Universidade do Minho
Escola de Engenharia

Fernando Rui Gomes Martins

Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management

February, 2025

Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management

Fernando Rui Gomes Martins

UMinho | 2025



Universidade do Minho
Escola de Engenharia

Fernando Rui Gomes Martins

Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management

PhD thesis

Doctoral Program in Information Systems and Technology

Thesis performed under the supervision of

Professor Doctor Pedro Miguel Gonzalez Abreu Ribeiro

Professor Doctor Francisco José Monteiro Duarte

February, 2025

Direitos de autor/Copyright

Este é um trabalho académico que pode ser utilizado por terceiros desde que respeitadas as regras e boas práticas internacionalmente aceites, no que concerne aos direitos de autor e direitos conexos.

Assim, o presente trabalho pode ser utilizado nos termos previstos na licença abaixo indicada.

Caso o utilizador necessite de permissão para poder fazer um uso do trabalho em condições não previstas no licenciamento indicado, deverá contactar o autor, através do RepositóriUM da Universidade do Minho.

This is an academic work that may be used by third parties provided that the internationally accepted rules and good practices regarding copyright and related rights are respected.

This work may therefore be used under the terms of the licence below.

If the user needs permission to use the work under conditions not provided for in the licence indicated, they should contact the author via the University of Minho Repository.

Licença concedida aos utilizadores deste trabalho / Licence granted to users of this work



Atribuição-NãoComercial

CC BY-NC

https://creativecommons.org/licenses/by-nc/4.0/

Acknowledgements

Finally, one of the first pages of this document represents practically the last effort of writing this thesis...

Thank you, Adriana (my drama queen) and Ariana (my sunflower). My strength wouldn't have been what it is without you always being present and testing my patience. I couldn't imagine a day without the hectic mornings and the countless nights of joy-filled struggles.

My gratitude to my parents and sister, for being so dull, they make me appreciate the little moments we spend more and more.

I would like to sincerely thank the people and entities who helped make this PhD project possible and whose contributions cannot be forgotten. I want to highlight the Transportes Urbanos de Braga Administration, in the person of Professor Baptista da Costa, Eng. Teotónio Andrade dos Santos and Dr. Sandra Cerqueira.

To my tutors, Professor Pedro Miguel Gonzalez Abreu Ribeiro and Professor Francisco José Monteiro Duarte, my heartfelt thanks for their guidance, impact on my academic life, and friendship through these years.

To my colleagues from various professional struggles, especially Veloso, Meireles, Nuno and Diana, for their help, support and the distillation of hatred that helps us survive the days that go by.

And since things cannot be explained, I also want to reference the two-wheeled friends who always gave me the moments when it was necessary to disconnect briefly.

Declaration of Integrity

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

Resumo

Estendendo a prática de gestão de projetos para projetos de inovação em Smart Cities, com foco na gestão de stakeholders.

A rápida evolução tecnológica tem transformado o desenvolvimento urbano através de iniciativas de Cidades Inteligentes (CI) que integram tecnologias avançadas para melhorar a habitabilidade, sustentabilidade e competitividade. Apesar de promissores, estes projetos produzem frequentemente resultados inconsistentes, revelando lacunas significativas nas práticas tradicionais de gestão de projectos e na integração dos stakeholders.

Esta tese aborda essas lacunas, alargando os modelos de gestão de projetos para apoiar projectos de inovação em CI, com um enfoque na gestão eficaz de stakeholders. Uma revisão crítica da literatura evidencia um foco predominante nas dimensões tecnológicas das CI, enquanto as perspetivas de gestão de stakeholders permanecem pouco exploradas. Este desequilíbrio tem contribuído para abordagens de implementação fragmentadas.

Para colmatar essa lacuna, introduzimos o Astrolabe4SM, uma framework concebida para simplificar a identificação, integração e gestão das partes interessadas nos projectos de CI. O Astrolabe4SM propõe uma metodologia sistemática que alinha os diversos interesses e capacidades dos vários stakeholders, facilitando práticas de gestão de projetos coerentes e adaptáveis. A validação desta ferramenta em múltiplos contextos demonstra o seu potencial para melhorar os processos de tomada de decisão, aumentar a continuidade dos projetos e reduzir os riscos associados à gestão de stakeholders.

Ao integrar eficazmente as perspectivas das partes interessadas na execução dos projectos, o Astrolabe4SM não só reforça a gestão global dos projectos de cidades inteligentes, como também garante uma maior sustentabilidade e replicabilidade. A identificação adequada dos stakeholders proporcionará não só uma maior integração de esforços conjuntos nestes projectos, mas também a sua continuidade e replicabilidade noutras cidades e menores custos ao longo da sua vida.

Acreditamos que esta abordagem poderá aumentar as taxas de sucesso dos projetos através de uma gestão mais robusta e eficiente, capaz de se adaptar a um ambiente tão volátil quanto o mundo da tecnologia e da sociedade em geral.

Palavras-chave: Cidades Inteligentes, Gestão de Projetos, Inovação*, Stakeholders*, Sustentabilidade.

Abstract

Extending Project Management Practices for Innovation Projects in Smart Cities, Focusing on Stakeholder Management.

Rapid technological evolution has transformed urban development through smart city initiatives that integrate advanced technologies to enhance livability, sustainability, and competitiveness. Despite their promise, these projects often yield inconsistent outcomes, revealing significant gaps in traditional project management practices and stakeholder integration.

This thesis addresses these gaps by extending project management frameworks to support smart city innovation projects, with a particular focus on effective stakeholder management. A critical review of the literature reveals a predominant focus on the technological dimensions of smart cities, while managerial, political, and stakeholder perspectives remain underexplored. This imbalance has contributed to fragmented implementation approaches, leading to projects that are often isolated, non-replicable, and financially unsustainable.

To bridge this gap, this work introduces Astrolabe4SM, a framework designed to streamline stakeholder identification, integration, and management within smart city projects. Astrolabe4SM offers a systematic methodology for aligning the diverse interests and capabilities of various stakeholders, facilitating coherent and adaptable project management practices. Empirical validation of this tool across multiple contexts demonstrates its potential to enhance decision-making processes, improve project continuity, and reduce risks related to stakeholder management.

By effectively integrating stakeholder perspectives into project execution, Astrolabe4SM not only strengthens the overall management of smart city projects but also ensures greater sustainability and replicability.Proper stakeholder identification will provide not only greater integration of joint efforts in these projects but also their continuity and replicability in other cities and lower costs throughout their lives.

We believe this opportunity could enhance the success rates of these projects through more robust and more efficient management, capable of adapting to an environment as volatile as the world of technology and society in general.

Keywords: Innovation, Project Management, Smart Cities, Stakeholders, Sustainability.

Table of Contents

Direitos de autor/Copyright i

Acknowledgements ii

Declaration of Integrity iii

Resumo iv

Abstract v

List of abbreviations and Acronyms ix

List of figures xi

List of symbols xiv

List of tables xv

PART I – Prologue 1

1. Introduction 1

1.1 Motivation 1

1.2 Problem 5

1.3 Goals 6

1.4 Plan of Activities 7

1.5 Document Structure 9

2. Research Methodology 12

2.1 Introduction 12

2.2 Bibliography Search Strategy 12

2.3 Action Research 13

2.4 Action Research in Action 15

2.5 Action Research Guidelines 17

2.6 Conclusions 18

PART II – State-of-the-Art 20

3. Project Management 20

3.1 Introduction 20
3.2 Historical Evolution of Project Management 21
3.3 Project Management Concepts 22
3.4 Comparative Analysis of PMBOK, PRINCE2, and PM² Methodologies 37
3.5 Conclusions 42

4. Stakeholders in Smart Cities 44

4.1 Introduction 44
4.2 Stakeholder Management 44
4.3 Smart Cities 59
4.4 Conclusions 74

PART III – Contribution 75

5. Powered By Action Research 75

5.1 Introduction 75
5.2 The EFQM Model 77
5.3 RADAR - Results, Approaches, Deployment, Evaluation, Refinement 81
5.4 Approach Structure for the Actions 86
5.5 Conclusions 87

6. Stakeholder Management in Smart Cities Projects 89

6.1 Introduction 89
6.2 Action 1 | Research Trigger: Business Case Framework Project 91
6.3 Action 2 | Implementation of GDPR on a Local Administration Company 117
6.4 Action 3 | Traffic Flow Prediction Using Public Transport and Weather Data 139
6.5 Action 4 | Braga Urban Innovation Laboratory Demonstrator 162
6.6 Action 5 | Bus Rapid Transit @ Braga 187

7. Framework Astrolabe4SM 211

7.1 Introduction 211
7.2 Project Classification 212
7.3 Stakeholder Identification 230
7.4 Stakeholder Classification 236

7.5 Proposed Framework 240
7.6 Document Classification 300
7.7 Project Framework Metro Line 302
7.8 Astrolabe4SM 304
7.9 Conclusions 305

PART IV – Epilogue 309

8. Conclusions 309

8.1 Introduction 309
8.2 Lessons Learned 310
8.3 Comments on the Actions 312
8.4 Critical Analysis 314
8.5 Future Work 316

Bibliography 318

Appendix 335

A. Astrolabe4SM 335
B. Activity Diagram 337
C. Project Metro Line 341
D. Stakeholder Mapping 342
E. Framework Documents and Fields Mapping 343
F. PhD Logo 344
G. Metrics matrix for the comparison of the results of Actions 345
H. EFQM RADAR scoring attributes for Enablers criteria 350
I. Actions Document Structure 351
J. Document Classification Structure 352
K. Project Timeline 353

List of abbreviations and Acronyms

AR	Action Research
Astrolabe4SM	Astrolabe for Stakeholder Management
BA	Business Analysis
BC	Business Case
BRT	Bus Rapid Transit
BUILD	Braga Urban Innovation Laboratory Demonstrator
CCP	Código da Contratação Pública
CSR	Corporate Social Responsibility
CI	Cidade Inteligente
CT	Comissão Técnica
EFQM	European Foundation for Quality Management
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technologies
IIBA	International Institute of Business Analysis
IPQ	Instituto Português da Qualidade
IS	Information Systems
IT	Information Technologies
MG	Main Goal
NGO	Non Governmental Organisation
NP	Norma Portuguesa (Portuguese Standard)
PCC	Public Contracts Code
PDCA	Plan-Do-Check-Act
PID	Project Initiation Document
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PRINCE2	PRojects IN Controlled Environments
PSM	Project Stakeholder Management

R&D	Research and Development
RACI	Responsible, Accountable, Consulted, Informed
RADAR	Results, Approaches, Deployment, Evaluation, Refinement
RAM	Responsibility Assignment Matrix
SG	Secondary Goal
SM	Stakeholder Management
SMEs	Small and Medium-sized enterprises
SWOT	Strengths, Weaknesses, Opportunities and Threats
TCB	Teatro Circo de Braga
TUB	Transportes Urbanos de Braga

List of figures

Figure 1 – Action Research 15

Figure 2 – Strategy, project, program, portfolio, and operations relationship. 30

Figure 3 – Three Aspects of Stakeholder Theory 34

Figure 4 – Stakeholder literature map 50

Figure 5 – Project Stakeholder Management Framework 56

Figure 6 – Overall Organisational Strategy Framework 62

Figure 7 – Performance in a context of change 63

Figure 8 – Cycle of the integrated approach to programmes and projects in public management 64

Figure 9 – Alignment between programmes and projects in public policies 65

Figure 10 – Intervention Logic Vs. Impact Logic 67

Figure 11 – Intervention structured around a relationship between means and ends 69

Figure 12 – Activities to be developed according to the intervention stages 70

Figure 13 – The relationship between projects, initiatives and Smart Cities 72

Figure 14 – EFQM Model 2020 77

Figure 15 – EFQM model and points 80

Figure 16 – RADAR assessment framework from EFQM 2010 model 82

Figure 17 – Actions Timeline 90

Figure 18 – Business Case Change Lifecycle 92

Figure 19 – Procedure for the start of a project 93

Figure 20 – Transportes Urbanos de Braga, Empresa Municipal 95

Figure 21 – Business Case Project - Stakeholder Map 97

Figure 22 – Preliminary Metro Line for Simple Project V.1.0 100

Figure 23 – Needs Identification Process (without Business Case) 105

Figure 24 – Needs Identification Process (With Business Case) 106

Figure 25 – Business Case V1 Proposal 108

Figure 26 – Teatro Circo de Braga EM, S.A. 122

Figure 27 – GDPR Project - Stakeholder Map 124

Figure 28 – Metro Line for Simple Project V.1.1 126

Figure 29 – Schedule and Gantt Chart for the GDPR Project 130

Figure 30 – Traffic Flow Prediction Project - main stakeholders – Minho University, LabSecIoT, TUB 144

Figure 31 – Traffic Flow Prediction Project - Stakeholder Map 146

Figure 32 – Innovation Project Classification of the Traffic Flow Prediction Project 147

Figure 33 – Metro Line for Innovation Project V.2.0 148

Figure 34 – Schedule and Gantt Chart for the Traffic Flow Prediction Project 152

Figure 35 – Traffic Flow Prediction Project Deliverable 154

Figure 36 – Presentation of the BUILD project with the Assistant Secretary of State for Mobility, José Mendes 162

Figure 37 – BUILD Project Architecture 165

Figure 38 – BUILD Project - Main Stakeholders 167

Figure 39 – BUILD Project - Stakeholder Map 169

Figure 40 – Preliminary Metro Line for Complex Project V.3.0 171

Figure 41 – Schedule and Gantt Chart for the BUILD Project 178

Figure 42 – Preliminary Routes of the BRT @ Braga Project 188

Figure 43 – BRT @ Braga Project 189

Figure 44 – Decision Support Study for a high-capacity transport system on its own site | Braga 190

Figure 45 – Demand Study for the Implementation of a BRT in Braga˜ 191

Figure 46 – BRT @ Braga Project - Stakeholder Map 195

Figure 47 – Metro Line for Complex Project V.3.1 196

Figure 48 – Total Investments and payments to BRT project 200
Figure 49 – Schedule and Gantt Chart for the BRT Project 202
Figure 50 – BRT @ Braga Project presentation by Prime Minister of Portugal 203
Figure 51 – Public procurement by type of procedure 225
Figure 52 – Selection of type of Public Procedure 226
Figure 53 – Innovation Partnership 227
Figure 54 – Direct Adjustment Procedure 228
Figure 55 – Public Tender Procedure 229
Figure 56 – Project Classification 230
Figure 57 – Navigating Effective Stakeholder Engagement 231
Figure 58 – Stakeholder Mapping (Influence and Requestor or Provider Side) 238
Figure 59 – Contract requirement on all types of projects 247
Figure 60 – Project Framework Metro Line 303
Figure 61 – Astrolabe4SM 305
Figure 62 – Framework Documents and Fields Mapping 306
Figure 63 – Framework logo 307
Figure 64 – Comparison of the Enablers of the Actions 313

List of symbols

€ Euro

km kilometer

List of tables

Table 1 – Planned thesis phases 8

Table 2 – Structure of the thesis 11

Table 3 – Procedure for conducting Action Research 18

Table 4 – Project Management Body of Knowledge (PMBOK) 38

Table 5 – PRINCE2 (Projects IN Controlled Environments) 40

Table 6 – PRINCE2 (2009) Vs PRINCE2 (2017) 40

Table 7 – PM² Project Management Methodology 41

Table 8 – Defining Stakeholders in Smart Cities Projects 46

Table 9 – Principles of Stakeholder Management 49

Table 10 – Design, implementation and evaluation during the lifecycle of a project 65

Table 11 – Programme / Project Cycle 68

Table 12 – EFQM RADAR scoring attributes for Enablers criteria 83

Table 13 – Proposed maturity levels to score Actions using a RADAR-like approach 84

Table 14 – Proposed metrics for the comparison of the results of Actions 84

Table 15 – Metrics fields and characterisation 85

Table 16 – Structure for the Actions (v1.5) 86

Table 17 – Business Case Project - Stakeholder Evaluation 96

Table 18 – Documents applied to the Business Case Project 99

Table 19 – Business Case Project Framework Documents 100

Table 20 – Business Case total costs 101

Table 21 – Planning of the project "Connected BUS" 102

Table 22 – Tools and techniques of the Business Case Template 104

Table 23 – Maturity Level Matrix of the Business Case Project 109

Table 24 – Results of the action related to the Business Case Project 111
Table 25 – GDPR Project - Stakeholder Evaluation 123
Table 26 – Documents applied to the GDPR Project 126
Table 27 – GDPR Project Framework Documents 126
Table 28 – GDPR Project - HR costs 129
Table 29 – GDPR Project - total costs 129
Table 30 – Maturity Level Matrix of the GDPR Project 132
Table 31 – Results of the action related to the GDPR Project 133
Table 32 – Traffic Flow Prediction Project - Stakeholder Evaluation 144
Table 33 – Framework evolution and documents applied to the Traffic Flow Prediction Project 149
Table 34 – Traffic Flow Prediction Project Framework Documents 149
Table 35 – Traffic Flow Prediction Project - HR costs 151
Table 36 – Traffic Flow Prediction Project - total costs 151
Table 37 – Maturity Level Matrix of the Traffic Flow Prediction Project 155
Table 38 – Results of the action related to the Traffic Flow Prediction Project 156
Table 39 – Build Project - Stakeholder Evaluation 167
Table 40 – Framework evolution and documents applied to the BUILD Project 172
Table 41 – BUILD Project Framework Documents Pt1 173
Table 42 – BUILD Project Framework Documents Pt2 173
Table 43 – BUILD Project - HR costs 176
Table 44 – BUILD Project - total costs 176
Table 45 – Project BUILD - Objectives and Deliverables by Stakeholders 179
Table 46 – Project BUILD - Other Stakeholders by Scope 180
Table 47 – Maturity Level Matrix of the BUILD Project 181

Table 48 – Results of the action related to the BUILD Project 182
Table 49 – BRT @ Braga Project - Stakeholder Evaluation 192
Table 50 – BRT @ BRAGA Project Framework Documents..... 197
Table 51 – BRT Project - HR costs 200
Table 52 – BRT Project - total costs 201
Table 53 – Maturity Level Matrix of the BRT @ Braga Project..... 205
Table 54 – Results of the action related to the BRT @ Braga Project..... 207
Table 55 – European Directives - three major classifications..... 215
Table 56 – European Directives adapted to a local context and projects from public procurements. . 217
Table 57 – Relationship between public procurement and stakeholder management 221
Table 58 – Types of Public Procedures 222
Table 59 – Effectively Engage with Stakeholders 231
Table 60 – Potential user group of stakeholders..... 232
Table 61 – Stakeholder Mapping and Definition 239
Table 62 – Stakeholder Classification Guidelines..... 239
Table 63 – Business Case Template Fields 243
Table 64 – Project Charter Template Fields..... 252
Table 65 – Responsibilities and Substitution Matrix Template Fields 255
Table 66 – Communication Plan Template Fields..... 262
Table 67 – Team Charter Template Fields 267
Table 68 – Team Toolkit Template Fields..... 271
Table 69 – Stakeholder Engagement Toolkit Template Fields..... 277
Table 70 – Stakeholder Template Fields 281
Table 71 – Stakeholder Template Fields 285

Table 72 – Change Management Template Fields 289

Table 73 – Stakeholder Evaluation Template Fields 293

Table 74 – Risk Management Template Fields 298

Table 75 – Type of Restrictions by Document 300

Table 76 – Documents Access Restrictions Definition 301

Table 77 – Scores for the Enablers of all Actions 312

Table 78 – Values for the Results of all Actions 313

Table 79 – Evaluation of Stopping Conditions for all Actions 314

Table 80 – Execution of the phases of the PhD 316

PART I – Prologue

"Go back?" he thought. "No good at all! Go sideways? Impossible! Go forward? Only thing to do! On we go!" So up he got, and trotted along with his little sword held in front of him and one hand feeling the wall, and his heart all of a patter and a pitter."

- Bilbo Baggins, The Hobbit, J.R.R. Tolkien

1. Introduction

In this first chapter, we start with the introductory aspects of the research, outlining the driving forces like the motivation, challenges that the problem offers, objectives as the definition of goals, and the structured approach adopted for the PhD effort. This structured narrative not only sets the stage for the forthcoming analysis but also provides a clear roadmap of the thesis document.

The motivation section describes the motivations that spurred this research, highlighting the relevance and urgency of the topic in the current academic and practical contexts. By identifying the gaps in existing literature and the pressing needs of the industry, we establish the significance of addressing these challenges through our research.

Following the Motivation, we delineate the specific Problem that our study aims to address, identifying the gaps in existing literature and the pressing needs of the stakeholders.

The Goals of this research are articulated in this part, where we define what the study intends to achieve. These goals are set to provide clarity on the intended contributions of our research.

To accomplish the outlined goals, this section presents a detailed plan of activities. It includes the predicted timeline, ensuring a systematic approach to tackling the research problem.

Finally, we provide an overview of the structure of the document, explaining how each chapter contributes to the overall document. This schematic description aids in navigating through the complex layers of research presented.

1.1 Motivation

Technological evolution offers new opportunities and challenges to cities. Look at the past decade and see that the increasing use of technology in all sectors of society has led cities to integrate the latest

technology to sustain their economic or political development (Zhuhadar et al., 2017). Still, all this has also created some uncertainty.

As a government unit, the city is growing increasingly more prominent, complex, and essential as the population ranks of urban areas swell with ever-increasing speed (Nam & Pardo, 2011a).

We are confident that the latest world indicators show that we are facing a world with an unprecedented level of urbanisation, since 10% of the world population lives in 30 megacities, more than a quarter of the population is accommodated in only 600 cities (Richard Dobbs et al., 2011) and that more than half of the entire population lives in cities.

