepts represented on such a model could increase when compared to other forms of representation as tabular, and reinforced the need to raise the level of abstraction to reduce the number of elements or to adapt to specific views more dedicated to stakeholder concerns.

The need to understand the ArchiMate language was considered as increasing the complexity when using the model.

The evaluation by experts with a modeling profile was considered as easy to understand and to use.

The need to have the concept definition agreed between all stakeholders is a key factor of success.

Relevant views that can provide value to stakeholders

The relevant views that can provide value to stakeholders are very much dependent on what are the concerns of the stakeholders, as all experts recognized.

The possibility to obtain ” views linking the technology with the Business translate value for the business stakeholders that need to understand what and technology applications affect business results”.

The dynamics of the models to be continually updated ”as the repository of the architecture of the organization to represent the cycles: ”As Was”, ”As Is” and the ”To Be” which encompasses the dynamics of the Benefits management process.” brings an added value to manage the project life cycle.

Interviews also pointed that views that could be derived from this model are the ”links to the implementation and migration phase of TOGAF ADM ” and also the ”representation of the business benefits and business changes owners”.

Another aspect that is relevant for managing the benefits is the integration and handling of the values to monitor the results.

8.4 Evaluation results

The evaluation provided an answer to the initial questions that consist of the objective for the research:

How to model alignment of Benefits Dependency Network (BDN) framework with Enterprise Architecture ArchiMate to provide an integrated modeling platform to manage the benefits of technology investments?

From the ontological evaluation provided by Wand and Weber resulted that the model provides coherence, clarity, as no ontological deficiencies were identified. Regarding the evaluation from experts, the proposed model was considered coherent and logical and rated as Good as well as it’s application on a real-life scenario was considered by the experts as valid and also rated as Good. The value added by the integration of the BDN framework inside an EA methodology was considered to provide a tool to communicate the architecture in a more holistic view to business stakeholders and also to focus the context of the business perspective, through the benefits and not just on the technology implementation.

The response to the sub-questions that arise, from the context are also answered by the evaluation:

What are the key success factors identified to achieve the objectives of the integration of BDN with ArchiMate?

From the use case demonstration and the interview with experts emerged the key success factors:

- The agreement on the concept of adoption and meaning by the stakeholders as the baseline for a common understanding.

- The simplicity and level of abstraction that needs to result from the application of the model in order to not increase complexity.

These are fundamental aspects to ensure the value offered by the use of BDN in an EA is realized by stakeholders as a semantic baseline as a common understanding can easily be compromised due to the abstract level of the concepts.
The number of concepts involved in a representation can compromise the readability, therefore, a maximum number of elements needs to be taken into consideration as well as the possibility to zoom or increase the level of abstraction, depending on stakeholders.

Can the modeling of BDN on ArchiMate provide a solution to manage benefits from their technological investments?

Experts considered that the model can be used to manage the perspective of the benefits integrated into an EA perspective and as part of the enterprise continuum.

The model was considered as a tool that can provide the view of the business perspective when managing a technology project and remove the weight of technology-driven management in the project life cycle and facilitating a holistic view and communication between different stakeholders.

What limitations are identified when transposing BDN to ArchiMate?

The limitations identified when conducting the evaluation were:

- The model can introduce complexity if the correct scaling and / or adjusted to the specific view required by the stakeholders is not carefully evaluated, so alternative representations should be considered in those cases.
- In a situation where stakeholders are not familiar with the ArchiMate language, it causes the representation not o be fully understood.
- The demonstrations were produced based on projects that were already implemented in a final implementation phase. The application to a use case of an ongoing implementation could demonstrate a closer approach o the real-life situation, besides it was not fundamental for the evaluation.
- The project demonstrations have been focused on the Media and Broadcast Industry as is the professional context of the author, besides the concepts, are not.industry specific and the technological concepts, it consists in a limitation of context.

Chapter 9

Conclusion

9.1 Conclusions, limitations and future work

The objective of this work was to produce an artifact capable of providing the representation of a modeling process to represent BDN on ArchiMate.
The literature available identifies the need and value of incorporating a business perspective into technology projects as well as the value of integrating this perspective into an EA methodology, this was resumed in Section 3.6 where the works are done in this field and considered relevant for this research are identified.

The artifact proposed in Chapter 4, has been developed to identify the consistency between BDN concepts and ArchiMate concepts, taking into consideration the fundamental concepts of EA finding the relation between BDN, and Zachman framework and also relating this one to the TOGAF ADM.

The artifact applied to a simpler use case on Chapter 5 provided a representation of BDN in ArchiMate to evaluate its applicability and provide the understanding of what value it can provide to stakeholders, as well as the views that can emerge from the application of the BDN framework in the context of an EA process.

This first demonstration, with the application to real-life scenarios and with examples of views that can be developed to enable Stakeholders with information relevant to their concerns, by connecting BDN to other architectural aspects provided a framework, under an EA process, to support the benefits management and provide stakeholders and either technical or business project manager a tool to achieve the benefits objectives, identify new benefits and identify disbenefits.

Disbenefits is defined by Ward [Ward and Daniel, 2012] to express the negative impacts of the technology implementation that are opposed to the benefits.

A second demonstration provided in Chapter 6, was developed to provide an understanding of how the model results when applying the BDN concepts to a larger scale as a *programme*

or portfolio management environment and integrating this on the EA perspective. A review from the results obtained by both demonstrations, in Chapter 7 summarises the results obtained from the model application, and defines areas where future work can add value to the artifact.

The analysis of the results obtained from both demos enabled to identify value areas that the artifact can offer as well as limitations and need to incorporate other areas covered by BDN methodology in the Archimate representation.

The evaluation taken in Chapter 8 enabled a response to this research. On the interviews conducted, 81% of the interviewed experts identified that value provided by incorporating BDN on an EA methodology.

Interviewed experts pointed the benefits for communication improvement of business and technology perspectives to either business stakeholders or technology stakeholders. This enables to incorporate the business focus on a technology project. Also, interviewed experts pointed the potential to use the artifact as a tool to manage the benefits over the project life cycle. *Programme* and Portfolio management where also referred by experts as an area where the application of the artifact can improve the analysis and management of the resources.

All the experts Interviewed, identified situations where the application of the artifact will bring disadvantages as increased complexity and where the understanding of the model is nor obtained. These occur when the model increases the number of concepts to a point where the advantages that this type of representations loose readability and when stakeholders are not familiar with ArchiMAte language, in these situations the use of alternative representations as tabular can offer a degree of simplification to the analysis that will improve the results of the communication.

The learning's from this research work enable the author to formulate an opinion about the results. The interest in the EA methodology to apply in the context of technological investments, as it brings real visibility of the management of the technology, processes, and people alignment is valuable as EA can deliver benefits by itself if the organization use it properly. Also, Benefits Management is relevant to overcome the temptation that most projects fall into that is to being driven based on a technology project only and losing the sight of the business as well as to create a pure economy driven evaluation of the project, on another side. A combination of both methodologies can integrate both visions and support project management and development to maximize both technology and business results. However, the use of the proposed artifact needs to take into consideration the scale of the representation as it can produce the adverse effect of bringing complexity where the objective is to obtain simplification. The views that can on focus specific areas are particularly useful as ways to communicate the technology perspective to non-technological stakeholders and business perspective to technology stakeholders.

Future Work:
Benefits Management Plan requirements, determine that Benefits and investment objectives need to be quantified and measured. In ArchiMate, valued measurements related with perfor-

mance indicators as cost, value, etc., can be incorporated in property fields of relevant concepts, this has been applied by works analyzed in the literature review. The use of this possibility or consideration of different alternatives requires further development of the model and was pointed in Chapter 7 where an example of incorporating values into ArchiMate concepts is exemplified.However, this was not considered on the scope of this research and future work can provide a view of what methods are available or can be developed to incorporate values into the BDN representation in ArchiMate.

BDN framework establishes a representation of the responsibilities for Benefits and Business Changes in terms of ownership for the results and implementation. This was identified in Chapter 7. Besides being outside the scope of this research, an example of how this representation can be achieved is provided to illustrate the possibility for development in future works in this area.