The growth of the urban population makes it imperative for the emergence of diverse possibilities for progress, change and innovation, even because the challenges faced encourage the appearance of ideas and technologies, such as Information Technologies (IT) and Information Systems (IS), can transform the panorama of this time.

The Smart Cities concept is currently considered one of the "hottest topics" in urban development, especially in Europe. As the term “Smart City” gains broader and more comprehensive currency, there is still confusion about what a smart city is, mainly since several similar terms are often used interchangeably.

Many stakeholders are promoting Smart Cities projects, believing that integrating technology and infrastructure can enhance the cities' liveability, sustainability, services, and competitiveness.

However, the same systems produce contradictory results, according to the organisational and deployment models present in the cities, leading to very different impacts according to the training and the profile of each manager, so leaving the decisions to the suppliers and specialists of these systems, is no longer viable or bearable, and, for this reason, it is necessary to introduce Project Management (PM) in IT.

It is, therefore, notorious the importance and relevance that the PM should have in this flood of projects related to Smart Cities, allowing the focus to be on the planning, organisation, direction, and control of the resources of a company or, in this case, in cities, with requirements as being time and goals to be achieved (Kerzner, 2021).

To that end, increasingly active, weighted, and well-structured stakeholder management, supported by a stakeholder management model present in the project management approach, makes an essential

contribution to the success of a project (Eskerod et al., 2015), while including stakeholder management in this equation.

We believe a smart city, or a smarter one, should be seen as a private company committed to innovation in diverse areas, such as technology, management and politics. Innovation for an intelligent city implies opportunities and risks, all at the same time.

There is a gap in the literature on a Smart City and project management for a smart city. Most authors refer only to technological aspects, showing only the manifestation of innovative characteristics, and few consider the perspectives of management and local politics (Nam & Pardo, 2011b).

All the existing systems in Smart Cities projects have the potential to support the decision-making in several layers of the city to which each project is destined, leading to the need to integrate an immense amount of data coming from diverse sources (Orłowski, 2014) and that can serve the purposes of several stakeholders, whom may not necessarily be those that would initially be identified.

Proper stakeholder identification will provide not only greater integration of joint efforts in these projects but also their continuity and replicability in other cities and lower costs throughout their lives.

Many authors also claim that projects still fail to meet the expectations of all the stakeholders as they continue to be disappointed by the results of these same projects (Cooke-Davies, 2002; Dai & Wells, 2004; Fernandes et al., 2013), especially regarding the information systems projects (Varajão et al., 2016).

As mentioned earlier, the failure to deliver projects successfully is due to the inexistence of project management processes, and an absence of standards in management leads to considerable informality.

This informality, in the posture adopted in the management of innovation projects from a Smart Cities' perspective, leads to an increase of several costs, be they financial, human or material, and other efforts, even because it is doubtful that informal project management works in an oriented organisation to projects, in which the project manager has responsibilities (Kerzner, 2021).

Our research has demonstrated that there are some critical factors for the success of the management of any project with a certain degree of complexity being those as efficient management of the stakeholders and effective control and monitoring of the systems related to the management of a project (Maldonado et al., 2010; Rezania & Ouedraogo, 2013; Tiwana & Keil, 2009; Turner & Zolin, 2012).

There are limitations to the approaches recommended in project management standards, and according to a study by Besner & Hobbs (2013), limitations are identified in these same approaches. It is concluded that good practices must be adapted to the context in which they are employed to achieve success and thus determine which measures should be targeted for their efforts considering the organisational context (Shi, 2011).

Stakeholders need to be identified and their power and influence mapped so that their potential impact on projects can be better understood.

Recognising the importance of defining standards in project management and their areas of expertise for Smart Cities and innovation and sustainable projects, we will focus our efforts on three standards: Project Management Methodology (European Commission, 2018), PMBOK (Project Management Institute, 2017) and PRINCE2 (Great Britain, 2017).

It is interesting to check the gaps identified in Project Management for Smart Cities, particularly the commitment of the various stakeholders and the sustainability of the same projects, perhaps justified by the innovative nature of these projects. However, considering the identified gaps, we see here represented an opportunity to create efforts to “extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management”.

We believe this opportunity could enhance the success rates of these projects through more robust and more efficient management, capable of adapting to an environment as volatile as the world of technology and society in general.

This way, while focusing efforts on a correct adaptation of the standards with a focus on stakeholder management, we hope to obtain an extended standard adapted to the theme of Smart Cities and for innovative projects that support a correct identification and management of all stakeholders in a city.

Motivation doesn't just have to be academic, it also has to do with what fuels the researcher's interest and curiosity, which may end up being combined with a professional career.

The researcher's connection to the public sector, as a member of the Innovation and TUBconsulting department of Transportes Urbanos de Braga (TUB) and responsible for the technology of Teatro Circo de Braga, EM S.A. (TCB), has led to numerous collaborations and participation in multiple projects in the city, both local and international, leading to the identification of a series of areas with multiple gaps waiting to be filled.

This connection was also the spark for the initial sponsorship of Transportes Urbanos de Braga in the doctoral effort carried out here and in recognising the value that this would bring to the environment in which they operate and to the challenges that often arise.

In conclusion, recognizing challenges and proactively seeking solutions is the driving force behind our motivations.

1.2 Problem

Smart Cities represent a transformative approach towards urban development, integrating technology, data, and innovative solutions to enhance urban life (Bibri & Krogstie, 2021). These initiatives typically involve complex projects with diverse stakeholders, including government bodies, private companies, local communities, and international organisations (Waddell, 2017).

In our opinion, effective stakeholder management is crucial for the success of these projects, for instance, ensuring that all interests are considered and conflicts are minimized.

While the concept of Smart Cities is well-discussed in contemporary research, there is a noticeable deficiency in studies that specifically address the mechanisms of stakeholder management within these projects (Eskerod et al., 2015). Most smart city frameworks focus predominantly on technological implementation, often overlooking the intricate dynamics and potential conflicts among various stakeholders. This oversight can lead to significant challenges, including project delays, increased costs, and reduced impact of the initiatives.

The primary problem is the lack of an all-encompassing framework that integrates stakeholder management into the project management of smart city initiatives. This deficiency leads to several issues (Maldonado et al., 2010; Rezania & Ouedraogo, 2013; Tiwana & Keil, 2009; Turner & Zolin, 2012):

1. Inadequate Stakeholder Identification and Engagement: Key stakeholders are often not identified early enough in the project lifecycle, or if they are identified, they are not adequately engaged;
2. Misalignment of Stakeholder Interests: Without a systematic approach to manage diverse interests and expectations, there is a high risk of misalignment, which can impede project progress and outcomes;

3. Ineffective Communication Channels: The absence of structured communication strategies results in misinformation or information asymmetry, further complicating stakeholder relationships.

Addressing these challenges is essential for ensuring the success of smart city projects. Effective stakeholder management will not only facilitate smoother project execution but will also enhance the sustainability and acceptance of these initiatives. By developing an integrated stakeholder management framework, this research aims to provide actionable insights and tools that can lead to more inclusive, efficient, and successful smart city projects.

Despite the critical importance of stakeholder management in the success of smart city projects, current project management frameworks inadequately address the complex stakeholder dynamics involved (Besner & Hobbs, 2013).

This research identifies a significant gap in the effective engagement, alignment, and communication with stakeholders, which often leads to project inefficiencies and conflicts.

This thesis aims to develop a broad and detailed approach that enhances project outcomes and stakeholder satisfaction by integrating stakeholder management within project management methodologies. The development and implementation of such a framework are crucial for advancing the field of Smart Cities and ensuring their long-term success and sustainability.

Having defined the problem, it was easy to identify the main objective, the outcome of which would be decisive for the success of this doctoral project, which can be found below.

1.3 Goals

Ensuring success in the various project deliverables is related to management capabilities, such as managing all the expectations of the different stakeholders throughout the project's lifecycle.

This is precisely why we agree with Bourne & Walker (2005) when they state that an important task to be undertaken in developing a project's strategic objectives is to identify key stakeholders and create a brief project statement that best meets the often-conflicting needs and desires.

Stakeholders and their influence on project management elements and teams are distinct, diverse, and misunderstood. Taking this into consideration and the opportunities we have described throughout this document, the main goal (MG) of the thesis is:

> (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.

This main goal has given rise to other secondary goals (SG), perceived as well as success criteria, such as:

- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.
- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.

This thesis intends to permit project managers, or any member of a project team, to manage Smart Cities projects, with a perspective on stakeholder management, considering, of course, if we provide them a set of proper processes, tools, and guidelines.

1.4 Plan of Activities

In order to ensure that all the objectives are achieved, while maintaining the rigour of the chosen research methodology, Action Research, we have adopted the activity plan shown in Table 1.

Table 1 – Planned thesis phases

#	Name	Planned Start	Planned End	Description
1	Preparation	March 2018	April 2019	Theoretichal research, drawing state-of-the-art and classes on the first year
2	Thesis Proposal	April 2019	January 2021	Define the contribute, the research questions and the main goal
3	Execution of Actions	June 2018	December 2020	Implement and analyse the Actions
4	Conclusions and Text Revision	January 2021	1st semester 2022	Extract conclusions from the Actions and define proposals for improvements
5	Thesis presentation	1st semester 2022	1st semester 2022	Public discussion of the thesis

The first phase, Preparation, is where theoretical research will be carried out on the topics covered, in particular project management, where we will also address the primary project management concepts and methodologies, the stakeholders present in cities that want to be smarter and in the projects carried out in this environment. The main aim of this phase would be to establish the state of the art. By the end of this phase, we should know the prominent authors and work in the related research fields.

In the second phase, the Thesis Proposal, we present contributions to theory, methodologies, and tools. This is where we propose the title for this PhD project, the research questions, and the respective goals.

In the third phase, execution of actions, all the actions are planned and implemented, following the stopping conditions defined for each action. We validate the proposals and lessons learned in a real project management context, and transpose all these as improvements to the developed framework for use in the new iteration.

We use the fourth phase, Conclusions and Text Revision, to derive the conclusions and compare the actions, including the lessons learned, the analysis of the results, the validation, the scope of the proposals, and some insights about possible future work. We also review the final document in this phase. The goal for this phase is to think over the proposals and to incorporate potential new ideas obtained from the execution of Actions into future work. This phase's success criterion is to complete the full thesis document.

Finally, the fifth stage, Thesis Presentation, involves presenting and discussing this thesis in public examinations. This phase's success depends on obtaining a positive result in the final discussion.

These stages were carefully planned to ensure a systematic approach to the PhD project. Subsequently, in Chapter 8, Critical Analysis, this planned schedule will be compared to the actual progress, identifying any deviations and understanding the factors contributing to those changes.

1.5 Document Structure

This document contains four parts, each having one or more chapters. The first part, the Prologue, consists of:

- Introduction: This chapter sets the stage for the dissertation by outlining the motivation behind the research, defining the problem statement, and elucidating the goals. It establishes the research context and underscores the significance of exploring stakeholder management, project management, and Smart Cities. This introductory narrative lays the foundation for the investigative excursion embarked upon in this dissertation.
- Research Methodology: This chapter describes the methodology employed throughout the research. It provides a detailed exposition of the chosen method, justifying its relevance and adequacy in addressing the research questions. This chapter clarifies the methodological approach and ensures transparency and replicability of the research process.

The second part, State-of-the-Art, represents research and bibliographical research, and also consists of two chapters:

- Project Management: Initiating the core research discussions, this chapter tries to research various aspects of project management within the context of Smart Cities. It reviews existing literature, identifies gaps, and sets the framework for integrating stakeholder management in later discussions.
- Stakeholders in Smart Cities: Central to the thesis, this chapter discusses the role of stakeholders in Smart Cities. It integrates findings from scientific research to shed light on how stakeholders influence and are influenced by smart city initiatives, thus contextualizing the importance of effective stakeholder management.

Part 3 of this document, Contribution, describes in three chapters the definition of the strategy to be applied in the chosen methodology (Action Research), the development of the framework and the application in its various stages of maturity in the actions selected for this effort. Thus, we have the following chapters:

- Powered by Action Research: This chapter recounts the application of the Action Research methodology within the project. It describes the iterative processes and the reciprocal impact between research actions and outcomes, emphasising the dynamic nature of Action Research in practical settings. It also refers to the strategy taken and the combination of another business evaluation model in the process.
- Stakeholder Management in Smart Cities Projects: Building on the previous chapters, this section details specific actions derived from the Action Research methodology to manage stakeholders effectively in Smart Cities projects. It provides insights into these actions' strategies and outcomes, contributing to theory and practice. It applies the developed framework to five different actions, each inserted on a different project with different scope, size and outcomes.
- Framework Astrolabe4SM: This chapter introduces a novel framework designed to enhance project management practices in the context of innovation projects for Smart Cities, with a special focus on stakeholder management, defining a process, workflows and document templates. It discusses the theoretical underpinnings, practical implications, and potential for scalability of the framework.

The concluding chapter, chapter eight, synthesizes the findings from each part of the dissertation, reflecting on the lessons learned and the practical applications of the research. It critically analyses the actions and framework implemented, evaluates the research's impact, and suggests future work directions.

This chapter encapsulates the dissertation's contributions and tries to define the broader implications for future research in Smart Cities and stakeholder management.

Table 2 shows a simplified table of contents representing the structure used in the thesis:

Table 2 – Structure of the thesis

Part #	Part Name	Chapter #	Chapter Name
I	Prologue	1	Introduction
		2	Research Methodology
II	State-of-the-Art	3	Project Management
		4	Stakeholders in Smart Cities
III	Contribution	5	Powered by Action Research
		6	Stakeholder Management in Smart Cities Projects
		7	Framework Astrolabe4SM
IV	Epilogue	8	Conclusions

The thesis also contains an appendix showing the various versions of the developed framework components and details of other documents.

2. Research Methodology

This chapter delineates the research methodology employed in this study, emphasising the Action Research framework adopted to investigate the pertinent issues within our field. The methodology is fundamental to ensuring the validity and reliability of the research findings and is detailed through a series of structured subchapters, each addressing a key aspect of the research process.

2.1 Introduction

The research methodology is a cornerstone of any scholarly inquiry, guiding the entire research process. Through this foundational methodology, researchers can systematically collect, analyse, and interpret data, ensuring that their findings are robust, reliable, and capable of rigorous scrutiny.

It is imperative to emphasise a methodology's critical role in the success of research projects, illustrating how the chosen methods open various pathways to knowledge.

Methodological choices profoundly influence a study's scope, depth, and overall direction, determining how questions are approached and how evidence is interpreted.

2.2 Bibliography Search Strategy

Our research was carried out considering topics such as "stakeholders", "stakeholder management", "innovation projects", "Smart Cities innovation projects", “project management”, “project management standards", "project management for Smart Cities", "Smart Cities", "sustainability".

Through these topics, we came across various articles and books that tried to clarify the present subjects and the multiple research efforts regarding these topics.

These themes were also discussed in several conferences where the researcher participated as a speaker or audience member.

Following the literature research, we focused on finding articles favouring theoretical and practical perspectives, so we tried to create the most balanced relationship possible at this stage.

We searched for these topics in places such as the Digital Library of Minho University, Google Scholar, Elsevier, Science Direct, Web of Science, SCOPUS, Research Gate, and physical books.

Based on the research strategy presented previously, we concentrated our efforts on various project management standards such as the Project Management Body of Knowledge (Project Management Institute, 2017), PRINCE2 (Great Britain, 2017) and the PM² Project Management Methodology Guide (European Commission, 2018).

2.3 Action Research

Considering the multidisciplinary approach regarding organisational processes and various business analyses, choosing the correct research methodology and method is a dominant factor in its success.

The choice of a methodology should be based on research methods and methodologies that validate the procedures and expected results.

Several authors define the research methodology as a set of sequential processes characterised by already defined steps (Cooper & Schindler, 2003) that allows the obtaining of new knowledge that makes it possible to describe, explain, verify facts or phenomena and answer the questions of investigation (Almeida, 2017).

However, according to Gable (1994), two methodologies suit this area: qualitative and quantitative. According to the authors Mack et al. (2011), the main differences between qualitative and quantitative methods are primarily related to:

- Analytical objectives;
- The types of issues that arise;
- The types of data collection instruments used;
- The types of data produced;
- The degree of flexibility incorporated into the research design.

In qualitative methods, the researcher collects data from a small number of experiments that lead the researcher to the details of specific environments. This method has as many advantages as the study of Information Systems (IS) in its natural habitat, or even, thanks to the analysis usually carried out, to obtain knowledge that initially would not be expected.

It is expected that there will be some difficulties in the preparation and obtaining of specific environments that are adequate to get the desired conclusions, in the repetition of the study or, in some situations, in the generalisation of the proposals (Duarte, 2014).

When analysing the quantitative methods, the researcher obtains data from many organisations using techniques such as surveys or interviews. After obtaining a significant sample, it is possible to establish relationships and draw conclusions through data analysis (Duarte, 2014).

This method has a central negative aspect: it does not fit into the organisational culture and management of the entity in which the research can be focused.

The flexibility of both methods characterises the main difference, the qualitative way being the one that offers greater spontaneity and adaptation to the moment in which the interaction between the researcher and the object of study is realised (Mack et al., 2011).

The Action Research methodology helps transpose theory to practice, perfectly adjusted to the characteristics of an IS of Information Technologies (IT) proof of concept, as it is seen as a unique way of associating research and practice (Avison et al., 1999).

The Action Research method includes several planned, executed, and studied cases/projects (called Actions), where theory moves into exercise. Later, the researcher evaluates the theory to improve the following Action.

Since the primary objective of this thesis is to propose a framework for extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management, it is more appropriate to focus on validating the proposals rather than making a comprehensive analysis of the different ways of project management and stakeholders management.

Therefore, we conduct several Actions to demonstrate the validity of the proposals and check their convergence with the thesis goals, leading to the final deliverable.

Baskerville & L. (1999) further argue that the best argument to justify Action Research's methodology is that more complex organisational processes can be better studied if changes are introduced in these same processes (Figure 1). Then, the effects of these changes are observed and recorded.

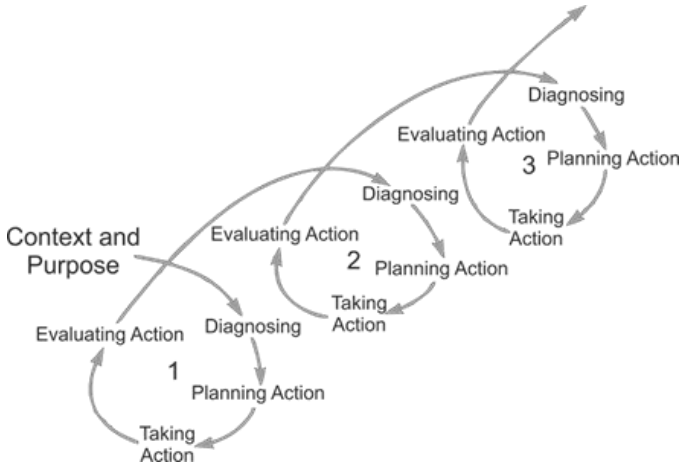


Figure 1 – Action Research

It is widely accepted that Action Research is used as a means of implementing organisational change, especially in complex social situations where the people whose lives or circumstances are being changed need to be involved in the design and the implementation of the change that affects them (Danny Burns, 2007; Parkin, 2009; Sankaran et al., 2010; Somekh, 2006).

The term "action inquiry technologies" was even applied to embrace several strategies for learning (and research) through systematic inquiry that used a recurring cycle of action, reflection, hypothesis, and revised or new actions based on the reviews and hypotheses about what occurred in our previous action (Danny Burns, 2007).

The Action Research methodology is versatile and can be used in various organisational contexts (Bryman, 2012).

Considering also that the philosophy of continuous improvement employed by most of the public companies involved in this work and that the methodology of Action Research has several conceptual similarities with the PDCA (Plan–Do–Check–Act) cycle (Deming, 2000; Kumar, 2012), it is possible to see, once again, the relevance of the methodology used.

The strategy adopted for research depends on the objectives that justify the research, existing knowledge, available resources, and the time frame to answer the central research question (Saunders et al., 2009).

2.4 Action Research in Action

It needed to be observed at work to validate what was occurring in the project manager's workplace and provide the necessary empirical evidence for the research. The research approach, specifically observing

individual project managers through subjective interpretations, meets Windelband's 1894 classification of "idiographic", as the research was not a general objective investigation into how project managers exchange knowledge.

This idiographic nature of the research directed the investigation toward the process used to examine social settings. This method of inquiry investigates decision-making by creating and testing hypotheses with individuals and groups of people.

This document aims to create a framework so that we can help project managers deal with all stakeholders regarding their engagement and responsibility and ensure traceability for their involvement.

To manage a project, the project manager must communicate and share knowledge with individuals or groups of people with a similar level of knowledge or status in an organisation or who are above or below this perceived level (Algeo, 2012). Communication needs are usually solved through written, verbal or non-verbal means in various forms, including more traditional digital mechanisms.

It is true that only through direct and indirect observation of this exchange of knowledge that questions can be raised about which activities and interventions affect project results and the people involved (Algeo, 2012). It is precisely the effort to exchange information between the people involved, usually identified as stakeholders, and how these impact and facilitate project management, that we want to focus on in this doctoral thesis, but which we will detail later.

Examining these environments will provide the context to examine how knowledge can't be created and shared in these environments. The main challenge was to provide the appropriate environment and conditions in order to exchange knowledge the physical environment can be formally structured to manage projects in a variety of situational contexts.