The application to the specific context of a particular industry is not ensuring that a generalization can be obtained, therefore further research on the possibility to ensure that the artifact can be applied to different industry contexts is an area for future work.

Limitations:

The work provided on this research incorporates limitations that need to be taken into account so the conclusions can be properly framed.

The demonstrations were conducted over projects that were already implemented in real-life situations the application of the artifact was not done along the real-time and environment of the project execution.

The model was applied in projects related to the media industry, the application to other industry environments might require some adjustments, this either a limitation as a potential for future work.

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Appendix A

Interviews Summary

1) Considering the EA perspective, What complement is offered by BDN?

It might help 'sell' the usefulness of EA to business users and managers, by showing how EA can enable more business benefits than treating every IT project separately. BDN complements the vision since it stress the need to focus more on business benefit and objectives and not just the solution delivered.
The stress on the WHY in the Zachman framework is reflected in the model and in the approach and complements with the need to use TOGAF ADM phases A and B and also preliminary phase initially and then Phases H and G to govern and handle changes in an effective way .
Doesn't see an advantage as it prefers a more simple and compact language.
Structured view of the benefits of investments in general and moving to concrete views and helps to justify the benefits - the promise of delivery can derive components and explode and allows to communicate the communication of benefits.
It values and favors communication and investment monitoring, but also changes.More holistic view.
That depends on how you scope EA. In a broad definition, this kind of benefit analysis is already included, as witnessed by e.g. ArchiMate's Motivation concepts.
I would say that BDN is a way of introducing a new concept to the field, by ensuring the investment objectives are being fulfilled by the changes required to address that benefits.
To sum up, EA can control the business and IT changes, and BDN can offer a different perspective by analyzing if the overall investments are generating the expected return.Therefore, we can say these two approaches are two faces of the same coin.
Enable a sense of the real benefit of each of the EA's architectural components and what actions are necessary to achieve / achieve them. Through this complement, it becomes easier to: 1) make decisions about possible alternative architectural scenarios and 2) ensure that the EA meets the objectives defined by the main stakeholders of the same. This is possible due to

traceability from IT resources (base element) to objectives (target element).
It makes explicit the relation between business benefits and the high-level architecture (capabilities and resources) which is supposed to help realise this. Benefits modelling is not explicitly done at the moment and there are little guidelines on this.

2) BDN as a tool to address the benefit management of technology investments, do you see on the connection between this framework with the elements of Enterprise Architecture an added value for the stakeholders involved? If affirmative what are the most relevant aspects that result from this connection?
I can see the connections and it is beneficial trying to link the two together – I think the work you've done is interesting and worthwhile. I think the value for business stakeholders is limited – EA is not popular with them as it involves a lot of work with little immediate benefit. The complex and somewhat confusing language of EA and ArchiMate does not help – too many terms, often quite vaguely defined. However it should be valuable for IT practitioners as it enables them to show the value of EA and how it produces benefits for users.
Doesn't see an advantadge, a simpler analysis with few concepts that support sucess of a project might bring more value.
"Connection is clear since EA stress the need ot provide value form busines perspective not just from an IT perspective. The extensive use of the ArchiMate motivation and strategy layers is a clear demonstration of this.
In terms of stakeholders the stress is given to the business benefits therefore covers business stakeholders and C-level besides technical audiences.
The benefit is not realized by the IT but the main investment is on IT so a tool to keep the monitoring and keep the alignement of the beneits along the project lyfe cycle is beneficial.
No clear understanding.
I would say that one of the benefits of EA is the fact that it can offer 3 different perspectives:
• As-Was
• As-Is
• To-Be"
Yes, despite the main objective of EA (designing a solution, contemplating it in its different layers, from the hardware to the business (eg employees and processes) that support a certain idea / initiative / project), it turns out that currently it is not always used as expected (eg not being used as a whole, or not having the desired adoption). Often this lack of adherence is due to the fact that existing traditional viewpoints do not allow stakeholders to view their main concerns (eg costs or achievement of goals and objectives), making the use of this approach only seen as a method for sketch a draft of the idea, it is not easy to understand how to implement it and what the result of each possible decision / choice is. Through this viewpoint it will be possible to ensure that the defined EA model allows to achieve the objectives outlined initially and even though these are achieved more efficiently.

Similarly to my answer to the previous question, yes, I do see an added benefit of using this relation. This is especially relevant for making specific the aspects of the TOGAF ADM preliminary phase and the architecture vision phase. In terms of ArchiMate, the concepts from the Strategy and Motivation extensions are the least used when modelling. This relation to BDN can provide more reasons to use these concepts to explicitly model the business outcomes required by the organization and relate them to element that represent how they can be realized.

3) Considering the solution proposed solution, how do you evaluate the use of the ArchiMate concepts in the representation of the BDN concepts? Do you see the correspondences as adequate as well as the assumptions that were on the basis of their definition?

"The fit is logical to some extent, if the definitions are treated quite loosely, so the two can be linked together, but not precisely. The weak links are: Objectives in BDNs and Goals in ArchiMate are not quite the same and Outcomes and Benefits are not the same – changes always produce outcomes, but not always benefits. Capabilities are a bit of a problem – they can be enablers, enabling changes or business changes, depending on how closely they relate to the delivery of specific benefits. I don't think they need special treatment here but each one should be positioned in relation to changes it helps bring about or even benefits it delivers. I don't think Enabling changes and Courses of action are very similar, as the latter are about plans not actual changes."
Generically the concepts are correctly assumed to translate the integration of the BDN concepts in ArchiMate language.
I suggest a synthesis of the concepts.
IT Enable is a capability are all success factors.There are many relationships that could be simplified. Show metamodel the type of relationship.
"ArchiMAte provides a known and natural language and therefore modeling in this language is interesting. It allows to explain IT deliveries, it has to be dynamic with changes. And the way to keep the model alive and consistent is through Archimate. The correspondence was well done".
"Maybe I would not have modeled the business changes with value streams and capabilities but with requirements, since it is rather the (planned or required) changes to the capabilities and value streams you are interested in. How do you propose to make that distinction?
The association relationship from IT Enablers to Enabling Business Changes is also rather weak. Serving might be a better choice. And finally, I would not draw influence relationships from the drivers to the goals. That would typically be just an association, or an influence in the opposite direction, towards what you achieve (the driver), like elsewhere in the language.
"I think there are different ways of modelling this, also at different granularity levels. Therefore, I believe that different respondents may have different opinions. I would say that what is more important is that all the stakeholders at the same organization agree on the mapping (regardless

of the mapping). If they agree on it, the will have a common language to discuss the subject and set the goals, improving in that way the communication between stakeholders.
Some of the correspondences of the mapping created are quite direct and do not raise any doubts (e.g. BDN Business Driver - ArchiMate Driver). In other cases, although these are not entirely obvious in the first instance (e.g. Business Change - 1) Value Stream; 2) Capability) it appears that they make sense, being duly justified, and the justification presented is pertinent, since it is based on adequate assumptions. ”Yes, I think that they are appropriate. The only correspondence that I am unsure of is the Enabling changes to the Course of Action. While I understand the reasoning used, this seems to be a partial match to the meaning of Enabling changes.
Additionally, I think that for the Business changes it would be less confusing to use only one ArchiMate equivalent concept rather than 2. It is not clear now when to use one or the other.

4) Looking at the application of the model to a use case, how do you evaluate the result under the scope of the benefits management? Are there aspects that bring a value and which aspects can be improved?

”Unfortunately I don’t think the case study is a very good one, so the value of the approach is not very clear. The case is weak because the benefits are vague – one benefit per objective is very odd. And restatement of an objective as some of the changes, which are rather generic, is poor practice. Automating workflow to achieve it’s not clear what the benefits would be – ‘cost reduction’ is too vague. It looks very like an IT push project, trying to justify new technology but based on vague benefits – traditional perhaps, but maybe not a good example for this purpose? As a result it’s difficult to judge how valuable the approach is.
” Representation is good but the layering view is difficult to read perhaps a high level could be delivered first and then more detailed ones that should are more details that could be seen using a “zoom” approach.