Therefore, the Action Research method seemed the obvious choice, given that it originated in the social sciences and was developed by Kurt Lewin (1947) as an approach to investigating field theory.

Action Research has an iterative character as it is conducted through several research cycles. As Richard Baskerville & Michael D. Myers (2004) state, Action Research is usually an iterative research process that capitalises on the learning of researchers and individuals in the same social context.

We believe that these two characteristics make Action Research studies suitable for application in research within the field of project management, particularly because changes are to be expected during projects of an innovative nature and also because these projects, like any other, always incorporate a

huge human and interaction aspect, taking the analysis of the project environment and also the analysis of the process applied in the intended area to draw lessons for improvements in subsequent projects.

According to the research and literature survey carried out, there is a lack of detailed guidelines for researchers and practitioners to understand and engage in Action Research studies in terms of design, process, presentation, and evaluation criteria (Avison et al., 1999; McNiff & Whitehead, 2002; Somekh, 2006).

Therefore, and considering the above, throughout this chapter, we explain how we designed, executed, and evaluated the actions, so that in chapter 7 we can assess the use of the respective Action Research method for developing a framework for project management, focused on stakeholder management, that would be called Astrolabe4SM (Astrolabe for Stakeholder Management), as a reference to the nautical tool used by the Portuguese during the Age of Discovery.

Since Action Research is an iterative research method that combines and exploits some similarities with operational research, we consider it essential to define a stopping condition for the studies carried out throughout this endeavour.

2.5 Action Research Guidelines

Consequently, for this doctoral project, we have defined the completion and closure of the various projects that lead to the creation of the proposed framework and its subsequent validation as the stopping condition for the succession of actions to be mentioned and detailed throughout this chapter, thus leading to the fulfilment of the objectives defined for this doctoral thesis.

The effort reflected here considers four essential premises of the Action Research methodology (Richard Baskerville & Michael D. Myers, 2004):

- All human concepts are defined by their consequences;
- Truth is represented in practical results;
- Although/despite rational is combined with action;
- Human action is socially contextualised.

From these four premises, according to Duarte (2014) and Richard Baskerville & Michael D. Myers (2004), it is possible to deduce a simple procedure for conducting the Action Research effort, sequencing

the execution of each action, and determining the relationship between the various actions and their sequencing.

In this way, and in line with the positive experience verified by Duarte (2014), based on the authors Richard Baskerville & Michael D. Myers (2004), we will use the following procedure for the way we conduct Action Research (Table 3):

Table 3 – Procedure for conducting Action Research
(based on Richard Baskerville & Michael D. Myers (2004))

Step	Description
1	Establish the objective of the action in advance
2	There must be practical action to define the problem
3	The theory must be adjusted according to the practical outcome of the action
4	Reasoning and action must be socially recognised

Having defined the research's implementation strategy, it would now be possible to apply it throughout the various actions that make up this doctoral project and thus create the tactic inherent for the respective evaluation, which can be found in Chapter 6, Stakeholder Management in Smart Cities Projects.

2.6 Conclusions

For this study, Action Research was selected as the primary methodology. This decision is based on the interactive and participatory nature of Action Research, which aligns with the dynamic and collaborative aspects of project management related to stakeholder management and the principles associated with this PhD effort.

Action Research enables a systematic approach to problem-solving and theory application within real-world project environments. This methodology supports an iterative cycle of planning, action, observation, and reflection, making it highly suitable for the evolving demands of project management.

The significance of the Action Research in this PhD project is evident, especially when looking at it from two perspectives:

- Practical: it allows for the development of solutions that are directly informed by and tailored to the realities of stakeholder management in the field of project management;
- Theoretical: it contributes to a deeper understanding of how project management theories perform in different settings and contexts, particularly stakeholder management.

This dual effort ensures that the research outcomes are both relevant and robust, providing significant contributions to the field of project management.

This chapter provides a theoretical approach to understanding the use and application of the action-research methodology. It lays the groundwork for the concepts and principles underlying this approach.

However, Chapter 5 will explore these concepts in detail, along with the specific contributions and implementation strategies. This upcoming chapter is part of the third section of this doctoral thesis, titled Contribution, where we will describe the practical aspects of the action-research methodology, the practical concepts of this methodology that were applied, the contributions and the strategy to be implemented, illustrating its application and the benefits it offers to the research field, particularly this research.

PART II – State-of-the-Art

"I wish it need not have happened in my time," said Frodo.

"So do I," said Gandalf, "and so do all who live to see such times. But that is not for them to decide. All we have to decide is what to do with the time that is given us."

- Frodo & Gandalf, The Lord of the Rings: The Fellowship of the Ring, J.R.R. Tolkien

3. Project Management

In this chapter, we will address the discipline of project management, tracing its development, defining its key concepts, and conducting a comparative analysis of major project management methodologies. The systematic exploration provided here seeks to clarify the evolution, application, and implications of project management theories and practices, offering a thorough understanding crucial for both theoretical advancement and practical application.

3.1 Introduction

Considering the vast ecosystem related to project management (*per se*), it is appropriate to use more detail and refer to various concepts. Therefore, it is essential to reach a common understanding of their basic semantics and understand this subject's genesis and impact.

It was also necessary to analyse project management methodologies to support part of our research, as they seem to play a critical role in guiding project managers, and their teams, towards successful outcomes. Each of these frameworks offers unique perspectives and tools, tailored to different types of projects and organisational environments, and we try to define them practically.

This chapter discusses the historical evolutions of project management and several expressions and terms used throughout this research. It will also compare the PMBOK, PRINCE2, and PM2 methodologies relatively condensed.

3.2 Historical Evolution of Project Management

The effort to implement a project before the appearance of project management would only be, in terms of effort, the development of a product or service without time and cost constraints and could, therefore, take an unaffordable cost and an overwhelming amount of time, and that is not acceptable.

Project management may have originated in the Egyptian era when the Giza pyramids were built (2500 BC). Its usefulness was evidenced in the complexity and demands of the planning and execution processes, based on the current definition of a project (temporary and unique). Hence, it has only been about half a century since organisations began to apply techniques and tools in complex project management (Kwak, 2005).

Project management took shape between 1900 and 1950 through the contribution of Frederik Winslow Taylor (1856-1915) and Henry Laurence Gantt (1861-1919), pioneers and promoters of this discipline, creating several tools that are still used today (Gantt chart, Work Breakdown Structure, Program Evaluation and Review Technique, Critical Path Method).

At the beginning of the twentieth century, and during World War II, the most significant development of project management occurred, touching the shape of its current configuration. One of the outstanding contributions was the Manhattan Project, whose goal was the creation of the atomic bomb by the Americans, this highly complex project involved about 125 000 people tangled in different research and development units and was successfully tested in July 1945, a month before the atomic bomb was dropped in Hiroshima (Kwak, 2005).

For many years, project management has been considered an activity of little value and even questionable. Yet another historical event, the disputed space race between Russia and the United States during the Cold War in 1969, contributed to the development of project management. That same year, one of the most influential Project Management Organisations emerged today—the Project Management Institute (PMI).

The substantial growth of project management in the 1990s produced the need for creating and developing several guides and standards for better company practice, so interest in project management was progressively increasing, and this concept was evolving to consider this discipline's organizational capacity (Crawford, 2007).

However, considering all the standards and reference guides available, it is difficult for companies to choose the most appropriate model for their projects and organisation. Hence, the need to reorganise all this knowledge in a standardised and integrated way arises, thus facilitating its use, adoption, and dissemination in the market (Oliveira, 2013).

3.3 Project Management Concepts

In the discipline of project management, the precision and clarity of terminology are imperative. This subchapter tries to elucidate the foundational concepts and definitions that constitute the core of project management.

The purpose is to establish a universally comprehensible lexicon that facilitates effective communication and collaboration among professionals across diverse industries and also to facilitate the reading of this doctoral thesis.

3.3.1 Project

To talk about project management, it is essential to understand the concept of a project and know how to separate it from the everyday activities that unfold within an organisation. Maintaining this concept, a compromise on what a project is can lead to internal friction and some frustration (Bentley, 2010).

A project is a temporary and finite effort to obtain a unique result, whether a product or service, carried out with quantified and limited resources.

Projects represent an investment of resources to achieve a goal, implement change, and keep in mind a concern for the future without losing the focus of achieving the initial goal.

Several authors have identified uncountable project definitions, standards and several publications, some of which are described below:

> *"A project is a temporary organisational structure set up to create a unique product or service (output) within certain constraints such as time, cost and quality. The project is defined, planned and executed under certain external (or self-imposed) constraints. These can relate to scheduling, budgeting, quality, but also to the project's organisational environment."* (European Commission, 2018).

"A project is a temporary endeavour undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a defined beginning and end. Its completion is achieved when project objectives are achieved or when the project is terminated because its objectives will not or may not be achieved, or when the project's need ceases to exist." (Project Management Institute, 2017).

"A project is a temporary management environment created for the purpose of delivering one or more business products according to a specific Business Case." (Great Britain, 2017).

"A project is a unique, temporary, multi-disciplinary and organised endeavour to realise agreed deliverables within predefined requirements and constraints." (IPMA, 2015).

Despite all the definitions, the existence of common elements is evident and can be summarised as being something unique, uncertain, temporary, simple or complex according to the requirements that characterise the project. The project's objective is to achieve a result that brings value to the organisation in a given period with the available resources.

Therefore, a project assumes specific characteristics, among which (Miguel, 2013; Roldão, 2007):

- Sequence of activities: a project consists of activities that must be performed in a given sequence. This sequence of activities is based on the project's technical requirements and not on management prerogatives;
- Unrepeatable activities: the context of a given project is unique in the past, present, and future, so each time a project's activities are repeated, something sets them apart;
- Interconnected activities: the existence of relationships, be they logical or technical, between activities, leads to the creation of an order for the realisation of these that are inserted in a project;
- Complexity: the difficulty is not associated with complexity, whereby complexity may be related to the fact that it can consist of task groups and independent resources, the size of the project and the evolution of circumstances, such as the environment in which the project inserts itself and inherent difficulties to it;

- Unrepeatable: a project consists of requirements ensuring each project becomes unique. It combines several requirements that ensure that the project becomes unique and unrepeatable;
- Finite: all projects have a completion date imposed internally and externally by the customer or other environmental conditions. Its end is determined by fulfilling all the objectives or realising it is impossible to complete the project, leading to its cancellation;
- High Risk: the absence of similar projects increases uncertainty and risk;
- Constraints: some constraints are always present in a project: time, cost and resource constraints (human, technical, and material). Although always present in projects, these constraints vary according to the type of project they are associated with;
- Multidisciplinary: a project requires the execution of efforts from different areas, whether present in the organisation or not. It requires integration, and many skills require specific coordination.

Some of the possible outcomes resulting from a project are (Project Management Institute, 2013):

- A product that can be a component of another product, the improvement of an existing product or a new product;
- A service or the ability to perform a service;
- Improvement in product lines and/or services;
- A result, such as a product or a document.

3.3.2 Project Management

Project Management (PM) comes from the definition mentioned in the previous subchapter, Project, which associates a form of control over the process of change or creation, thus demonstrating its importance in managing, planning, and coordinating resources with a focus on the intended objective. According to (Kerzner, 2021), it is essential to understand a project first to realise what project management is.

Along with the definition of Project, Project Management is also defined by several authors and standards:

"Project Management consists of the planning, organisation, direction and control of the resources of a company, with a defined short term, in order to fulfil specific objectives." (Kerzner, 2021).

"Project Management is the application of processes, methods, skills, experience and knowledge to achieve the proposed objectives of the project." (Association for Project Management, 2012).

"Project Management is the application of knowledge, skills, tools and techniques to define activities that meet project requirements. This application of knowledge requires effective management of appropriate processes." (Project Management Institute, 2017).

"Project Management can be described as the activities of planning, organising, securing, monitoring, and managing the resources and work necessary to deliver specific project goals and objectives effectively and efficiently." (European Commission, 2018).

Project Management is the application of knowledge, techniques, tools, and skills to the project activities to meet the pre-established requirements. It comprises planning, monitoring, and controlling all the processes involved to meet all the assumptions assumed as project goals.

This way, it becomes clear that correct identification of the requirements and objectives is necessary, and all the needs, expectations, and concerns of all project stakeholders must be heard. This will enable effective and active communication and correct management of the parties involved to monitor every one of them's necessary and required progress.

To ensure proper compliance with all the factors involving scope, quality, time, cost, resources, and risks and to comply with all identified requirements, several points of control and checkpoints must be carried out regularly. Thus, the satisfaction of all stakeholders and their expectations will be ensured. All these restrictions can be altered according to the characteristics and context of each project.

Several methodologies present Project Management as a change management or a way to introduce a unique change (Association for Project Management, 2012; European Commission, 2018; Great Britain, 2017; IPMA, 2015; Project Management Institute, 2017).

To be able to verify the change is necessary:

- Definition of the term, cost and performance parameters and quality of the project;

- Development and definition of a plan to achieve the defined objectives and subsequent use of the plan so that the project follows according to the baseline of the plan;
- Use of the most appropriate Project Management techniques and tools for planning, monitoring and controlling progress;
- Defining and creating a team with suitable skills and knowledge of project management, well-defined roles and responsibilities, and choosing a project manager responsible for implementing the change and certifying the execution of the plan and compliance with all goals successfully.

To facilitate the application of all project management practices, separations were created in the project's lifecycle, calling them phases. Thus, phases represent a fundamental tool for organising requirements and resource planning for each phase, reducing the complexity inherent to a project so that it can be more easily managed.

In the classical view of the project lifecycle, it can be identified four phases with different types of activities predominate in each phase:

- Design phase: characterised by the preliminary evaluation of the idea that triggered this process. At this stage, it is the responsibility of the PM to define the project and its scope, identify the objectives and requirements of the project and compare them with the strategic goals of the organisation, creating alternative strategies and defining a plan of action;
- Development phase: consists of increasing the detail of the elements that were analysed in the previous phase to create realistic parameters in terms of critical factors such as time, cost and quality;
- Implementation phase: considers the execution of the plan and a constant control throughout it from continuous comparisons between the actual state of the project and what was planned. This way, it is possible to obtain indicators that analyse the deviation of the project at different levels, thus supporting the decision-making processes that may occur throughout the project;
- Completion phase: represents the closure of the project and aims to evaluate all the efforts made to close the project and the lessons learned.

3.3.3 Program Management

A program consists of several related projects and is therefore managed in a coordinated way to optimise the benefits obtained and facilitate a more significant control of these projects, which would be challenging to get if they were handled individually.

Several standards define the concept of a Program:

> *"A program is a set of projects and organisational changes related and assumed to achieve a strategic goal and the implementation of change."* (IPMA, 2015)
>
> *"A program is a group of related projects, managed in a coordinated way to obtain benefits and control that is not achieved through their individual management."* (Project Management Institute, 2017)
>
> *"A programme is a collection of projects aimed towards a common goal which are managed in a coordinated way to obtain benefits and control that could not be obtained from managing them individually. Programmes may also include work outside the scope of the discrete projects in the programme."* (European Commission, 2018)

Program management consists of coordinating several projects to create the conditions for their success.

Several standards define the concept of program management:

> *"Program management is the coordinated management of related projects, which may include common business activities, which together bring about beneficial change in an organisation."* (APM, 2012)
>
> *"Program management coordinates a set of projects to deliver the results needed for the strategic objective and defines the organisational changes needed to facilitate strategic change with the organisation."* (IPMA, 2015)
>
> *"Program management is the application of knowledge, skills, tools and techniques to a program in order to meet its requirements and obtain benefits and ensure adequate control that are not available when managing individual projects."* (Project Management Institute, 2017)

> *"Programme management is the process of managing several inter-dependent projects to better achieve the programme's strategic objectives and benefits."* (European Commission, 2018)

According to Miguel (2013), projects can and should be included in programs for several reasons:

- Need for a general description of all projects;
- Dependencies between current projects;
- Need to monitor technical and human resources as multiple projects can share them over the same period.

In addition to gaining value in program management, such as improvement processes, advantages that can be obtained with this type of management are also identified, for example (Pellegrinelli, 1997):

- Greater visibility of all the projects for the company management;
- It makes resources more adequate and efficient;
- Improves planning and coordination;
- Reporting of the program can improve the strategic performance of monitoring progress;
- It provides a better prioritisation of the projects, facilitating resource reallocation.

3.3.4 Portfolio Management

The use of portfolios, from the business perspective of organisations, was created in 1950 and was only used for resource allocation and prioritisation, however, over time, it became a planning tool for what was then introduced as the management of portfolios to help with new product selection, allocation of resources to all of the organisation's projects, managing risks, aligning the business with the organisation's strategy, and controlling its human and financial resources (Logan, 2011; Müller et al., 2008).

The definition of a portfolio is consistent with a group of individual programs and projects whose purpose is to facilitate the management of this group, thus making it more effective in achieving a strategic objective for a specific business.

This theme is also subject to several definitions according to various authors and standards:

> *"A portfolio is a group of projects and programs undertaken under the commitment of an organisation. Portfolios can be managed at an organisational, programmatic or functional level."* (APM, 2012).
>
> *"A portfolio is a set of projects and/or programs that are not necessarily related, but which are analysed together for control, coordination and optimization purposes."* (IPMA, 2015).
>
> *"A portfolio can be seen as a representation of projects and programs, which may affect the strategic objectives outlined and whose most important characteristics are to define priorities, resources and investment decisions"* (Project Management Institute, 2017).

By centralising the management of one or more projects and / or programmes, it becomes feasible to optimise the set of projects based on the available resources within the organisation. This approach facilitates the achievement of strategic objectives, thereby giving rise to the concept of Portfolio Management.

Several definitions for portfolio management have been identified, including:

> *"Portfolio management is intended to justify, select and prioritize programs and / or projects that really help achieve strategic objectives."* (Project Management Institute, 2017)
>
> *"Portfolio management is the selection, prioritization and control of an organisation's programs and projects in accordance with its strategic objectives and the ability to deliver them. The goal is to balance change initiatives and business practices while optimising return on investment across the board."* (APM, 2012)
>
> *"A project portfolio is a collection of projects, programmes and other activities, which are grouped together to allow better control over their financial and other resources and to facilitate their effective management in terms of meeting strategic objectives."* (European Commission, 2018)

Portfolio management is then characterised by the centralised management of one or more programs and projects to achieve the identified strategic objectives, thus passing through an alignment of business leadership that seems to be the focal point for the success of the same management, as seen in Figure 2.



Figure 2 – Strategy, project, program, portfolio, and operations relationship. (European Commission, 2018)

3.3.5 Project Manager

According to the European Commission (2018), a project manager oversees the project daily and delivers high-quality results within the identified objectives and constraints, ensuring the effective use of the allocated resources.

The project manager is the person chosen by the organisation to lead a project from start to finish. The project manager coordinates and integrates activities throughout the project lifecycle.

The project manager focuses on the specific objectives of the project, controlling the resources associated with it and the constraints (scope, planning, cost, quality) to achieve success. Therefore, managers should create clear and achievable objectives to monitor the projects and thus reach their conclusion successfully.

The project manager position combines theoretical knowledge obtained during the learning process and practical skills acquired through applying theoretical knowledge.

For a project manager to succeed, the project manager must perform several crucial tasks, for example (Kerzner, 2021; Miguel, 2013):

- Development of the project plan and all its components;

- Keep the project controlled and within the limits imposed by the project plan in terms of deadlines, costs and quality;
- Conduct risk management through the identification, evaluation and creation of risk responses throughout the project lifecycle;
- Provide information about project performance in a timely and accurate manner, regularly and when requested.

According to PMBOK (Project Management Institute, 2017), for a project manager to understand and apply knowledge using tools and techniques, he or she must have three competencies:

- Knowledge of project management: general knowledge of project management;
- Performance in project management: competence and aptitudes that the project manager possesses when applying knowledge in project management;
- Personal: the so-called soft skills that relate to everyone's attitudes and personality and the ability to lead and motivate a team.

If we consider the entire profile outlined above, it is also possible to identify part of the responsibilities associated with this role (European Commission, 2018):

- Executing the project plans as approved by the management team;
- Coordinate the Project Team, ensuring the effective use of the allocated resources;
- Ensure project objectives are achieved within the identified constraints, taking preventive or corrective measures where necessary;
- Management of the stakeholder expectations;
- Oversee the creation of all management artefacts and secure approval from the project owner and management team;
- Ensure the controlled evolution of products delivered through proper change management;
- Perform risk management activities for project-related risks;
- Monitor project status and report to the management team on project progress at regular predefined intervals;
- Escalate unresolvable project issues to the management team.

In short, the project manager is responsible for the initiation, organisation, execution, monitoring and closure of a project, ensuring that the project meets the defined success criteria, thus achieving success.

3.3.6 Informal Project Management

According to the definition in the Merriam-Webster dictionary (Merriam-Webster, 2019), the word informal can be defined as:

1. marked by the absence of formality or ceremony

   // An informal meeting

2. characteristic of or appropriate to ordinary, casual, or familiar use

   // Informal clothes

Informal project management does not deviate from this definition because it does not involve strict standards and rules for managing the project. The management approach focuses on open communication and greater flexibility.

According to Kerzner (2021), informal project management is based upon guidelines rather than the policies and procedures that are the basis for formal project management. This was shown previously to be a characteristic of a sound project management methodology.

Informal project management mandates:

- Effective communication;
- Effective cooperation;
- Effective teamwork;
- Trust.

Combining these four elements makes this project management perspective successful in some specific environments.

3.3.7 Projects Vs Operations

Despite the substantial growth around projects, almost all of which are called projects, it is sometimes difficult to distinguish between projects and operations, and these terms are very susceptible to errors.

We have already had the opportunity to demonstrate that a project is temporary and must always have a beginning and an end. A project should be considered finalised when it is determined that its objectives have been achieved. When this happens, the team should be split.

On the other hand, operations comprise the daily activities undertaken by an organisation to provide services or products on an ongoing basis.

3.3.8 Stakeholders

The word stakeholder first appeared in 1963 in an international memorandum from the Stanford Research Institute (Eskerod et al., 2015). According to R. E. Freeman & Mcvea (2008), the term stakeholders appears for the first time within the management, aiming to define "all groups without which the company would cease to exist".

The origin and nature of the word stakeholder are closely linked to the word stake, and therefore, it is necessary to describe the word stake and explain why it is present in all stakeholders. From the definition relating these two, a stake is an interest or a share in an undertaking, while a stakeholder is an individual with a stake (Friedman & Miles, 2006).

The stakeholder theory originated in 1984 when Freeman published his book "Strategic Management: A Stakeholder Approach". According to him, a stakeholder is a person, group or organisation that has a direct or indirect interest in a particular company or organisation, and which can affect or be affected by all kinds of actions, decisions, goals or policies taken by the company (S. Freeman & Cavusgil, 1984).

The term stakeholders is related to people, groups, or organisations that connect with the project and can positively or negatively affect the project (Donaldson & Preston, 1995; Mitchell et al., 1997; Rowley, 1997).

According to PMBOK (Project Management Institute, 2017), a stakeholder is an individual, group or organisation that can affect, be affected, or feel affected by a project's decision, activity or outcome. Stakeholders may be actively involved in the project or have interests that may be positively or negatively affected by the project's performance or completion.

Donaldson & Preston (1995) refer to stakeholder theory as normative, descriptive, and instrumental.

Normative because it guides the standards of behaviour and action of organisations concerning the management of relations with stakeholders (Donaldson & Preston, 1995).

Descriptive presents a model that describes a corporation: "a constellation of cooperative and competitive interests full of intrinsic values" (Donaldson & Preston, 1995).

Furthermore, it is instrumental because it defines an analytical framework that examines the links between the practice of stakeholder management and the achievement of strategic and performance objectives of the organisation (Donaldson & Preston, 1995).

According to Donaldson & Preston (1995), the three dimensions can be seen together (Figure 3).

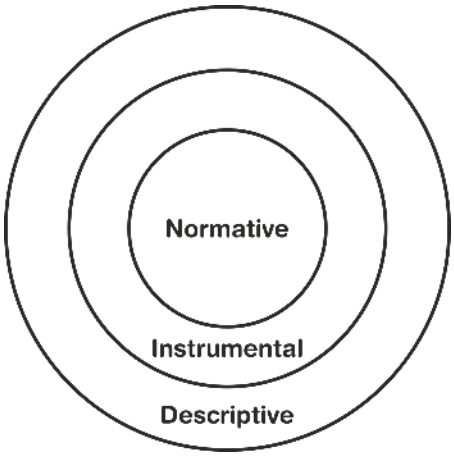


Figure 3 – Three Aspects of Stakeholder Theory
(adapted from Donaldson & Preston (1995))

At the first level, descriptive, the theory presents and describes the relations observed with the stakeholders.

The observed relationships are then supported, at a second level, by instrumental use, which allows us to analyse and quantify cause-and-effect relationships.

The third and last level, normative use, is the core of stakeholder theory because the values and moral principles of the organisation are the basis for the descriptive and instrumental levels.

Stakeholders can influence the project and its deliverables to achieve a set of results that meet strategic business objectives or other needs. On the other hand, according to the PMBOK (Project Management Institute, 2017), they may have different expectations of the project's results and benefits, leading to conflict generation within the project.

So, the stakeholder theory gets mixed reviews related to its difficulty of implementation. R. E. Freeman & Mcvea (2008) point out this difficulty in identifying stakeholders, their relevance to their organisation, their objectives and needs, and how to reconcile them to successful management.

R. E. Freeman & Mcvea (2008) also emphasize that the difficulty in meeting the different interests of the stakeholders, with fair criteria decisions may lead to conflict situations.

With the emergence of stakeholder theory, attention was given to other groups of people who were not just the shareholders or owners of the company, thus making the organisation accountable both to itself and to shareholders and other stakeholders (Kevin Gibson, 2000), which has become increasingly important since its management is vital for the success of projects and for the sustainable growth of any organisation.

According to Kanter (1999), to achieve long-term goals and a convergent vision for the same objectives and direction, it is also necessary to interlink the interests of all stakeholders so that stakeholders and organisations share their destinies and mutually support one another.

These are the reference interests in guiding the individual to act and perform certain activities that lead him to something he identifies in the environment to meet his needs, or else to avoid them and withdraw if he realizes that such activities will not lead him to what he searches (Morgan, 1996).

Personal interests may diverge from collective interests, and the effective management of potential conflicts of interest is essential if activities are to be carried out for the organisation to thrive and people to succeed (Morgan, 1996).

One common denominator in all the perspectives is that stakeholders perceive that they have a stake in the entity or task, have expectations and, consequently, engage in certain types of behaviour, being constructive or destructive (Sutterfield et al., 2006).

The importance of stakeholder management is based on the current know-how obtained through feedback, whether positive or negative, based on the growing number of projects in all areas of action. This allows us to conclude that to achieve success in a project, it is no longer enough to comply only with the client's deadlines.

Today, more than ever, projects must meet stakeholder expectations, and it is therefore of imposing importance to carry out their identification since all critical decisions during the initial planning and implementation phases of the project are influenced mainly by these stakeholders, and since they have claims, rights and expectations, they must be managed in each project to avoid any of their influences that could be contrary to a firm’s objectives

Generally, and by giving some examples of stakeholders, we can identify clients, sponsors, project team elements, vendors, suppliers, subcontractors, institutions, regulators, consultants, specialists in the various areas of knowledge present in the project and many others (European Commission, 2018; IIBA, 2015; Project Management Institute, 2017).

In addition to the various types of stakeholders, and according to Clarkson (1995),it is also possible to separate these by category:

- Primary Stakeholder: individuals or groups that directly influence the organisation in which they are inserted. These stakeholders are those without whom the company could not survive. They are employees, suppliers, customers, competitors, investors and owners / shareholders.
- Secondary Stakeholders: individuals or groups that are not directly related to the company's economic activities but may have a considerable influence on that company or may seriously impact its operations. Secondary stakeholders also have the capacity to bring together public opinion, thus influencing, positively or deceptively, the efforts to be considered.

This classification of stakeholders seems to obtain some consensus in the community, and it is argued that the primary stakeholders should receive greater attention from the project manager. However, according to the understanding obtained throughout the research, we believe that this fact is due only to the time constraints that a project manager has since the impact that the secondary stakeholders present is evident.

Project stakeholders are essential for project success because the project needs contributions, and they often establish the criteria for assessing its success.

The resistance that the stakeholders can create may cause various threats and negatively affect the desired outcomes of the project and its success. The opposite can bring a positive impact on the beforementioned results (Robert Bosch GmbH, 2024).

3.3.9 Stakeholder Management

Now that we have a clear definition of what a stakeholder is, we can talk about its management.

According to the authors Eskerod et al. (2015), there are two approaches in the management of stakeholders and that are listed below:

- Management of Stakeholders: it is an instrumental approach, which sees stakeholders provide resources while committing them to the needs of the organisations;
- Management for Stakeholders: it is a normative or ethical approach in which stakeholders are considered to have legitimate rights, considering their power in influencing the organisation.

Stakeholder management of any project can be defined as all activities aimed at project stakeholders to improve project success (Huemann et al., 2016).

Another interesting factor in the research, which underpins part of the research question in this present document, is based on the vital question of how an element or organisation, according to various constraints and contingencies, can introduce a strategy to develop a relation with any of the stakeholders, or group of stakeholders, under a favourable perspective of the organisation?

We are sure that the project's success is also closely linked to the project manager's ability to overcome certain difficulties or situations that may jeopardize the project's progress and completion and its ability to manage the previous outputs better, considering each project's objectives.

According to National Competence Baseline 4.0 (NCB) (APOGEP, 2017), "the identification, the obtaining of commitments and the management of expectations of all the parties involved in the project is also a fundamental element for its success, and in order to achieve the same, it is necessary, from its beginning, to be performed a systematic control of its stakeholders and their many variants of influence, be they positive (supports) or negative (disturbances, interferences)".

3.4 Comparative Analysis of PMBOK, PRINCE2, and PM² Methodologies

In the complex world of project management, selecting an adequate methodology is crucial, as it intermediates the interaction between various project elements, including the crucial component of stakeholder management.

The Project Management Body of Knowledge (PMBOK), PRINCE2 (Projects IN Controlled Environments), and PM² methodologies emerge as prominent frameworks with distinctive attributes and stakeholder considerations.

3.4.1 PMBOK

PMBOK, heralded by the Project Management Institute, offers a wide-ranging and flexible framework globally recognised and applicable across diverse industries.

There is now a particularity of two valid editions of PMBOK, the sixth and the seventh editions. Considering that only the sixth edition of the PMBOK was available at the time of writing this research project, and that the seventh edition only appeared in August 2021, and that at the time of writing this thesis, both editions are still valid, we consider it justified to use the sixth edition as the primary reference for this research project.

Despite the above, in order to make a fair comparison between all the references, here are some considerations regarding the two editions of the PMBOK.

The 6th edition of the PMBOK (Project Management Institute, 2017) adopts a process-based approach, organising project management into ten specific knowledge areas. Each knowledge area is detailed with processes that are divided into five process groups. This edition is highly structured, offering a detailed guide that describes step-by-step how to manage a project effectively. This methodology is beneficial in environments that require strict regulatory compliance and where detailed documentation is crucial.

The 7th edition of the PMBOK (Project Management Institute, 2021) presents a significant change from the procedural approach, adopting a framework based on principles and performance domains. This edition is centred on 12 principles that provide general guidance for project management, reflecting a more adaptive and flexible approach. In addition, the guide is organised into eight performance domains that cover the main project management activities (Table 4).

Table 4 – Project Management Body of Knowledge (PMBOK)

Project Management Body of Knowledge (PMBOK)	
Overview:	
	Developed by the Project Management Institute (PMI), the Project Management Body of Knowledge (PMBOK) is a set of standard terminology and guidelines for project management.
Structure:	
	Knowledge Areas (PMBOK 6TH Edition)/ Principles (PMBOK 7TH Edition)
	PMBOK 6th Edition is structured around ten knowledge areas: Integration, Scope, Schedule, Cost, Quality, Resource, Communications, Risk, Procurement, and Stakeholder Management. PMBOK 7th Edition is structured around 12 principles: Stewardship, Team, Stakeholders, Value, Holistic Thinking, Leadership, Tailoring, Quality, Complexity, Opportunities and Threats, Adaptability and Resilience, Change Management.
	Process Groups (PMBOK 6th Edition) / Performance Domains (PMBOK 7th Edition)
	PMBOK 6th Edition methodology divides project activities into five process groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing.

	PMBOK 7th Edition methodology divides into performance domains: Stakeholder, Team, Development Approach and Lifecycle, Planning, Project Work, Delivery, Measurement and Uncertainty.
Strengths:	
	Exhaustiveness
	PMBOK provides an extensive framework that covers various aspects of project management, making it applicable to a wide range of industries.
	Global Recognition
	PMBOK is internationally recognised, and PMP certification is highly valued in the field of project management.
Limitations:	
	Complexity
	Some practitioners find PMBOK to be complex and overwhelming, especially for smaller projects.
	Flexibility
	While comprehensive, PMBOK can be perceived as rigid, requiring adaptation for specific project contexts.
Sources:	
	Project Management Institute (2017), A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Sixth Edition. Project Management Institute (2021), A Guide to the Project Management Body of Knowledge (PMBOK® Guide)-and The Standard for Project Management

From a stakeholder perspective, both editions of PMBOK emphasize the importance of identifying and managing stakeholder expectations throughout the project lifecycle.

Both versions advocate for continuous communication and engagement, ensuring stakeholders are kept in the loop, their needs are addressed, and their inputs are valued.

Considering the particularities of each edition and the type of projects we would apply ourselves to, with the different scrutiny and rigour associated with them, we decided to maintain the sixth version of the PMBOK as a reference for our efforts in this doctoral project.

However, the extensive nature of PMBOK can be overwhelming, particularly for smaller projects or less experienced teams, necessitating a tailored approach to fit the specific project context.

3.4.2 PRINCE2

PRINCE2 methodology, originating from the UK, offers a structured and controlled project management methodology (Table 5). With its seven principles, themes, and processes, PRINCE2 ensures that every project facet is meticulously planned and executed (Axelos, 2017).

Table 5 – PRINCE2 (Projects IN Controlled Environments)

PRINCE2 (Projects IN Controlled Environments)	
Overview:	
	Originating in the UK, PRINCE2 is a process-driven project management methodology that provides a step-by-step approach to project delivery.
Structure:	
	Principles
	PRINCE2 is based on seven guiding principles: Continued Business Justification, Learn from Experience, Manage by Stages, Manage by Exception, Focus on Products and Tailor to Suit the Project Environment.
	Themes
	The methodology includes seven themes that address various aspects of project management: business case, organisation, quality, plans, risk, change and progress.
	Processes
	PRINCE2 outlines seven processes that guide the project from initiation to closure.
Strengths:	
	Standardisation
	PRINCE2 promotes a standardised approach to project management, enhancing consistency across projects.
	Control
	The methodology places a strong emphasis on project governance and control.
Limitations:	
	Complexity
	New users may face a learning curve due to the methodology's detailed processes and terminology.
	Flexibility
	PRINCE2 can be perceived as prescriptive and may require tailoring for specific project contexts or industries.
Sources:	
	AXELOS (2017), Managing successful projects with PRINCE2: 2017 edition. TSO (The Stationery Office) AXELOS (2009), Managing successful projects with PRINCE2: 2009 edition. TSO (The Stationery Office)

The transition from PRINCE2 2009 to PRINCE2 2017 introduced several important updates to the project management methodology, focusing on making it more flexible, practical, and adaptable to various project environments.

The major differences can be seen in Table 6:

Table 6 – PRINCE2 (2009) Vs PRINCE2 (2017)

PRINCE2 (2009) Vs PRINCE2 (2017)
Tailoring PRINCE2 to the Project Environment:
2009 Edition: Acknowledged the importance of tailoring but provided limited practical guidance.
2017 Edition: Places a significant emphasis on tailoring PRINCE2 to suit the specific needs of the project, the project environment, and the organisation, including detailed guidance on how to adapt the method to different project sizes, complexities, contexts, and risks.
Emphasis on Principles
2009 Edition: The seven principles were mentioned, but their practical application and importance were not as heavily emphasized.

	2017 Edition: Stresses the importance of the seven principles throughout the project's lifecycle, ensuring they are acknowledged and actively guiding decision-making and project management practices.
Simplification and Streamlining	
	2009 Edition: The manual and guidance were more verbose and complex.
	2017 Edition: Offers streamlined and clarified guidance and processes to be more accessible and easier to understand. The main book was condensed and simplified in order to improve usability and comprehension.
Role Definitions	
	2009 Edition: Roles were defined but not as flexible.
	2017 Edition: Roles and responsibilities are more adaptable, with guidance on how roles can be tailored according to the project's size and complexity.
Sources:	
	AXELOS. (2017). Managing successful projects with PRINCE2: 2017 edition. TSO (The Stationery Office) AXELOS. (2009). Managing successful projects with PRINCE2: 2009 edition. TSO (The Stationery Office)

Stakeholder management is a core element of this methodology, delineating clear roles and responsibilities, and ensuring accountability and transparency. Stakeholders are considered integral to the project's success, with their interests safeguarded through strong governance structures.

Yet, the prescriptive nature of PRINCE2 may require customisation to suit specific projects or industries, and its detailed processes demand a steep learning curve, particularly for newcomers to the methodology.

3.4.3 PM²

PM², developed by the European Commission, presents a tailored solution for managing projects within the intricate organisational structures of EU institutions.

It highlights the significance of strong governance and clear project lifecycle phases. For stakeholders in the public sector, PM² ensures their interests are predominant, promoting an environment of trust and collaboration (European Commission, 2018) as seen in Table 7.

Table 7 – PM² Project Management Methodology

PM² Project Management Methodology	
Overview:	
	Developed by the European Commission, PM² is a project management methodology designed to deliver solutions and results within the complex organisational structures of EU institutions.
Structure:	
	Governance
	PM² underlines strong governance structures, defining clear roles and responsibilities.
	Lifecycle
	The methodology outlines a project lifecycle from initiation to closure, including specific phases and decision points.
Strengths:	

	Public Sector Orientation
	PM² is tailored to the needs and complexities of public sector projects, particularly within the EU (European Commission, 2016).
	Free Access
	The methodology is openly available, promoting transparency and accessibility.
Limitations:	
	Specific Context
	While versatile, PM² was explicitly designed for the EU context, which may limit its applicability in other settings.
	Recognition
	PM² is less globally recognised compared to PMBOK and PRINCE2.
Sources:	
	European Commission (2018), PM² Project Management Methodology Guide – version 3.0

The methodology's open access aligns with principles of transparency and accessibility, which are critical for public stakeholders. However, PM²'s specificity to the EU context may limit its applicability elsewhere, and its recognition is less extensive than PMBOK and PRINCE2.

3.5 Conclusions

This chapter has traced the historical evolution of project management, revealing its progression from ancient times to a distinct and sophisticated discipline. We revisited several essential definitions such as project, project management, program and portfolio management.

Understanding the historical origins and theoretical principles of project management methodologies is vital, helping to enrich the appreciation of their current applications and potential future developments.

While PMBOK, PRINCE2, and PM² all provide robust frameworks for navigating the complexities of project management, their effectiveness in managing stakeholder relations varies.

The comparative analysis of PMBOK, PRINCE2, and PM2 yielded crucial insights. While PMBOK's flexibility accommodates diverse stakeholder needs, PRINCE2's structured approach ensures stakeholder interests are systematically addressed, and PM²'s public sector orientation offers transparency and collaboration.

Theoretically, this supports a contingent approach to project management, which argues that there is no one-size-fits-all method.

Combining the best features among these methodologies should be done with a thorough understanding of their unique characteristics and a keen eye on stakeholder dynamics. This will ensure that the selected framework qualities and combinations not only align with the project's objectives but also harmoniously integrate the voices and needs of all stakeholders involved.

4. Stakeholders in Smart Cities

This chapter analyses the intricate web of stakeholders involved in developing and managing Smart Cities projects and the complex dynamics between these stakeholders.

Understanding these diverse groups' roles, interests, and interactions is critical for effectively managing smart city projects.

4.1 Introduction

Successful project completion may require several years and efforts to develop, implement, and evaluate a successful project management strategy.

Projects are challenging to manage even under the best circumstances due to various structural, behavioural, and environmental complexities. Many of the complexities stem from the fact that the project manager will likely be beset by multiple project stakeholders from above and below (Sutterfield et al., 2006).

Recognised project management practices are related to increased business value, greater achievement of identified benefits and better management of all activities (Kerzner, 2021).

Our initial research showed that, although being given some attention regarding the management of project stakeholders, there is a lack of research that examines the process management process through the theoretical perspective of a stakeholder theory (Bourne & Walker, 2005, 2006).

4.2 Stakeholder Management

In the sphere of smart city development, stakeholder management emerges as a fundamental component, especially when dealing with innovation projects. Smart Cities, by their very nature, are complex ecosystems involving a diverse array of stakeholders, including local governments, private sector entities, technology providers, community groups, and residents or city users.

These projects, characterised by their innovative approaches to urban challenges, require a nuanced understanding of stakeholder dynamics to ensure successful implementation.

The importance of effective stakeholder management in smart city projects cannot be overstated. Innovation projects often imply introducing new technologies or processes that significantly impact various stakeholder groups (Angelidou, 2015). Managing these stakeholders effectively is crucial for encouraging acceptance, securing necessary support, and ensuring the sustainability of these initiatives (Alawadhi et al., 2012; Caragliu, del Bo, et al., 2011). Stakeholder management in this context involves identifying key players, understanding their interests and concerns, and engaging them in a manner that aligns their objectives with project goals.

Tracing the evolution of stakeholder management within project management reveals a shift from traditional methods to more collaborative and inclusive approaches (S. Freeman & Cavusgil, 1984). This is particularly evident in the Smart Cities domain, where the interconnectedness of systems and the diversity of stakeholder interests necessitate a more holistic and agile approach to stakeholder engagement (Bryson, 2004).

These challenges also present opportunities for developing more responsive, inclusive, and effective stakeholder management strategies that can drive the successful implementation of innovative solutions (Alawadhi et al., 2012).

The stakeholder management topic is one of the most underrated in Project Management, an example of that is the lack of research that applied the stakeholder theory and the strategic management process to the project management process (Ives, 2005; Jugdev & Müller, 2005; Norrie & Walker, 2004).

It can even be said that despite the intense research efforts concerning stakeholder theory within general management, the project management community has not sought much inspiration in these developments (Eskerod et al., 2015).

According to several authors, such as Jergeas & et al. (2000) and Cleland et al. (2000), efficient management of the relationship between a project and its stakeholders is an important step towards achieving the desired success.

However, before we get to the core of our study's objectives, it becomes necessary to deepen the topic of stakeholder management in project management *per se* so that the result of this effort can be consulted in the chapter dedicated to the concepts.

4.2.1 Stakeholders in Smart Cities

In the context of Smart Cities, effective stakeholder management is not just a strategy but a necessity for achieving the much-desired sustainable urban development through innovation.