”Accomplished the objective, corroborates other viewpoints and in a valuable way and the realization in the realization of the TOGAF F and G can be extended and could align with the vision of migration and plan the next actions. The realization of the benefits can be phased and not all at once - execution of benefits.
The migration plan is interesting.”
It is difficult to understand without the context of e.g. the capabilities and value streams of the use cas, and I see e.g. a “Workflow Manager” capability but also a “Workflow Manager Service” capability. Moreover, “service” is a very specific notion in ArchiMate, so using that for a capability may confuse users.
For the objective of showcasing the application of the model the objective has been achieved ”The presented demonstration clearly illustrates the possibility of applying the BDN model in

ArchiMate, allowing to verify which IT resources and which actions associated with them should be applied, in order to verify what the desired outcomes and benefits are, thus ensuring that they are achieved. In fact, through this viewpoint, decision making related to other topics is still facilitated. For example, in the hypothetical case of the need to eliminate or end support for a given resource, it is possible to easily verify which objectives may be questioned and their implications.
However, it should be noted that for a first case with only 3 objectives (achieved through the use of 3 resources), the diagram's complexity is already considerable (since it already contains more than 30 elements). Nevertheless, I consider that the objective of the proposed solution has been successfully achieved, and the above limitation can be solved by creating additional views on the model presented." The structure of the model in Figure 3 makes it easy to understand the logic of what is presented. This kind of hierarchical approach emphasizes the relation between the resources and capabilities of an organization which are required to achieve certain business outcomes and objectives. It can be a useful tool to use for discussion with managers, by emphasizing where investments are needed in order to achieve the desired outcomes.

5) Wich views might be considered to bring more value to different stakeholders?

I think BDNs (and the rest of the Benefits Management approach) are valuable for business stakeholders and also for IT practitioners, whereas EA approaches have more value for IT practitioners "- Value stream maps connected with motivation and with business layers (process and functions) – Business owners and C-level - Capability map connected with Value streams – Business owners and also owners of the main capaiblities - Process models and service models connecting with platform implementations – Business and technical stakeholders"
"it can be complicated depending on who is interested. It would be interesting to have a representation of another type of the tabular genre to facilitate the representations"
"Migration - F and G and transition architecture and contemplating phasing. The realization of benefits is part of the technical spectrum.
It was not necessary to go into this part so much, it would gain a focus on governance"
A very open question. This can only be answered when you know more about the stakeholders and their needs.
Depends on the stakeholders, going down to the technical ifrastructure level can create views to understand the implication of specific elements in the benefits realization and also representing the owners of the benefits.
Other views that could be potentially interesting could include "Business Roles" or "Business Actor", in order to identify the people responsible and "accountable" for each of the Business Changes and Enablng Changes, or even for verifying whether the objectives already outlined have been achieved.

6) Do you consider the model and its application as easy to understand either from the practicioner as from the stakeholder point of view? Are there points that are not so clear looking at the graphical representation?

I can understand the model and its use, but from extensive experience of using BDNs, I know it's not easy for everyone to distinguish, for example, business and enabling changes. We kept to a minimum of terms to achieve understanding, but it was still difficult for some people to grasp. Therefore introducing many more terms will not be helpful for business users. It's a longstanding IT problem – using too many unfamiliar terms, which users see as IT practitioners trying to exercise control. The ArchMate terminology is not 'natural' and even quite contrived in places, which will not help gain user involvement. The graphical representation is fine, but maybe combining all the IT project details with the business changes and benefits may be a bit frightening for some business users?
All is clear just consider the improvements suggested above
"The question would be to be able to have less concepts. A visual representation to have small things is good but with the complexity.
There's a question of scalability,
The work is valid in connecting technology with organizations.Who the stakeholders are going to be is the question.
Scalability problems in graphical representation"
Easy to understand modification and application quickly is trivial. It adds value and manages to be very fast.
Perhaps for the benefit of non-modelers you need to use a different representation of the model, e.g. using only simple arrows and no icons in the ArchiMate boxes, since they will probably not need that to understand the reasoning. Tables or matrices could also be alternative representations of the same model.
"Structural is well modulated and is readable with grouping of boxes.
Requires knowledge of language.
Complexity with a high number of concepts"
In my opinion the model is easy to understand, given the direct and concise mapping in the respective BDN elements and taking into account the small (but perfectly acceptable and adequate) number of ArchiMate concepts used, as well as the simplicity of the type of connectors used.
I think that the model and its application are good, but there are some aspects which can improve its readability.