Stakeholders in smart city projects involve numerous entities and individuals who are directly or indirectly affected by urban development initiatives that integrate advanced technologies, or who have a personal interest in these initiatives, somewhat like the definition of stakeholders made by Friedman & Miles (2006) and which can be seen in subchapter 3.3.8 of this thesis.

According to the report Smart Cities: Digital Solutions for a More Livable Future (Jonathan Woetzel et al., 2018), the classification of stakeholders in a smart city can be structured into four groups, a classification that has also been validated by numerous authors (Table 8):

Table 8 – Defining Stakeholders in Smart Cities Projects

Defining Stakeholders in Smart Cities Projects	
Primary Stakeholders	Primary stakeholders include key entities that wield significant influence and involvement in smart city projects: • Government Entities: Local, regional, and national governmental bodies responsible for policymaking, regulatory frameworks, and funding allocation crucial for smart city initiatives. As emphasized by Nam & Pardo (2011a), the government plays a central role in the establishment and coordination of smart city initiatives. • Private Sector: Companies specializing in technology solutions, infrastructure development, and service provision essential for smart city operations and advancements. Caragliu, Del Bo, et al. (2011) highlight that the private sector is a pivotal contributor to the technological backbone of Smart Cities. • Citizens: Residents of Smart Cities whose quality of life, mobility, and access to public services are directly affected by technological innovations and urban planning strategies. Engaging citizens in the planning and implementation process is essential for the success of smart city projects" (Albino et al., 2015)
Secondary Stakeholders	Secondary stakeholders comprise entities that contribute to and support smart city developments through various means: • Academic and Research Institutions: Universities and research centres provide expertise, conduct studies, and foster innovation in urban planning, sustainability, and technology integration. Hollands (2008) notes that academic institutions are critical in generating knowledge and fostering innovation for Smart Cities. • Non-Governmental Organisations (NGOs): Advocacy groups and organisations focused on social, environmental, and civic issues relevant to smart city development. According to Neirotti et al. (2014), NGOs advocate for sustainable and inclusive urban development practices. • Media and Press: Entities responsible for disseminating information, shaping public perception, and fostering transparency in smart city initiatives. The media's role in shaping public opinion and ensuring transparency in smart city projects cannot be overstated (Giffinger et al., 2007).
Tertiary Stakeholders	Tertiary stakeholders encompass entities that indirectly influence or support smart city projects through specialized contributions: • Suppliers and Vendors: businesses supplying materials, equipment, and technologies essential for implementing and maintaining smart city infrastructure.

	As highlighted by (Harrison et al., 2010), suppliers and vendors provide the critical components and technologies that underpin smart city infrastructure. • Financial Institutions: banks, investment firms, and international financial organisations providing funding, loans, and grants to support smart city initiatives and infrastructure projects. Cohen (2015) states that financial institutions are key enablers of smart city projects, providing necessary funding and financial instruments. • International Organisations: Global entities offering expertise, funding, and guidance on sustainable development practices and smart city strategies. International organisations bring in global expertise and resources to support local smart city projects (Batty et al., 2012).
Community and Individual Stakeholders	Community and individual stakeholders include entities and citizens directly impacted by and engaged in smart city transformations: • Local Businesses: small and medium enterprises (SMEs) contributing to the local economy and affected by changes in urban infrastructure and business environments. Komninos (2011) notes that local businesses are integral to the economic vibrancy of Smart Cities. • Civil Society Groups: neighborhood associations, cultural organisations, and advocacy groups representing diverse community interests and influencing urban development policies. Civil society groups ensure that diverse community interests are represented in smart city projects (Chourabi et al., 2012). • Special Interest Groups: organisations advocating for specific causes such as digital inclusion, environmental sustainability, and social equity within smart city frameworks. As Townsend (2013) points out, special interest groups play a critical role in advocating for inclusive and equitable smart city policies.

Identifying and strategically managing stakeholders in Smart Cities projects are foundational to achieving successful and sustainable urban transformations. By acknowledging and engaging with the diverse array of stakeholders involved, cities can leverage their expertise and perspectives to innovate and address urban challenges effectively. The future of Smart Cities depends on our ability to manage and integrate diverse stakeholder interests in a cohesive and collaborative manner (Kitchin, 2014).

4.2.2 Stakeholder Management in Smart Cities

Stakeholder management in Smart Cities involves identifying, analysing, and prioritising stakeholders based on their influence, interests, and impact on project outcomes.

As defined by Caragliu et al. (2013), stakeholder management in Smart Cities is the process of systematically engaging and communicating with individuals and organisations to achieve project objectives while addressing their concerns and expectations.

In Smart Cities, key stakeholders can be categorised into several groups, as mentioned in the previous subchapter, and successful stakeholder management in Smart Cities requires adopting strategic approaches to engage and collaborate with these stakeholders, such as:

- Transparent Communication: establishing clear communication channels to disseminate information, solicit feedback, and address concerns in a timely manner (Giffinger et al., 2007);
- Inclusive Decision-Making: promoting inclusivity by involving stakeholders in decision-making processes, thereby fostering ownership and commitment to project outcomes (Chourabi et al., 2012);
- Partnership Building: Cultivating partnerships with stakeholders to leverage expertise, resources, and networks that contribute to project success (Neirotti et al., 2014).

Managing stakeholders in Smart Cities projects presents challenges such as diverse interests, power dynamics, and conflicting priorities. Addressing these challenges requires a nuanced understanding of local contexts and adaptive strategies to build consensus and manage expectations effectively (Komninos, 2011).

Effective stakeholder management is pivotal for navigating the complexities of smart city projects and achieving sustainable urban development. By recognising the diverse roles and interests of stakeholders and adopting proactive engagement strategies, cities can harness collective intelligence and foster innovation that enhances the quality of life and promotes resilience in urban environments (Townsend, 2013).

4.2.3 A need for Stakeholder Management

The needs caused by a city's constantly changing ecosystem lead to the emergence of new customers or users, and with their demands come new requirements in projects that seek to meet these exact requirements.

There is an urgent need for more efficient coordination and versatile management of all stakeholder participation, thus ensuring more effective leadership (Chinyio & Olomolaiye, 2009; Sutterfield et al., 2006).

The Project Management Institute (PMI) underscores the importance of stakeholder management, stating that projects often fail not because of PM competence but because stakeholders are not adequately engaged (Project Management Institute, 2017). This statement highlights the critical impact of stakeholder attitudes and their potential to positively or negatively sway project results.

Bourne (2016) further elaborates on the significance of stakeholder management by explaining that by engaging stakeholders and understanding their expectations, project managers can enhance mutual understanding and cooperation, increasing the likelihood of project success.

Effective stakeholder management thus not only mitigates risks but also enhances strategic alignment and value creation within projects, being essential as it directly influences project viability and success.

4.2.4 Principles of Stakeholder Management

Our research made it impossible not to come across the work done by the author Max Clarkson on the principles of stakeholder management (Clarkson, 1995) that became an essential reference in the concept of stakeholders and their management.

Its purpose was to create a concept in which a company should be a vehicle for promoting the interests of various stakeholders. In this way, the principles incorporate a series of perspectives and provide a model and a guide for companies to manage their stakeholders. The principles can be seen in Table 9:

Table 9 – Principles of Stakeholder Management
(adapted from Chinyio & Olomolaiye (2009))

#	**Managers should...**
1	Acknowledge and actively monitor the concerns of all legitimate stakeholders and should take their interests appropriately into account in decision-making and operations.
2	Listen and openly communicate with stakeholders about their respective concerns and contributions and the risks they assume because of their involvement with the corporation.
3	Adopt processes and modes of behaviour that are sensitive to the concerns and capabilities of each stakeholder constituency.
4	Recognise the interdependence of efforts and rewards among stakeholders, and should attempt to achieve a fair distribution of the benefits and burdens of corporate activity among them, considering their respective risks and vulnerabilities.
5	Work cooperatively with other public and private entities to ensure that risks and harms arising from corporate activities are minimised and, where they cannot be avoided, appropriately compensated.
6	Avoid altogether activities that might jeopardise inalienable human rights (e.g. the right to life) or give rise to risks that, if clearly understood, would be patently unacceptable to relevant stakeholders.

7	Acknowledge the potential conflicts between (a) their known roles as corporate stakeholders and (b) their legal and moral responsibilities for the interests of stakeholders, and should address such conflicts through open communication, appropriate reporting, incentive systems and, where necessary, third-party review.

Although principles can be adopted, innovation and new philosophies in cities require advancing or refining the principles of stakeholder management based on empirical research.

4.2.5 Stages of Stakeholder Management

This research topic, focused on identifying stakeholders and their analysis, has been a topic of interest since 1984 with the publication of the book "Strategic Management: A Stakeholder Approach" (S. Freeman & Cavusgil, 1984). Since then, about a dozen books and just over a hundred articles have been published (Elias et al., 2002), but this only demonstrates how far we are from knowing as much as we should about stakeholder management in project management.

According to our research, the development of the stakeholder concept in the literature can be classified into several stages, as shown in Figure 4.

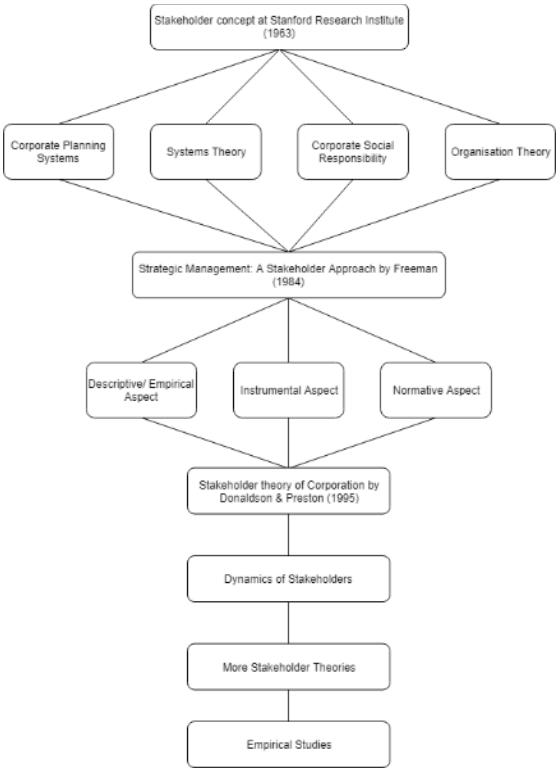


Figure 4 – Stakeholder literature map (Elias et al., 2002)

S. Freeman & Cavusgil (1984) developed the first three levels, which saw their genesis in 1963. Stakeholder management is divided into four fields: corporate planning, systems theory, corporate social responsibility, and organisation theory. This stage is called “classical stakeholder literature” (Elias et al., 2002).

Freeman's work (S. Freeman & Cavusgil, 1984) was considered a reference, which meant that all the research carried out was focused on three distinct aspects: descriptive/empiric, instrumental, and normative.

Another landmark was the combination of these three aspects in the stakeholder theory of corporation from the authors (Donaldson & Preston, 1995).

Further, the literature on stakeholders, which resulted from research efforts, initiated some iterations in the dynamics of stakeholders and the various theories underpinning stakeholder management.

It is a fact that stakeholder management requires the identification and classification of stakeholders. This process makes it easier to promote engagement with them in a more controlled way, considering factors such as planning and coordination (Chinyio & Olomolaiye, 2009).

4.2.6 Systematic Analysis of Stakeholder

It is interesting to note that there are processes that allow a systematic analysis of stakeholders in research and development projects, which are very similar to innovation projects as we know them today.

For example, according to Elias et al. (2002), we can see a model that is composed of eight steps, the first seven based on S. Freeman & Cavusgil (1984) and the eighth is based on (Mitchell et al., 1997).

1. Develop a stakeholder map of the project;
2. Prepare a chart of specific stakeholders;
3. Identify the stakes of stakeholders;
4. Prepare a power versus stake grid;
5. Conduct a process-level stakeholder analysis;
6. Conduct a transactional level stakeholder analysis;
7. Determine the stakeholder management capability of the R&D project;

8. Analyse the dynamics of stakeholders.

Today, all projects are implemented or carried out in a context where stakeholders have a dominant role in achieving success. Numerous researches reveal that many projects are susceptible to environmental changes (Jan Terje Karlsen, 1998) and that the stakeholders' behaviour can lead to changes in the project scope and performance (Hermano Rebolledo, 2013; Petit & Hobbs, 2010). In public enterprises controlled by public authorities, even more challenging decisions are made during project execution, further substantiating the need to recognise the importance of stakeholder management.

In this effort, it is also necessary to determine what is valued by the stakeholders. In the following listing can be seen some points such as (Robert Bosch GmbH, 2024):

- Motivation: vision, excellence and ethical values;
- Tasks: new resources (financial and technical), learning, support;
- Positioning in the organisation: recognition, visibility, reputation, networking;
- Relationships: acceptance and inclusion, understanding;
- Personal values: gratitude, ownership, involvement.

These are the challenges and requirements that a project manager cannot ignore and should consider. Then, it is necessary to develop a methodology that can generate the necessary understanding, supported by the tools that we propose to develop, and that can lead to constructive and collaborative relationships between the project manager and all stakeholders.

Stakeholder management is increasingly relevant to sustainable development (Jensen & Sandström, 2011; Porter & Kramer, 2011) in the same way that sustainable development is present in the contemporary context of any business activity (Elkington, 1997). Thus, the authors Eskerod et al. (2015) argue that for projects to meet or exceed the needs and expectations of stakeholders in the future, project management must be done in the context of sustainable development with due consideration in stakeholder management.

4.2.7 Stakeholders from a Public Management Perspective

Another factor to consider, which represents a very interesting challenge, is that in a city, many stakeholders are linked to public management and appear as undeniable candidates to stakeholders with high interest and preponderance.

These public entities, such as the local administration, are subject to a very particular management environment, and this also presents a unique kind of project management environment, if not absent when viewed in practical terms, related to their own organisational culture and institutional characteristics and the type of present leadership (F. Martins et al., 2018).

According to Bower (1977), although we know enough about management in the public sector to distinguish it from management in the private sector, we do not know as much as we should. Almost three decades later, the lack of studies and empirical research on public management and management in local administration is still evident (Wart, 2003).

Given the awareness of this lack of dissemination of knowledge, an exploratory attitude based on bibliographic research is therefore assumed.

Succinctly, the literature review seeks to obtain a holistic view in the context of project management of the local public administration, using the standards in project management mentioned as a reference to overcome the difficulties inherent in this culture of project management, whether formal or informal. They're offering some usefulness in the efforts that we propose to carry out.

Public management models have evolved, often associated with changes in the conception and ideology of the state, which is more or less interventionist (Ângelo & Rodrigues, 2005).

Like the private environment, diverse economic, financial, political, and ideological pressures provided the conditions for the appearance of a new model of management denominated by New Public Management.

The New Public Management is based on the introduction of market mechanisms and the adoption of tools already present in private management, in the promotion of competition between suppliers of public goods and services promoted by transparency, in the expectation of improving the service for the citizen, in the increasing effectiveness and making the management of these public bodies more flexible (Ângelo & Rodrigues, 2005).

In the case of private management, when comparing the new public management and the creation of new products or services, it would be possible to identify some standard requirements in the definition of what a project is and the management of the same and the expected gains, but further efforts are needed to manage these stakeholders and identify others.

One of the central pillars of the New Public Management is the improvement of the delivery of services and the emphasis given to the citizen as a significant stakeholder, in order to create a more responsive bureaucracy (Joaquim Filipe Araújo, 2000).

From a global perspective, the strategy of public service organisations is based on the requirements identified in the law that help clarify their public policy strategy to achieve public value or products.

Considering that, according to Simões (2003), these are organisations that are constantly confronted with economic, social and technological challenges, it is then necessary to monitor, manage and evaluate the various elements, such as stakeholders, being an essential principle of current project management and it is here that, once again, we find a point of support for our efforts to fill this gap.

The present capacity for stakeholder management, and adaptation to change, brought about by the adequacy of various resources, time constraints, compliance with requirements, control and evaluation of performance levels, are the requirements to achieve the change that a city needs or value creation within it (Simões, 2003), especially when we make a direct analogy between a city and a company.

Another fact is that governments can also be counted as stakeholders because they can have an interest in the operations and existence of specific organisations, for example, that can have a presence through their fiscal and regulatory policies (Sutterfield et al., 2006).

4.2.8 Stakeholder Management in the context of Innovative Projects for Smart Cities

The innovative character of projects for Smart Cities shares all the peculiarities of research and development projects. It also has something in common with how this type of project affects the interests of different stakeholders.

As we are interested in project stakeholder management in the context of innovative project practices for Smart Cities, we try to conceptualize a sustainable and innovative development perspective related to this topic.

Since the interest of this research work lies in elements of project management standards, especially suitable for project management in a dynamic and unpredictable environment such as a smart city, and on the satisfaction of those involved, that is the reason why we conduct our research by focusing on various project management standards such as the Project Management Body of Knowledge (Project Management Institute, 2017), PRINCE2 (Axelos, 2017) and the PM² project management methodology guide (European Commission, 2018).

A factor that underpins the importance of this matter is the PMBOK (PMI, 2017), which includes an area of knowledge called Project Stakeholder Management, which consists of the processes needed to identify individuals, groups, or organisations that may impact or have an impact on the project. It also allows efforts to analyse the expectations of stakeholders and their impact on the project, thus enhancing the creation of strategies for the efficient management of stakeholders and their involvement in decision-making during a project and its execution, although, in our opinion, insufficient or that should be seen only as guidelines.

4.2.9 Existing Gap in Stakeholder Management

We have been talking about the existing gaps and the lack of attention given to the management of the stakeholders, however, it is also necessary to mention why this happens (Leonidou et al., 2018).

According to the research, one of the likely factors is that this stakeholder identification process can be viewed in the wrong way, for example, it can only consider the users of the solutions, the project team as well as the elements of the various entities involved as the sole stakeholders (Pacheco & Garcia, 2012).

Another factor is this lack of attention because this process of identifying and managing stakeholders can be eliminated or replaced by opinions or knowledge obtained from other more accessible or direct sources of information (Smith & Smith, 2000).

The project manager is responsible for managing all the inherent difficulties of stakeholder management, and for this reason, the need to create methodologies that identify and manage all stakeholders, whether implicit or explicit, is once again validated.

4.2.10 Framework for Stakeholder Management

Although there are several stakeholder management processes, such as those in the various project management standards, where we focus on the stakeholders of projects, programs and portfolios, we must overcome the barriers imposed by an organisation or enterprise and see stakeholders as stakeholders of an entirely different dimension.

It is still common to find frameworks dedicated to the engagement of the various stakeholders, or efforts to ensure success for each of the stakeholders, however, frameworks dedicated to the entire process of identifying and managing stakeholders is a subject that we believe is still an area with many gaps.

There are some frameworks for managing stakeholders in a given project, such as the one proposed by Sutterfield et al. (2006) and adapted by David (2011), that can be seen in Figure 5, which defines a framework defined by nine steps to help project managers in managing their project stakeholders and the various agendas.

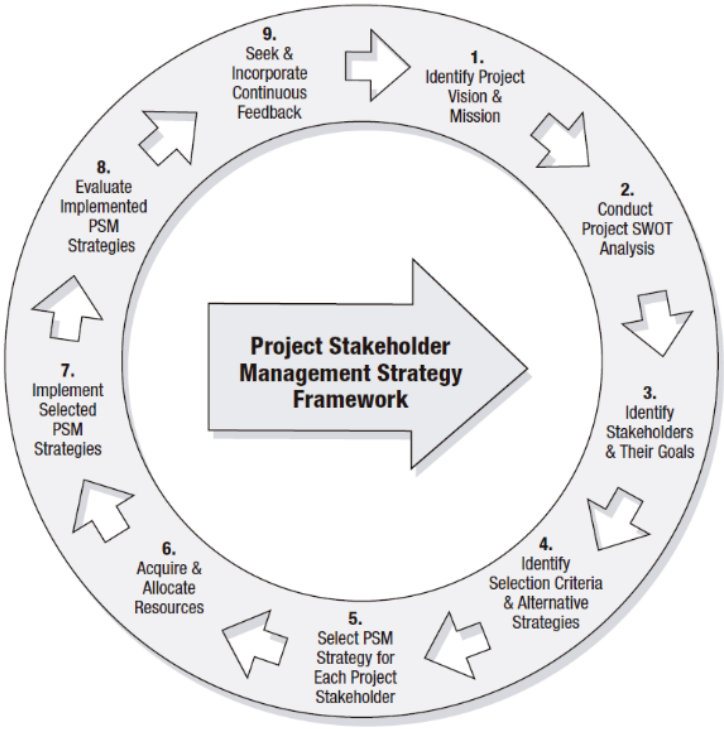


Figure 5 – Project Stakeholder Management Framework (Sutterfield et al., 2006)

Those steps are (Sutterfield et al., 2006):

1. Identify Project Vision & Mission: the project manager must identify and articulate the project vision and mission;

2. Conduct Project SWOT Analysis: the project manager must conduct a project SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to identify the internal strengths and weaknesses of the project team;
3. Identify Stakeholder & Their Goals: this is where the project manager identifies all the project stakeholders, their goals and stakes in the project;
4. Identify Selection Criteria & Alternative Strategies: the project manager determines the selection criteria and identifies alternative strategies or plans of action for managing each project stakeholder and the existing goals;
5. Select Project Stakeholder Management (PSM) Strategy for Each Project Stakeholder: the project manager selects the project stakeholder management strategies that will ensure that the project stakeholders achieve their goals while the project manager is able to attain his project goals;
6. Acquire & Allocate Resources: the project manager acquires all the resources needed to implement the selected project stakeholder management strategies;
7. Implement Selected PSM Strategies: the actual implementation of the selected project stakeholder management strategies;
8. Evaluate Implemented PSM Strategies: evaluation of the project manager regarding the implemented project stakeholder management strategies and to make corrective changes in the implemented project stakeholder management strategies where necessary;
9. Seek & Incorporate Continuous Feedback: the project manager searches to obtain elicit feedback from the various project stakeholders regularly but also processes the received feedback and incorporates it into the strategic project stakeholder management process.

The frameworks mentioned above do not consider the distinction between the company or organisation, the posture that these may have during the project, and the many particularities that are almost exploratory of an innovative project dedicated to Smart Cities.

It is, therefore, essential to be clear about the distinction between organisation and company when defining the requirements for creating a framework for stakeholder management.

According to BABOK (IIBA, 2015), an organisation is an “autonomous group of people under the management of a single individual or board, that works towards common goals and objectives. Organisations often have a clearly defined boundary and operate continuously instead of an initiative or project team, which may be disbanded once its objectives are achieved”.

On the other hand, also according to BABOK (IIBA, 2015), an enterprise is “a system of one or more organisations and the solutions they use to pursue a shared set of common goals. These solutions (...) can be processes, tools or information. An enterprise may include any number of businesses, government, or any other type of organisation”.

Frameworks help map and manage stakeholders during project management, but they must be tailored to the project and the project environment.

We firmly believe that a framework for managing stakeholders during project management must possess the elasticity and tenacity necessary to comply with the requirements that these two definitions impose and the specificity offered by the type of projects inherent to the character we have described.

4.2.11 Standards as a foothold

Following the literature research, we concentrated on collecting project management topics from the standards mentioned before while creating a method to help determine all the stakeholders, implicit or explicit, and define their strengths, influence, and interest in the project at hand.

The choice of these references is based on the fact that they are used by practitioners as guides to good practices in the areas of project management (Tereso et al., 2018).

With all these efforts, we expect to help harmonize the terminology of the project management field and reduce conflicts within the project team and with a project’s stakeholders.

To address the needs and challenges of the project stakeholder management, as well as those of other stakeholders, we would argue that the stakeholders' needs must be identified and accordingly managed.

In this way, we expect to expand the management of innovation projects to Smart Cities, focusing on stakeholder management and enabling the project manager to manage multiple stakeholders' interests throughout the project management process.

This stakeholder management concern is also practical and already implemented, for example, in industry, that identifies the stakeholder as the one who is directly involved in the project or whose interests may be positively or negatively affected by the execution of the project, and who may also have an influence on the project and its deliverables (Robert Bosch GmbH, 2024).

There is an absolute truth in the fact that all project managers must understand, quantify and record any stakeholder's needs in relation to the project. Requirements that can be managed must be created and form part of the scope management process.

As the whole environment is changing, so are these needs, so they can't just be defined at the start of the project. This process is also called progressive elaboration, where we understand more about the project as it progresses (Robert Bosch GmbH, 2024).

4.3 Smart Cities

Smart Cities have been a research topic for over a decade, and there are many ways of looking at them. Still, in today's modern urban context, we appear to be constantly bombarded with a wide range of definitions trying to define a Smart City and combining terms such as smart, intelligent, innovative, wired, digital, creative, and cultural (Hollands, 2008).

One of the difficulties is separating the terms themselves, which often appear to borrow on one another's assumptions or, in some cases, get fused together.

The adjective "smart" in Smart City is indebted to the concept of "intelligent city" (Hollands, 2008; Komninos, 2013), mainly relating to the connection between urban space and technology, including issues such as the ability to generate innovation, the transition towards forms of e-governance, social learning, and the provision of Information and Communications Technology (ICT) infrastructures (Vanolo, 2016).

One of the critical elements that stands out in the various definitions of smart city is the use of networked infrastructures to improve economic and political efficiency and allow social, cultural, and urban development (Komninos, 2013).

Therefore, there is a broad agreement about the fact that Smart Cities are characterised by the pervasive use of ICT, which, in various urban domains, helps cities make better use of their resources (Neirotti et al., 2014)

Recently, Smart Cities have been viewed as ecosystems, which are generally defined as communities of interacting organisms and their environments and are typically described as complex networks formed because of resource interdependencies (Gretzel et al., 2015) which can be seen as an interdependent social system of actors, organisations, material infrastructures, and symbolic resources (Maheshwari & Janssen, 2014).

Another perspective is that a Smart City is transformed into a " platform society" (Van Dijck et al., 2018). This name illustrates that various urban infrastructures, such as transport and traffic management, are now transformed into services with dynamic and adaptable prices, managed by platforms composed of algorithms that govern the requests of the various users (Lange & Waal, 2018).

4.3.1 Public Management of Cities and Projects

Any Organisation's competitive advantage is increasingly based on its ability to find new solutions and direct its human capital, with all its individual and collective skills and talents, towards finding these solutions and achieving its goals.

Local government has a particular type of project management environment, if not absent when seen in practical terms, related to its own organisational culture, its institutional characteristics, and the kind of leadership present.

According to Bower (1977), although we know enough about management in the public sector to distinguish it from management in the private sector, we don't know as much as we should. More than two decades later, the lack of studies and empirical research on public management and management in local government is still evident (Wart, 2003).

Aware of this lack of dissemination of knowledge, an exploratory approach based on bibliographical research is adopted. In short, the literature review aims to provide a holistic view of project management in local government, making comparisons with the various project management methodologies.

Aware of this lack of dissemination of knowledge, an exploratory approach based on bibliographical research is therefore adopted. In short, the literature review aims to provide a holistic view of project management in local government, making comparisons with the various project management methodologies.

Public management models have evolved, often linked to changes in the conception and ideology of the state, which have been more or less interventionist (Ângelo & Rodrigues, 2005).

Like the private environment, various economic, financial, political and ideological pressures provided the conditions for the emergence of a new management model called New Public Management.

New Public Management is based on the introduction of market mechanisms and the adoption of tools already present in private management, the promotion of competition between suppliers of public goods and services promoted by transparency, the expectation of improved service for the citizen, increased efficiency, and greater flexibility in the management of these public organisations (Ângelo & Rodrigues, 2005).

In the case of private management, when compared to the new public management and the creation of new products, it would be possible to identify some usual requirements in the definition of what a project is and its management and the gains expected from them.

One of the main pillars of New Public Management involves improving service delivery and emphasising the citizen as a customer, to create a more responsive bureaucracy (Joaquim Filipe Araújo, 2000).

Figure 6 shows the strategy of public service organisations from a global perspective. It is based on the requirements identified in the law, which help clarify its strategy expressed in terms of public policies so that public value can be realised, whether in services or products.

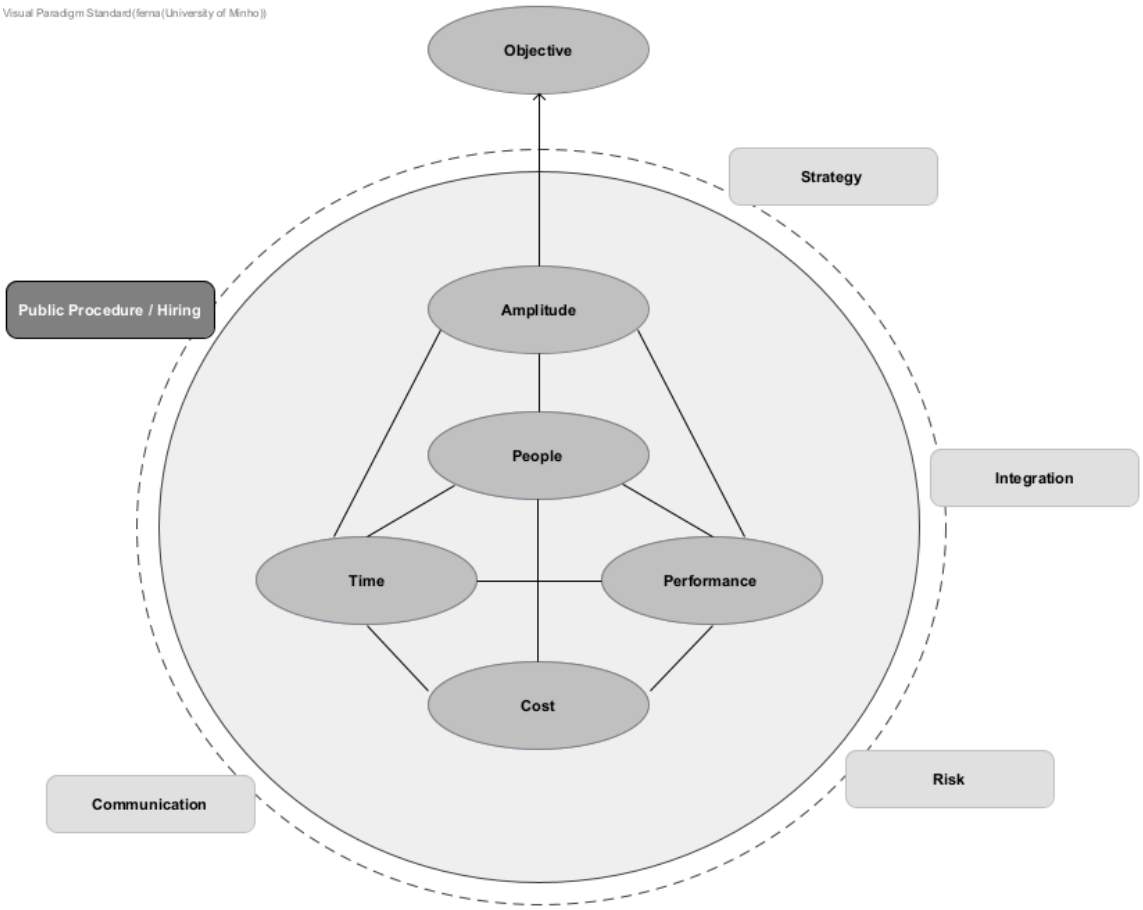


Figure 6 – Overall Organisational Strategy Framework (adapted)

Hiring is, therefore, a strategic tool on the road to achieving the organisation's objectives. According to Simões (2003), considering these organisations are constantly faced with economic, social, and technological challenges, monitoring, managing and evaluating performance is therefore necessary. This is one of the most essential principles of project management today, and it is here that we find common ground with this discipline.

The ability to adapt to change, brought about by the adequacy of various resources, time constraints, compliance with requirements, control and evaluation of performance levels, is the way to achieve organisational change or value creation within the organisation (Simões, 2003), as Figure 7 tries to demonstrate.

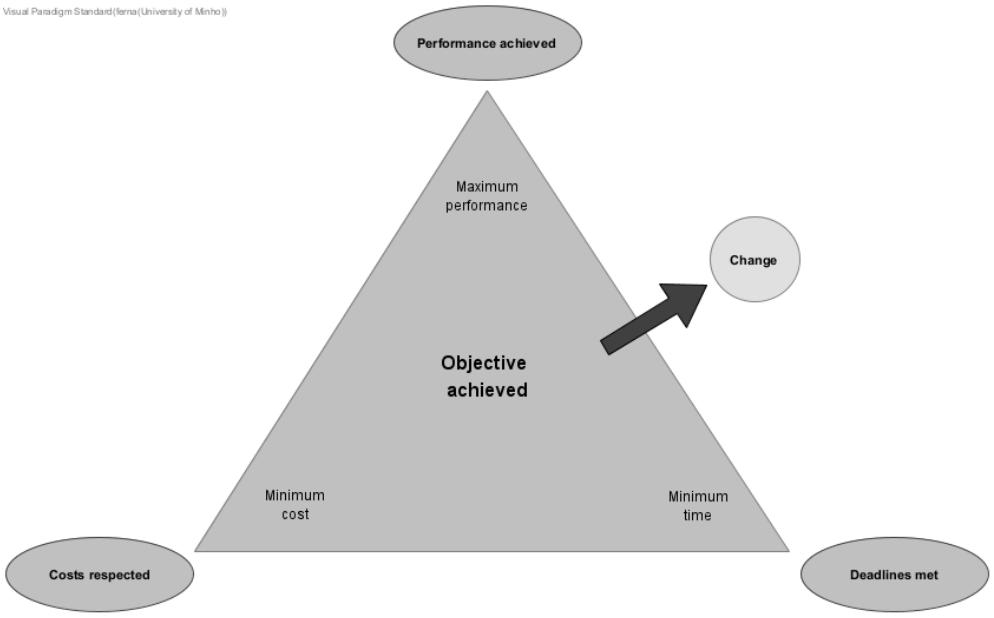


Figure 7 – Performance in a context of change (adapted)

Continuing this new public management, emphasis is placed on management by objectives, the management and evaluation of performance, managers and employees. Through "knowing how to be" (attitudes and values) and "knowing how to do", there is an evolution towards "knowing more" through knowledge and training, leading to the creation of added value in the services provided and an organisational culture focused on results.

A new management paradigm is thus emerging that seeks to incentivise compliance with previously identified budget restrictions, leading to management based on rules and regulations (Tavares et al., 2009), which, despite having legal characteristics, are comparable in this understanding to the methodologies and standards that exist in project management.

To substantiate this view, it can also be said that the management models of the new public management are performance-orientated and have the following characteristics (Tavares, 2003):

- Aimed at supporting and realising;
- Grounded in and justified by strategic guidelines, according to the organisation's vision;
- Results-orientated, serving citizens, communities and other stakeholders through cost-effectiveness analysis;
- Based on innovation processes that constantly identify use cases from the perspective of the client/citizen;

- Based on integrated information flows, thus allowing knowledge to be created and accessed by all stakeholders, both internal and external;
- Organised by appreciation and leadership;
- Structured by programme and project management;
- Characterised according to models that consider cost in relation to efficiency;
- Evaluation of the models by the stakeholders who benefit from the product, both in terms of services and products.

From the perspective of the new public management, a project is an identifiable operation that involves an effort of resources, financial, human or physical, with defined and articulated activities to obtain a product that represents the objectives/requirements identified initially, together with the implementation and management model, execution schedule and budget.

All of the above are precisely defined, and the management and execution of which is the responsibility of an operator or promoter under contractual stipulations (Simões, 2003).

From a public management perspective, the integrated management of programmes and projects follows a cycle that begins with design, implementation and evaluation. The evaluation considers economic and social impacts.

Figure 8 illustrates the cycle of the integrated approach to programmes and projects:

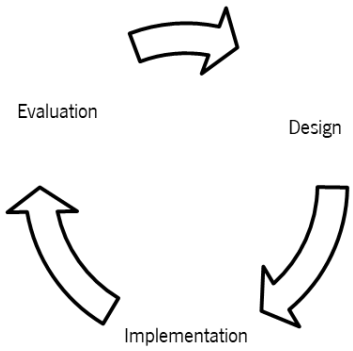


Figure 8 – Cycle of the integrated approach to programmes and projects in public management (adapted)

The genesis of projects in this environment results from a top-down approach duly integrated into a programme, whose joint objective will always be creating public value, justified by the mission and vision.

Unlike the genesis of projects, an evaluation is carried out using a bottom-up approach, whereby evaluation is always carried out according to the impact and value gained by external stakeholders.

Figure 9 represents the alignment between programmes and projects with public policies.

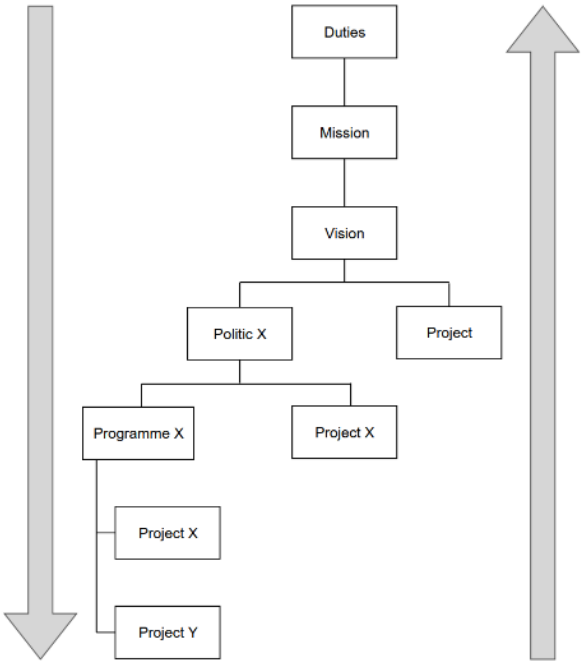


Figure 9 – Alignment between programmes and projects in public policies

The management of each of the programmes and projects is based on each of the processes in their lifecycle, which are framed according to the moment they are at (Table 10):

Table 10 – Design, implementation and evaluation during the lifecycle of a project

Design	**Implementation**	**Evaluation**
Framework: - Context and history; - Stakeholders; - Scope; - Other projects.	-	Framework: - Context and history; - Stakeholders; - Lessons learnt; - Other projects and interventions.
Project intervention logic: - Purpose / objectives; - Output / results / products; - Activities.	Progress against objectives: - Objectives; - Outputs / results / products; - Activity.	Progress towards objectives: - Contribution to general objectives and their impacts; - Project objective and immediate effects; - Outputs, results or products; - Activities.
Assumptions: - Assumptions of the intervention logic; - Risks; - Constraints.	Verification of assumptions: - Objectives; - Outputs / results / products; - Activity.	Verification of assumptions: - Assumptions in the intervention logic; - Risks and constraints.
Framework: - Timeline; - Costs;	Project execution: - Timetable; - Financial execution;	Project execution: - Timetable; - Budgeted costs;

Design	Implementation	Evaluation
- Budget; - Organisation and procedures for implementation; - Technical assistance; - Interconnection with other projects.	- Physical execution; - Interconnection with other projects.	- Organisation and implementation; - Technical assistance; - Interconnection with other projects.
Feasibility and justification: - Institutional and political framework.	Feasibility and justification: - Institutional and political framework.	Feasibility and justification: - Institutional and political framework.
Monitoring and evaluation: - Verifiable indicators; - Audits.	Monitoring and evaluation: - Realisation indicators; - Monitoring and mid-term evaluation systems.	Monitoring and evaluation: - Indicators of realisation, effects and impact; - Devices and final evaluation.

In this environment of strong political intervention in public programmes and projects, evaluating results and their impact is the focus of a great deal of attention in determining policies' impact on achieving objectives (Baccarini, 1999; Pfeiffer, 2006).

This form of evaluation aims to assess programmes and projects to improve decision-making in relation to them, as well as their design and implementation. In order to carry out a proper evaluation, considering that it is a systematic process and covers various aspects of it (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003), it is necessary to:

- Scope: identify the scope of the evaluation and its objectives;
- Stakeholders: identify participants with essential roles;
- Costs and benefits: determine the costs and benefits of the assessment.

To ensure success, it is also necessary to (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003):

- Commitment and Involvement: the commitment and involvement of top management;
- Adaptation and Innovation: considering the environment in which it operates, a constant innovation and adaptation culture should always be required.

The link between the decision-making process, the involvement of the decision-maker, the evaluator and communication is one of the most critical elements in the management of evaluations of public policies, programmes and projects (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003), which in itself seems to be entering common ground with any project management methodology or standard.

Evaluating the results and their effectiveness depends a lot on (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003):

- Public Policy;
- Objectives: scope, focus, selection of methodologies and their selection and use, cost and time constraints;
- Continuous improvement: the continuous improvement of the management and quality of evaluation through its planning, definition of objectives and criteria for selecting them.

The purpose of presenting all the evaluation results should be to reinforce the credibility of the programme and projects, and it should also be public to create conditions for sharing experiences and perspectives, thus stimulating dialogue.

The aim is to emphasise the importance of properly managing a project's lifecycle based on public policies and programmes based on a logic of impacts, a situation illustrated in Figure 10.

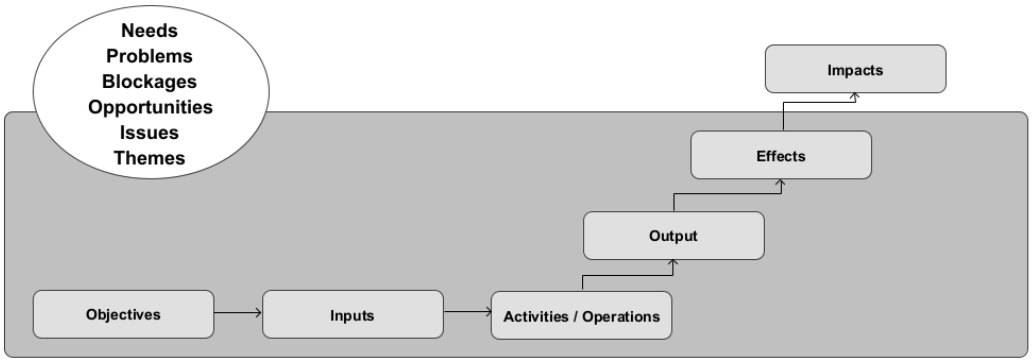


Figure 10 – Intervention Logic Vs. Impact Logic (adapted)

The results should also focus on the difficulties and problems encountered to create lessons learnt (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003).

Evaluating the above context, it is necessary to distinguish the impacts obtained as either the end result or the changes brought about by these projects. It is therefore necessary to assess the effect, which can be broken down by (Baccarini, 1999; Pfeiffer, 2006; Simões, 2003):

- Problem: impact on the problem to be solved and its surroundings, such as people, and the consequences that may arise;
- Externalities: impact on groups or entities for which the projects and programmes are not intended;
- Current and future: impact on the present and future;

- Costs: as a rule, only direct costs are quantified, but it is important to consider indirect costs as well as benefits.