Table A.1: Quantitative Result

Interiewed Expert	Conceptual Quality	Demonstration Quality
A	5	5
B	5	4
C	3	3
D	5	4
E	3	2
F	3	3
G	4	5
H	4	4
Standard Deviation	**0,92**	**1,03**
Median	**4**	**4**

Appendix B

SIC Project Overview

The Following information was obtained from SIC Request for Proposal docu-ment: “NEW SIC Television and Multimedia Production Center RFP” published on June 2017 and send to media industry turnkey solution providers.

Company information Impresa Group is one of the largest media groups in Portu-gal. Our activity is split in several business units, where the major ones are related to television broadcast and publishing, with economic interests that include a free to air TV channel, several cable TV channels, a large portfolio of magazines and a weekly newspaper. Our television operation includes a free to air channel (Sic), international channel (Sic Internacional), 24h news cable channel (Sic Noticias), two entertainment cable channels (Sic Mulher and Sic Caras), and two youth cable channels (Sic Radical and Sic Kids).

Guidelines about what must be analyzed and proposed Impresa is going to centralize all operations in a single location, located in Paco de Arcos. In this location, we already have the publishing area (that includes both print and digital) and recently SIC has already installed and is running its new Program-ming Content Central Ingest area, Multichannel HD Playout Center and Media Asset Management technical core. This project consists, in simple terms, in a re-foundation of SIC Television. The major reasons are:

- New location in a reconstructed building, adapted to accommodate all the companies and activities of Impresa Media Group;
- New technical infrastructure, planned, designed and implemented from scratch;
- New technological paradigm, related with the evolution of Television Station Cores to IP based infrastructures.

Considerations about future “TV Station Core” technology SIC team has been evaluating, analysing and learning the various technical possi-bilities offered by the industry for the future core of its new TV and Multimedia Pro-duction Centre. This is a challenging time to make technical choices once there is gradual movement towards “IP” that is still in consolidation, both

in the standards domain and regarding the technology development to be accommodated in this new reality of a TV Station Core. SIC defines the following general requirements for its future station core:

• Flexibility- Overall system and specially its routing core must be highly flexible to be configured, to be managed in real time locally and from remote places, provide agility to allow on-the fly changes in studios set-up and in overall interconnection among the various active devices, preferably software defined;

• Robustness - System must be designed with an architecture that integrate key components technologically robust and intensively tested and used before their inte-gration at New SIC Production Center;

• Reliability, redundancy and automatic failover - SIC requires a “No downtime” for key components that will be part of the Station Core and Studio Platforms, sup-porting Live TV Production. Suppliers must analyse all the single points of failures, mitigate the risks of disruption in the operation, design alternative signal paths and alternative interconnections and design and intensively test the changeover devices and set-up and rehearse all the identified situations that might be considered emergen-cy cases;

• No operational disruption during technological upgrades - Considering the required continuity of operation of a broadcasting operation, maintenance and up-grades should be made with no disruption to the broadcasting operation;

• Comply with the 2110 standard family – SIC is requiring the total compliancy of all the technological devices with all the standards of the SMPTE 2110.

Solution Implemented – Extraction from Sony Europe Project documents.

IP Video Routing - real challenge of the project is to achieve a new technological paradigm, related with the evolution of the Television Station Core to IP, as rightly mentioned by SIC in the RFP. Global vision - The move to a new production centre brings to SIC the opportunity to have new studios and the latest infrastructure. The broadcast industry has evolved in the last few years towards a more IP-based architecture, and this is a very good opportunity to gain the benefits of it. IP Live Production System Applications - IP Live Production System by Sony is suitable for multiple Live Productions scenarios. The goals are about maximizing the use the production system by sharing resources, reducing the downtime of the equipment between programs and to enable the best business flexibility. IP gives the possibility to dispatch the processing units from the control surfaces. Remote production and remote integration are the natural applications where IP Live Production System gets the most.