As can be seen in Table 11, in a nutshell, the cycle of a programme or project is

Table 11 – Programme / Project Cycle

Stage	Project Cycle Activities
Programme	Review of Socioeconomic Indicators; Review of Priorities.
Identification	Researching ideas for the project; Creation of the initial project idea.
Formulation	Preparation of a feasibility study; Detailed specification of the project idea/business case; The decision to draw up a financing proposal.
Financing	Drawing up a financing proposal; Financing decision.
Implementation	Tendering and contracting; Mobilisation and project execution; Follow-up.
Evaluation	Analysing the benefits and impacts of the project; Lessons learnt.

All of the above approaches to project management in local government are based on the Logical Framework methodology.

The Logical Framework is a matrix drawn up in a successive structuring process that focuses on a project's essential elements and allows for a systematic, logical, and clear presentation. What always precedes project planning is an analysis of what the project is intended to achieve or a description of the situation, problem, or need.

It is important to note that the Logical Framework does not represent a complete project plan, but rather a brief statement of the intervention plan. In this way, the Logical Framework provides answers to the following questions (Pfeiffer, 2006):

- Why should the project be carried out?
- What is its objective, and what changes are to be achieved?
- How are the changes to be achieved?
- What external conditions influence the achievement of results and their effects?
- How can the scope of improvements and changes be identified?

In other words, the Logical Framework aims to define and demonstrate the gains of a project already at the planning stage, considering that this prior definition of success is a complex challenge, since there is no consensus on the definition of project success (Baccarini, 1999).

Considering the previous methodologies, the Logical Framework has apparent similarities with the PRINCE2 Business Case, and it is easy to extrapolate it systematically.

Several aspects must be observed appropriately as a project moves from implementation to evaluation. Considering that all projects must be duly justified, the contexts, objectives, components, and budgets must then be described so that their design, preparation and planning can be drawn up.

Once the project has been prepared, it must be approved, particularly in obtaining the necessary funds, and then the project will be implemented.

The implementation of the project requires the definition of its various constituent phases (Figure 11), which are subject to a constant monitoring, management and evaluation system (Pfeiffer, 2006; Simões, 2003).

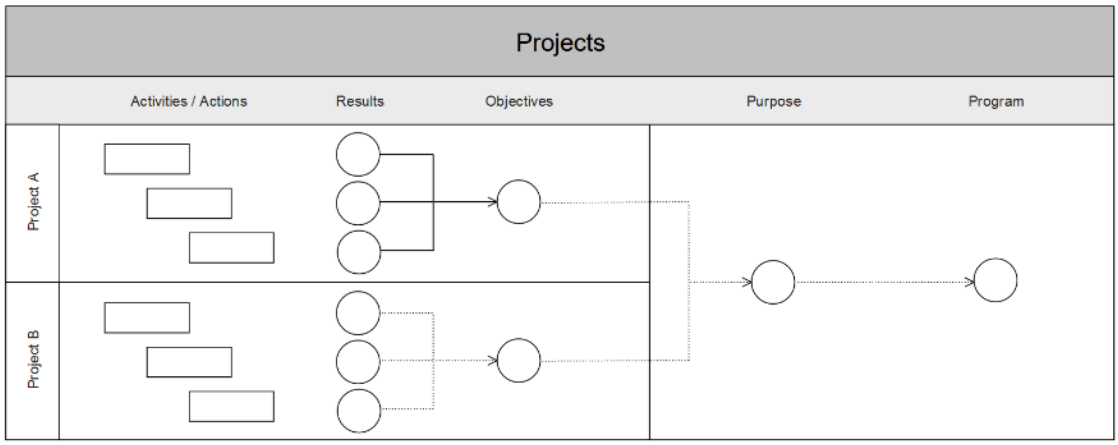


Figure 11 – Intervention structured around a relationship between means and ends (adapted)

The implementation of the project requires a monitoring system, with various evaluations throughout the lifecycle of this phase, so the assessment carried out in this monitoring should cover aspects such as:

- Relevance: how the objectives fit the problem;
- Efficiency: comparing the outputs with the inputs to determine their operational efficiency;
- Effectiveness: comparing the benefits and impacts with the objectives;
- Sustainability: analysing the extent to which these benefits and impacts are sustainable;

- Usefulness: analysing the extent to which these benefits are useful in terms of the changes they were intended to achieve.

Thus, and according to the Logical Framework illustrated in Figure 12, this integrated approach to the project cycle identifies a set of stages, each with a set of activities to be carried out:

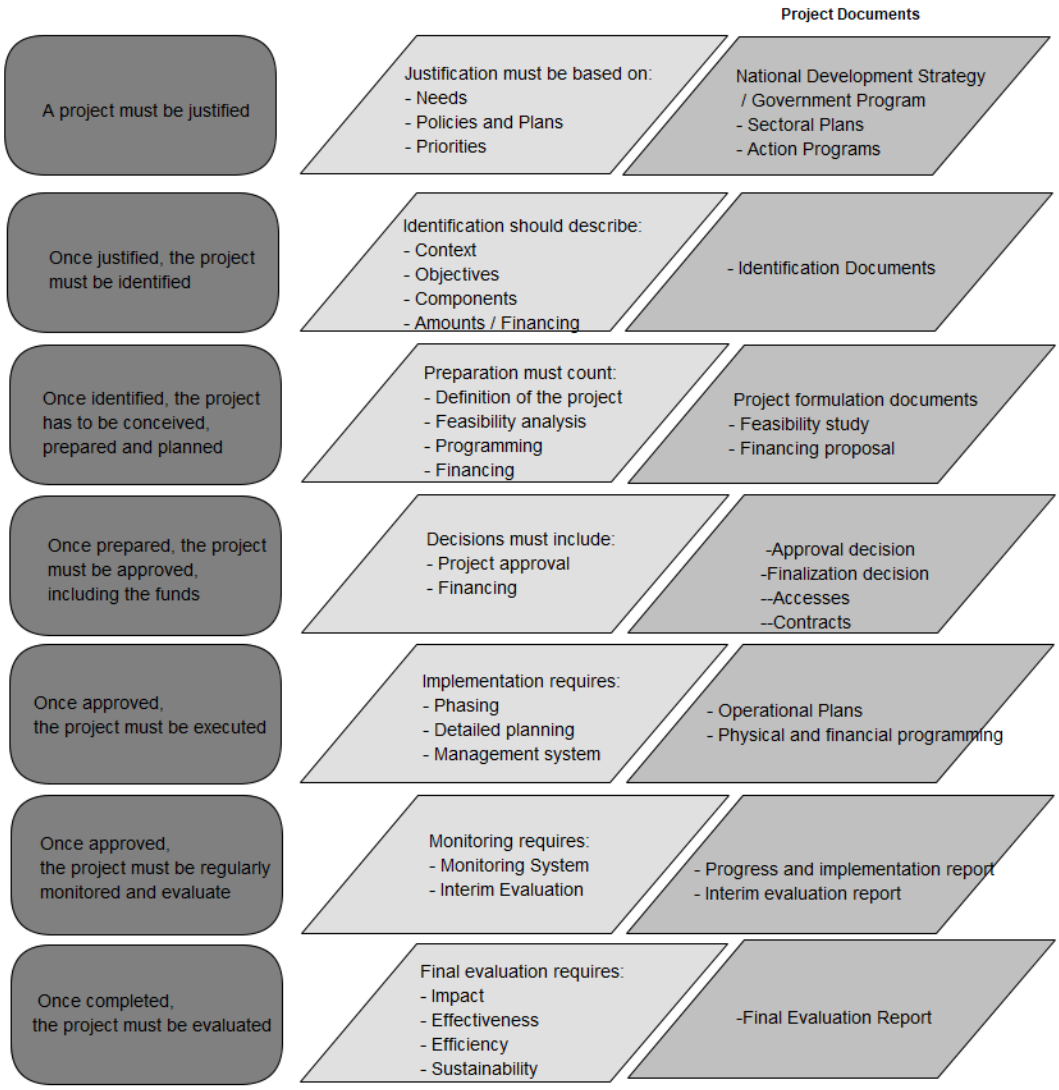


Figure 12 – Activities to be developed according to the intervention stages

Considering all the research carried out, there is an evident concern about developing an integrated system to monitor, manage, and subsequently evaluate the impact of projects. This is based on a logic of intervention in public policies and public value, using indicators capable of measuring the achievement of the final objectives and the means of verification used for this evaluation.

4.3.2 Stakeholder Management in Smart City Projects

Smart city initiatives, characterised by their specific scope and complexity, inherently involve diverse stakeholders, including public entities, private companies, and city users. We consider that effective stakeholder management in this particular context is not merely beneficial as it is imperative for the successful implementation and operation of smart city projects.

Smart Cities are urban areas that use electronic data collection sensors to supply information to manage assets and resources efficiently (El-Sherif & Khalil, 2022). Integrating technology into urban management necessitates the involvement of multiple stakeholders to harness expertise, manage resources, and ensure the alignment of diverse objectives in the project lifecycle.

Stakeholder management in this setting involves identifying all relevant parties, understanding their influence and interest, and strategically engaging them throughout the project lifecycle. As noted by Gohari et al. (2020), the successful deployment of smart city initiatives heavily depends on stakeholders' active participation and commitment, whose interests and interactions can determine project trajectories and outcomes.

Moreover, the complexities of smart city projects often result in an environment where governance structures must be vigorous yet flexible enough to adapt to evolving technological and societal contexts (Munene et al., 2018). Effective governance, facilitated by adept stakeholder management, ensures that public and private entities can contribute to and benefit from the smart city initiative, advancing an ecosystem of innovation and sustainability.

Despite the current wave of discussion and debate on Smart Cities' value, function, and future, it resist easy definition as a concept. At its core, the idea of Smart Cities is rooted in the creation and connection of human capital, social capital and information and Communication Technology (ICT) infrastructure to generate more significant and more sustainable economic development and a better quality of life (Publications Office of the European Union, 2014).

Smart Cities have been further defined along six axes or dimensions:

- Smart Economy;
- Smart Mobility;
- Smart Environment;

- Smart People;
- Smart Living;
- Smart Governance.

The coordination of policies along these dimensions reflects the positive feedback between city development and urbanisation; cities attract people while the availability of populations and infrastructure facilitates economic and societal development (Publications Office of the European Union, 2014), and the same conclusion takes us to the relevance of stakeholder management.

Smart Cities comprise a portfolio of initiatives, with different, though often overlapping, focal areas, modalities, participants and constituencies. As distinct from ideal Smart Cities, actual Smart Cities are more process than outcome (Publications Office of the European Union, 2014).

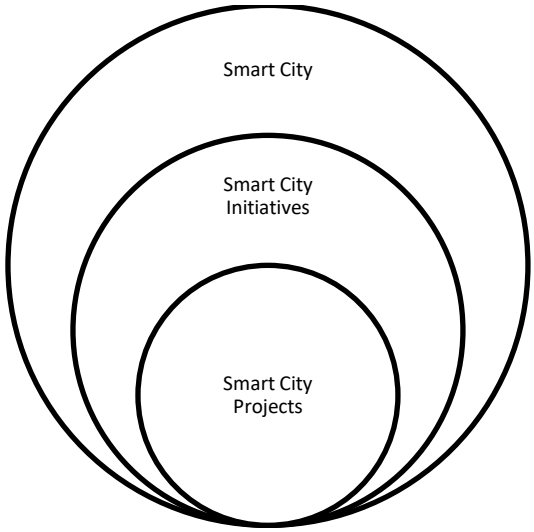


Figure 13 – The relationship between projects, initiatives and Smart Cities (adapted from Publications Office of the European Union (2014))

Smart Cities are comprised of a portfolio of initiatives with different focal areas, modalities, participants, and constituencies. In a Smart City, these initiatives are linked together, supporting and positively feeding off each other.

To sum up, the European Union define 'Smart City' initiatives as multi-stakeholder municipally based partnerships aimed at addressing problems of common interest with the aid of ICTs, which underpin the 'Smart' classification(Publications Office of the European Union, 2014), and the importance of all the involved stakeholders.

This combination of Smart Cities and stakeholders allows us to recognise the value inherent to a framework for managing stakeholders of all projects, on which governments, businesses, and citizens can communicate and work together and track the city's evolution.

In conclusion, stakeholder management in Smart Cities is a critical facilitator of success, particularly in projects bridging the public and private sectors. Managing these relationships with a clear strategy that aligns different interests and harnesses collective capabilities is essential for transforming urban environments into Smart Cities.

4.3.3 Urban Sustainability

The concept of sustainability has a vast influence on planning and policy at the local level (Maclaren, 1996), which has led many cities to adopt sustainability as one of the objectives in numerous project planning and execution efforts.

However, most people inevitably associate the term “urban sustainability” with environmental issues related to the finiteness of natural resources.

However, it is unquestionable that environmental issues cannot be dissociated from social, cultural, and economic dimensions, and a relevant percentage of scholars also incorporate the political dimension in their studies (Alvarez et al., 2018).

To obtain a definition of the term “urban sustainability”, it must first be compared with “sustainable urban development” because these two are very close and are used interchangeably in the literature several times.

One way to distinguish is to think of sustainability as a desirable state or a set of conditions that endure over time. In contrast, we have the word development in terms of “sustainable urban development”, which implies a process in which sustainability can be achieved (Maclaren, 1996).

The place-based conceptualization enforces the idea that urban sustainability requires urban self-sufficiency.

Urban sustainability is fundamentally the sustainability of the urban environment as a whole, so it is related to the composition and configuration of the city, which continuously extends beyond its limits (J. Wu, 2010).

From the research carried out, and considering the notion that seems to obtain greater consensus, urban sustainability is the thought that requires the minimization of the consumption of space and resources, optimising the urban form to facilitate the urban flow, protecting both the ecosystem and human health, guaranteeing equal access to resources and services, maintaining cultural and social diversity and also their integrity (Spiekermann & Wegener, 2003; J. J. Wu, 2008).

4.4 Conclusions

The literature review conducted as part of this thesis provides a foundational understanding of the complexities and challenges associated with stakeholder management within the context of Smart Cities.

This review has identified significant trends, gaps, and theoretical perspectives crucial for understanding the multifaceted nature of smart city initiatives by critically examining existing research.

The insights gained from the literature are directly relevant to the research questions posed in this thesis, particularly concerning the identification of best practices for engaging stakeholders in smart city initiatives.

The reviewed literature not only provides a theoretical framework for analysing stakeholder interactions but also offers practical examples and case studies that will guide the empirical component of this research.

PART III – Contribution

"I was talking aloud to myself. A habit of the old: they choose the wisest person present to speak to."

- Gandalf, The Lord of the Rings: The Two Towers, J.R.R. Tolkien

5. Powered By Action Research

This chapter details the strategic application of Action Research (AR) within the context of this study, demonstrating how this participatory and reflective methodology drives the research process. Action Research is distinguished by its cyclical and iterative nature, enabling researchers to actively engage with and respond to the evolving dynamics of the research environment.

Here, we specifically incorporate the EFQM model and the RADAR logic as evaluating models to guide and enhance the Action Research process, ensuring a structured and effective approach to achieving the research objectives.

5.1 Introduction

Over the years that make up this doctoral project, and even before, due to the researcher's professional activity, various challenges materialized in projects that were embraced and managed.

To evaluate Action Research studies, Myers (2019) has two statements that we consider important:

- Every study should make a contribution or a potential practical contribution. Even if the action turns out to be a failure, this can also be considered a contribution. Valid examples of Action Research contributions could be a change in a project management process or creating an IT solution to support a business process;
- Each study should contribute to the research.

Evidence of evaluations considered valid or positive, for the two previous statements could be:

- For the first statement, evidence was obtained from the organisation (for example, in the form of a written letter stating that the action was justified and had satisfactory results);

- For the second statement, evidence from the scientific community (e.g. in the form of accepted publications and peer-reviewed journals related to the research contributions).

Due to their intrinsic characteristics of promoting practical demonstrations of research theories, Action Research studies can also increase the practical aspect of research related to companies and knowledge, which is often associated with more theoretical approaches.

The main objectives of the Action Research methodology are to solve organisational problems through intervention and to contribute to scientific knowledge (Melin & Axelsson, 2016). Researchers have been encouraged to consider the Action Research methodology as a suitable approach (Mckay & Marshall, 2001) for developing knowledge, achieving organisational change, and developing solutions, even in the field of project management.

The practical aspect of Action Research approaches is appreciated by organisations, managers and researchers, mainly because of any project's time constraints, thus making time scarce and expensive.

Another fact to consider, and one that favours Action Research, is that organisations don't always have adequate human resources to transform theoretical research results into efforts that bring internal value, often represented by changes to processes and workflows normally associated with management.

To this end, in the context of research aimed at supporting organisations through the appropriate development of solutions and processes that are more agile and suited to the culture and ecosystem in which they operate, we apply Action Research, which is an important research method, provided it is well applied, since it always creates practical and useful work artefacts, such as a process or a digital solution that enhances that same process (for example, the digitisation of an internal process or management effort).

Action Research must always be committed to maximising the value of using this methodology. To do this, it is necessary to evaluate how we carry out each action, and not just focus on the results produced by each action. This evaluation of each action allows for better planning of the next action, thus enabling the researcher to use Action Research to complete cycles of improvement during the Action Research study (Duarte, 2014; F. Martins et al., 2018).

We are certain that a strategy will have to be developed and worked out to achieve a valid approach to evaluating each action. For this reason, we propose an assessment strongly influenced by the EFQM RADAR model, which can be found in the next subchapter.

5.2 The EFQM Model

The EFQM Excellence Model is a topic of high academic interest, and several authors have carried out comprehensive and meaningful literature reviews covering the EFQM Model, validating the importance and relevance of this model in the academic environment and in validating the research carried out in that same environment (Fonseca, 2021; Saunders et al., 2009; Suárez et al., 2017).

Research results support empirical evidence on the validity, reliability and predictive power of the EFQM model, particularly when applied to different sectors of activity or organisations of different sizes and activities (Fonseca, 2021).

The results of research into the causal relationships within the EFQM Model suggest that these relationships generally indicate the path to achieving excellent performance and results (Heras-Saizarbitoria et al., 2012).

Since its creation, the EFQM Model has guided organisations to develop a culture of improvement and innovation. Built on design thinking, the new model has gone from a simple assessment tool to a vital framework and methodology to help with the change, transformation and disruption individuals and organisations face EFQM, 2019).



Figure 14 – EFQM Model 2020
(EFQM, 2019)

The EFQM model aims to help organisations achieve their desired success by assessing their position on the path to sustainable value creation.

At the time of writing this doctoral thesis, the 2020 version of the same model has been launched, as seen in Figure 14, which is based on the simple logic of answering three questions:

- “Why" does this organisation exist? What purpose does it fulfil? Why this particular strategy? (Direction).
    - Management that answers the Why (Purpose, Vision and Strategy; Organisational Culture and Leadership).
- "How" do you intend to fulfil your purpose and strategy? (Execution).
    - Execution that responds to the How (Stakeholder Involvement, Creating Susceptible Value, Driving Performance and Transformation).
- "What" have you really achieved so far? "What" do you want to achieve tomorrow? (Results).
    - The Results that resolve the What question (Stakeholder Perceptions; Strategic and Operational Performance).

At the genesis of the EFQM 2020 Model are the contributions of almost 2,000 change experts, leading inputs from more than 60 organisations and a team of experts from all industries and knowledge academies (EFQM, 2019; Fonseca, 2021).

This feedback addressed the concerns of EFQM stakeholders, including business owners, senior managers, assessors and consultants, emphasising the need for an up-to-date business framework and methodology to help deal with change, transformation and disruption while ensuring business performance.

However, due to the age of the EFQM 2020 model, scientific studies on its application are still scarce. Considering the time frame of this doctoral project, the researchers thought it an acceptable risk to use the 2013 EFQM model, which will be focussed on throughout the document.

The strategic nature of the EFQM model, combined with its focus on operational performance and results orientation, makes it the ideal framework for testing the coherence and alignment of an organisation's ambitions with its current ways of working and its ability to respond to challenges and opportunities for

improvement, so one of the main aims of the EFQM model is to provide a chance to look at the whole picture, adopt the holistic perspective and realise that an organisation is a complex but organised system.

Like the world in general, an organisation or a challenge, should not be seen as linear, mechanical and predictable, but should be perceived as a complex and adaptive system of dynamic and unpredictable beings (EFQM, 2019).

The literature study, mainly dedicated to analysing and weighing up the differences between the models, shows that both the EFQM 2020 and 2013 models consider Results (relevance, usability, etc.) and Approach, Implementation, Evaluation, and Refinement.

However, the 2020 Model still incorporates three tables, two for EFQM in the 2013 version, to support Direction, Execution and Results. The focus of the new methodology is now on strategic periods and cycles, rather than 3-year trends, and data integrity and segmentation (Fonseca, 2021; Nenadál, 2020). The differences do not stop there, for instance, the 2013 model considers Customers, People and Society to be the organisation's main stakeholders, while the recent 2020 model has more flexible characteristics.

Each organisation needs to identify its most important (key) stakeholders concerning its Purpose, Vision and Strategy, such as customers, people, investors and regulators, among others).