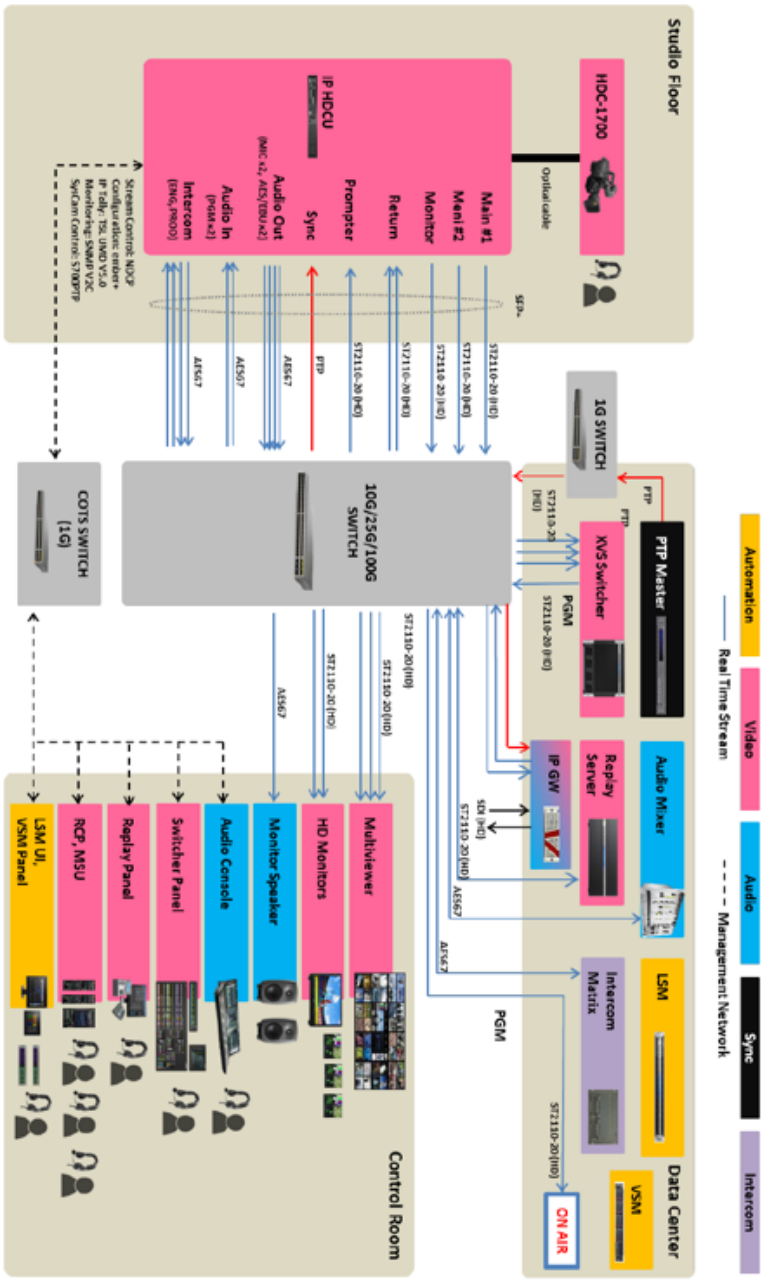

Figure B.1: SIC Studios Project.

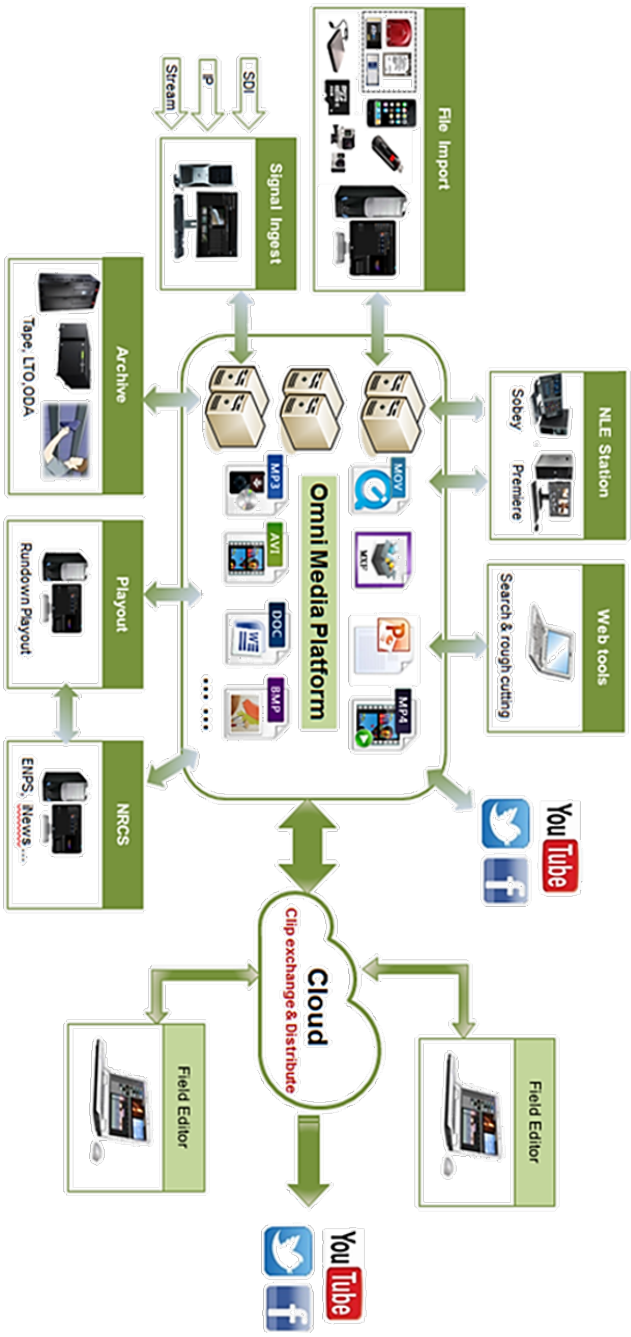

Figure B.2: News Production Concept .

Appendix C

Media Industry Chalenges Mind Map

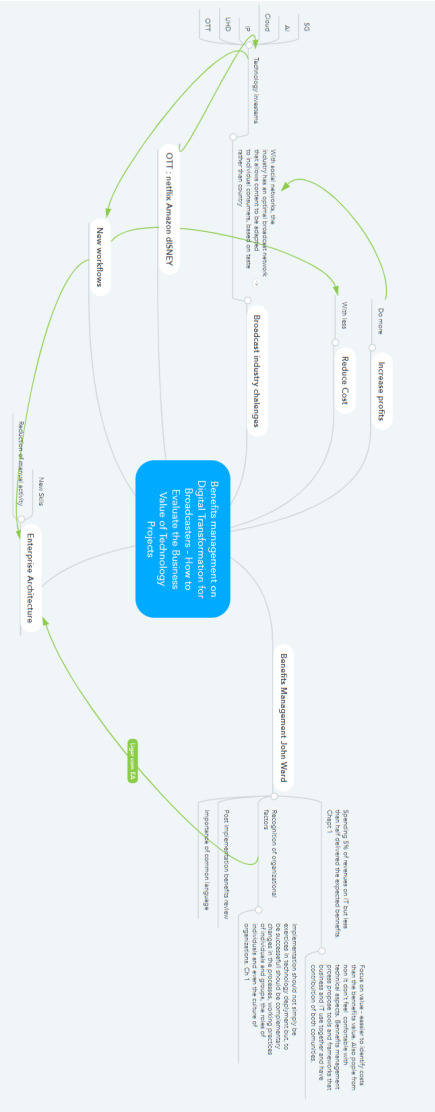

Figure C.1: Media Industry Digitization Challenges Mind Map.