The measurement of stakeholder perception must then be flexible and adjusted to the specific objective of the organisation, its strategy and the ecosystem in which they operate, or, in the context of this doctoral effort, the project being managed (Fonseca et al., 2021; Heras-Saizarbitoria et al., 2012; Nenadál, 2020). So, more graphically, we can indicate that the structure of the EFQM is as Figure 15 illustrates:

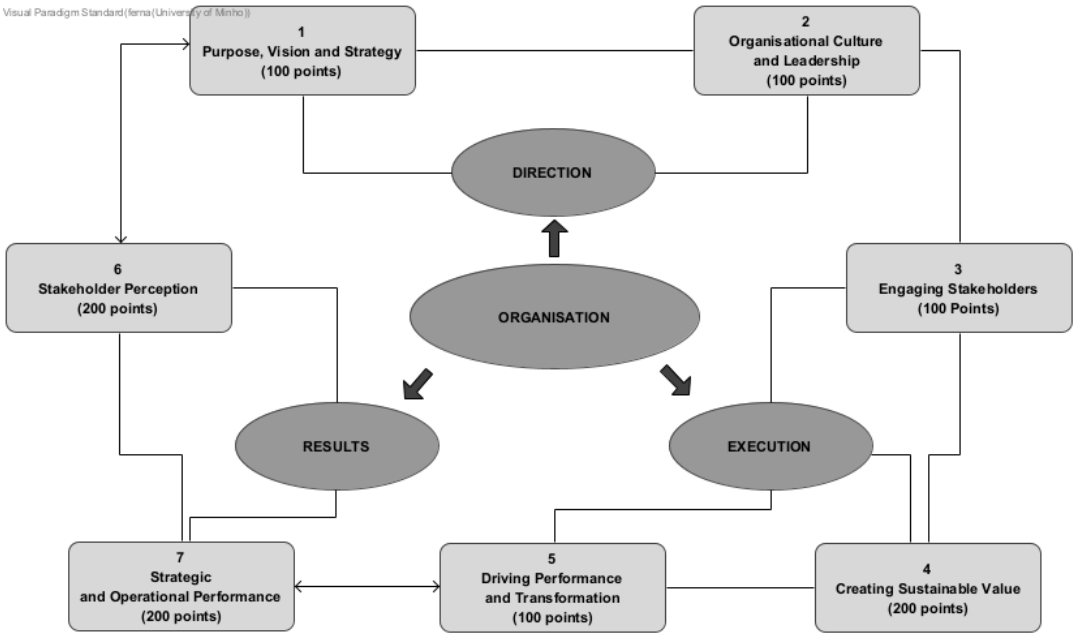


Figure 15 – EFQM model and points
(adapted from EFQM (2019))

Instead of the nine main criteria that formed the framework of the previous EFQM model, the new model includes seven main criteria:

1. Objective, vision and strategy (5 partial criteria);
2. Organisational culture and leadership (4 partial criteria);
3. Stakeholders' involvement (5 partial criteria are included in this criterion);
4. Creating sustainable value (4 partial criteria are included in this criterion);
5. Driving performance and transformation (5 partial criteria are included in this criterion);
6. Stakeholder perception (no partial criteria);
7. Strategic and operational performance (no partial criteria).

We must, therefore, apply an appropriate weighting to the results offered. Performance results must be linked to Direction and Execution and the fulfilment of stakeholder expectations, with a future focus and the support of predictive data (Alanazi, 2021; Fonseca, 2021).

In the context of project management and in alignment with various project standards, it is essential to establish a clear direction. This involves defining a purpose that inspires all stakeholders and setting objectives to ensure their expectations are met or exceeded. By doing so, a strategy can be developed to achieve these objectives and many others.

In this way, it will be possible to determine a path that places these efforts in a good position to execute the project plans correctly.

This vision is then broken down into criteria, and each of these criteria is regularly assessed by RADAR, a tool from the EFQM model.

Because of this, we believe RADAR can be used to correctly evaluate organisations (or parts of them), processes, and even results included in Action Research studies.

5.3 RADAR - Results, Approaches, Deployment, Evaluation, Refinement

The acronym RADAR (Results, Approaches, Deployment, Evaluation, Refinement) is used in the EFQM model as the logic used to manage the current way of working, making it possible to diagnose strengths and opportunities for improvement (Duarte, 2014; EFQM, 2019; Fonseca, 2021).

Despite the differences between the 2013 and 2020 models, the logic is mostly kept in its original form, also as a natural part of the model.

This simplification of the model's overall structure is intended to enable all managers to realise this as a beneficial feature when it comes to its practical implementation (Nenadál, 2020).

At the highest level, RADAR's logic states that an organisation needs to (EFQM, 2019):

- Determine the Results you hope to achieve as part of your strategy;
- Have a series of Approaches that will deliver the desired results, now and in the future;
- Deploy these approaches;
- Evaluate and refine the approaches implemented in order to learn and improve.

The RADAR logic can be seen as a dynamic assessment framework that makes it possible to calculate the general level of organisational exceptionality (maturity) by identifying susceptible areas for the next improvement of the management system (Nenadál, 2020).

RADAR (Results, Approaches, Deployment, Evaluation, Refinement), within the scope of the attributes and the EFQM 2020 model, focuses on supporting the organisation in identifying its current strengths and opportunities for improvement and helping to map out its future, namely what results are desired and what actions are needed to achieve them (Fonseca, 2021).

RADAR is thus the standardised system for measuring excellence, which makes it possible to score approaches, deployment, evaluation, and refinement in the case of the Direction and Execution criteria, as well as relevance, usefulness, and performance in the Results criteria.

The RADAR assessments, part of the EFQM model, are proven industry models that help and guide organisations on their path to an outstanding organisation. One of the main objectives of the EFQM model is to provide a holistic view of each organisation.

This holistic view is broken down into criteria, and each requirement is assessed recurrently in RADAR evaluations. Because of this, RADAR can be used to evaluate organisations correctly (or parts of them), processes, and even results, which are included in Action Research studies.

This is why, in order to realise a solid approach to evaluating the implementation of each Action, we propose using an evaluation similar to EFQM RADAR.

In order to maximise the value of using Action Research, evaluation methodologies should be created for each of the actions. This subsequent posture of each of the actions, where we will evaluate each one, allows for better planning of subsequent actions, so that the executor of the Action Research methodology can complete the improvement cycles while applying that same methodology.

So, to obtain a solid approach and stance in the various iterations we carry out, we propose using an EFQM RADAR-type evaluation (Figure 16).

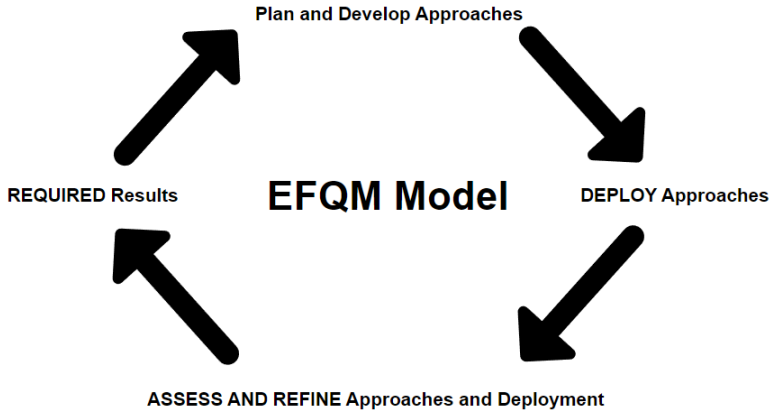


Figure 16 – RADAR assessment framework from EFQM 2010 model (adapted from Duarte (2014))

For the Action Research endeavour mentioned here, the RADAR evaluation was carried out at the end of each action, with the procedure shown in Table 12 being applied as the enabler that will lead to the evaluation being carried out.

This is one of the most vital evaluation procedures, as it will be the process we implement for each action/project we analyse using the Action Research method.

Therefore, given that the focus of this doctoral project is not correlated with the use of Action Research, RADAR will be limited to the procedure described in Table 12.

Since all assessment processes must have metrics to assess these same attributes, we have determined to use the following EFQM RADAR criteria and values (Table 12):

Table 12 – EFQM RADAR scoring attributes for Enablers criteria (adapted from Duarte (2014))

Elements	Attributes to Score	Description of Attribute
Approach	Sound	The extent to which the approach has a clear rationale, defined processes and focuses on stakeholder needs.
	Integrated	The extent to which the approach supports policy and strategy, and is linked to other approaches where appropriate.
Deployment	Implemented	The extent to which the approach is implemented.
	Systematic	The extent to which the deployment is carried out in a structured way with the method used to ensure deployment being itself planned and executed soundly.
Assessment and Review	Measurement	The extent to which regular and appropriate measurement of the effectiveness of the approach and deployment takes place.
	Learning	The extent to which learning activities take place to identify best practices and improvement opportunities.
	Improvement	The extent to which the output from measurement and learning is analysed and used in order to identify, prioritise, plan and implement improvements.

It is recognised that RADAR evaluation methods also include attributes for scoring results. However, the ability to score results is not the most necessary characteristic for evaluating Action Research studies since the main focus of Action Research is not to verify trends in results or the achievement of objectives.

Bearing in mind that RADAR does not have, and will not be able to include, the definition of a suitable set of metrics to be used for each type of organisation and product, the maturity levels for evaluating actions will be used, using an approach similar to that of RADAR, previously validated by the author Duarte (2014) in his research efforts.

Table 13 – Proposed maturity levels to score Actions using a RADAR-like approach (Duarte, 2014)

Maturity Level	Description
0	Not implemented
1	Some evidence
2	Evidence
3	Clear evidence
4	Comprehensive evidence

When we started thinking about how to make an evaluation matrix, the initial strategy was that all the requirements would have to be grounded in the existing literature and all the researchers' accumulated experience in team leadership, project management, and the social component.

So, in keeping with the initial strategy, we propose eleven metrics that make up the evaluation matrix, which can be seen in Table 14:

Table 14 – Proposed metrics for the comparison of the results of Actions

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Justification
C1	Complexity	Requirements	Requirements Complexity	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	#	Business Case
C2		Cost	Total Predicted Investment	3 - Innovation Project 2 - Complex 1 - Simple	#	Public Procurement Code (CCP)
E1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	#	PRINCE2
E2		Engagement	Communication	4 - Interactive Communication 3 - Push 2 - Pull 1 - Basic Communication	#	PMBOK and PRINCE2
E3		Quality	Stakeholder Influence	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	#	PM2
E4		Requirements	Change Management	Number of changes made by stakeholders to the project	min	PRINCE2
E5		Performance	Project Team Experience	Average number of years of experience in similar projects	max	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Minimum changes to the team	#	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	%	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	%	PMBOK and PM2
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	max	PM2, PMBOK, PRINCE2

Throughout this doctoral project, we have used various project management methodologies, such as PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017) and also the Project

Management Methodology (European Commission, 2018), we therefore propose using existing metrics in these various methodologies that are both quantifiable and qualitative.

However, given the wide range of projects to which we applied this analysis, it was necessary to include other sources regulating the selected measurement methods, such as the Public Contracts Code (CCP) (Código dos Contratos Públicos (CCP), 2008).

A more detailed analysis of Table 14 shows that there are 11 metrics with the characteristics shown in Table 15:

Table 15 – Metrics fields and characterisation

Field	Description
Id	Short identification of the metric.
Metric Scope	The metric's scope can be an assessment of complexity, involvement and commitment, project monitoring and the team's perception.
Dimension of Analysis	Using the main dimensions existing in project management such as cost, time and quality, while also mentioning stakeholder involvement and commitment and the requirements identified in each project
Metric Name	The name is given for each of the metrics.
Metric Formula	The expression that represents the result for each of the metrics identified.
Unit	The unit of measurement.

The choice of projects to which the described methodology was applied followed several criteria, or guidelines, that allowed the method described to be met and thus substantiated.

The researchers' principle in this endeavour is to understand the whole (i.e. challenge) and do something about it. It is realised that sometimes the biggest enemy of iterative progression is the desire to understand and take responsibility for everything.

This can lead to what is sometimes called analyst paralysis, where too much time is spent analysing the situation that nothing is done about it. Understanding the problem is essential, but so is making progress.

The various projects selected show different times when the analysis took place, so it is important to emphasise that fast does not mean incomplete.

Just because an iteration is small enough to be done quickly does not mean it should not include all the elements necessary for success. Any iteration must be generated according to the intended objective.

A minimum viable result is a conclusion that allows the maximum amount of learning to be validated with the effort made.

It was felt that the best way to illustrate the implemented form of the Action Research study would be to introduce a project with a controlled dimension. This would allow various challenges to be introduced, leading to numerous conclusions that would thus substantiate the adopted Action Research technique.

5.4 Approach Structure for the Actions

In the pursuit of creating impactful research, it is imperative to adopt a structured approach to evaluating the various actions undertaken during this PhD project. This subchapter presents a comprehensive framework for the structures proposed in terms of approach for these projects, detailing each aspect meticulously to ensure a holistic understanding and rigorous assessment.

The outlined structure facilitates a systematic examination of each action, and over the following few pages, we will present the structure defined for describing and evaluating all the cases chosen for this doctoral project (Table 16):

Table 16 – Structure for the Actions (v1.5)

Project Name
• Purpose of Action
• Practical Action
• Stakeholders
• Project Management
• Project Management Methodology
• Investments and Costs
• Time and Schedules
• Metrics and Lessons Learned
• Theory Adjustments
• Conclusions

This is the fifth iteration of the proposed structure for analysing each action under study, and it has progressed over the time allocated to this effort (previous versions can be analysed in an appendix to this document).

The proposed structure is organised into several components:

- Project Name: Identifies the specific project / action under evaluation, providing context and a reference point for the subsequent analysis;
- Purpose of Action: Describes the project's primary objectives and intended outcomes. This section outlines the rationale behind the project;

- Practical Action: Details the benefits of the application of the mentioned project;
- Stakeholders: Identifies all relevant stakeholders involved in the project, including their roles, contributions;
- Project Management: Examines the management strategies and practices implemented throughout the project's lifecycle. This includes planning, execution, monitoring, and control mechanisms:
    - Project Management Methodology: Outlines the specific project management methodologies;
    - Investments and Costs: Provides a detailed account of the financial aspects of the project, including budget allocation, expenditures, and cost management practices;
    - Time and Schedules: Evaluate the project's timeline, including planning, milestones, deadlines, and any deviations from the original schedule.
- Metrics and Lessons Learned: Discusses the results using the matrixes created to measure the project's success;
- Theory Adjustments: Analyses how the findings and experiences from the action necessitated adjustments to the theoretical framework guiding the research;
- Conclusions: This section summarises the action evaluation's overall findings, highlighting key achievements, challenges, and implications for the research context.

In a brief manner, this structured approach aims to provide a detailed analysis of each action, highlighting its objectives, practical actions, stakeholder involvement, and overall management, while comparing the effect that the proposed framework has created.

5.5 Conclusions

This chapter has demonstrated how the Action Research methodology was applied, emphasising its participatory, iterative nature and suitability for real-world application. To evaluate the results, the European Foundation for Quality Management (EFQM) model was specifically considered to determine how this approach could be operationalized, providing tools for that effort.

The model offers a structured yet flexible methodology for managing and improving performance by employing the RADAR logic.

This chapter demonstrated how the RADAR approach can guide the Action Research cycles of planning, acting, observing, and reflecting, thus ensuring that each action is systematically evaluated and enhanced based on qualitative and quantitative outcomes.

6. Stakeholder Management in Smart Cities Projects

This chapter demonstrates the practical application of Action Research methodology through five distinct projects, each representing a targeted action with a defined stopping condition to address specific challenges within various organisational and urban contexts. Following the Action Research methodology, each action in this chapter serves as a standalone study and contributes to a comprehensive understanding of applying theory or models to real-world scenarios.

The chapter concludes by synthesizing the findings from all five actions, reflecting on the effectiveness of the Action Research methodology. The outcomes are discussed in terms of their broader implications for theory and practice, highlighting the adaptability and impact of the Action Research approach in sustaining the development of the framework for Extending Project Management Practices for Innovation Projects in Smart Cities, Focusing on Stakeholder Management, with the short codename Astrolabe4SM (Astrolabe for Stakeholder Management).

6.1 Introduction

The Action Research methodology aims to solve organisational problems through intervention and contribute to scientific knowledge (Melin & Axelsson, 2016), and Information Systems (IS) researchers have been encouraged to consider the Action Research methodology as an appropriate approach (Mckay & Marshall, 2001) to develop knowledge, achieve organisational change, and develop many systems, such as information systems.

Considering that the Action Research is concerned with creating organisational change and studying the process of creating it (Ravn & Nuri Babüroğlu, 1992), it is correct to think that Action Research studies are suitable to be applied in the research regarding the domains of project management and stakeholders' management, as well as business software development (Duarte, 2014).

Another aspect to consider is that projects always involve and incorporate human-related elements, converting the analysis of the project environment and the applied process into important areas to derive conclusions and improvements for the following projects represented as actions.

The social transformation that occurs as the result of planned, participatory interventions is within "a family of research methodologies that pursue the dual outcomes of action and research profiting from

the use of a cyclical or spiral process in which the researcher alternates action with critical reflection" (Dick, 2002). The social aspect of the research, which is how project managers and project members exchange knowledge, is intrinsically linked to this Action Research cycle and underpinned by a naturalistic approach to the research.

Considering that the selection of a group of project managers and coordinators meets the definition of Zuber-Skerritt & Perry (2002), where "Action Research necessarily focuses on a workgroup in an organisation or community, all of whom are involved in the cycle of planning/acting/observing/ reflecting".

Therefore, the Action Research methodology was selected to review whether the accepted understanding of how knowledge is exchanged in theory occurred in practice. To undertake research into practice, Action Research requires and provides a process to plan, act, observe, and reflect in a formal structure.

This four-stage cycle represents what Lewin (1951) described as "a social learning and problem-solving process that generates valid information to assess deviations from desired goals (Bargal, 2006). This information feedback provides the basis for a continuous process of goal-directed action and evaluation of the consequences of that action" (Kolb, 1984).

The starting point was to consider the Action Research as an iterative method. So, a stop trigger had to be created for the intended investigation regarding all the iterations we would have to go through. For this PhD project, we defined it as a stopping condition for the succession of actions, creating a framework representing the solution and the methodology that meets the initial goals proposed for this thesis.

To apply the Action Research methodology, five actions were identified to maximize value, which we illustrate in Figure 17 (for better detail, please refer to the image provided in the appendix of this document):

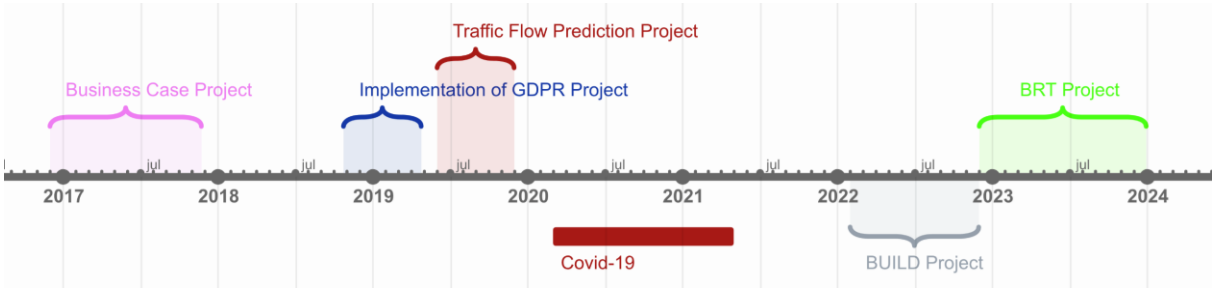


Figure 17 – Actions Timeline

This was not a static plan defined at the start of the PhD project, but rather a seizing of opportunities according to the possibilities that arose and the relevance to the research.

To get the most value out of it, we wanted topics related to Smart Cities, projects with various internal and external stakeholders, and a differentiating environment for the multiple projects that would be the target of the researchers' attention and efforts.

6.2 Action 1 | Research Trigger: Business Case Framework Project

As in everything, there is always a first spark that initiates an entire endeavour. Knowing that the project "Improving Project Management Practice through the Development of a Business Case: a Local Administration Case Study" was carried out before the doctoral project's time window, it can be clearly stated that this project was a significant stimulus that motivated and initiated this PhD effort.

An element that further demonstrated the validity of the Action Research methodology was this project, which excelled in developing a framework that would justify the start-up of a project in a local administration company and saw the Action Research methodology used with the validation of all previously identified specifications and, therefore, results.

The purpose of this project was to develop a solution that would help to justify initiatives that lead to projects and ensure correct management throughout the lifecycle of each project in a company, knowing in advance the low maturity in the project management discipline existing in the company and its human resources. Purpose of the action

This project incorporates research to develop a solution for a Business Case template intended to be integrated into the lifecycle of project management of the company under study. The template is transversal to all the areas of knowledge described by PMBOK and has several inputs provided by PRINCE2 and BABOK. It justifies initiatives that lead to projects and ensures correct management throughout each project's lifecycle.

This is a new area for creating value at an organisational level, for improving project management practices and the organisation's state of maturity, and consequently the efficiency and success rate of projects, given the potential of project management and reducing the risk generally associated with projects with a strong innovative character, an obligation imposed by the NP4457:2007 standard (Instituto Português da Qualidade, 2007b).

One of the critical steps in PM is its start-up, which is being ignored most of the time, so presenting a solid Business Case (BC) increases the probability of obtaining the leadership engagement and the resources needed to start and implement successful projects. According to the International Institute of Business Analysis (IIBA) (IIBA, 2015), the BC is a tool that justifies a particular solution based on the benefits gained compared to the cost, effort and several other considerations.

Observing and analysing the improvement business is only part of identifying the benefits. It is also necessary to develop a BC to justify the level of investment and ensure that all risks are identified. One of the critical elements of the BC is the identification and quantification of benefits guaranteed by change (IIBA, 2015). To facilitate its implementation and versatility, this should not be a complex document, and it can be the catalyst for several different change initiatives and follow the whole lifecycle of a project, as seen in Figure 18:

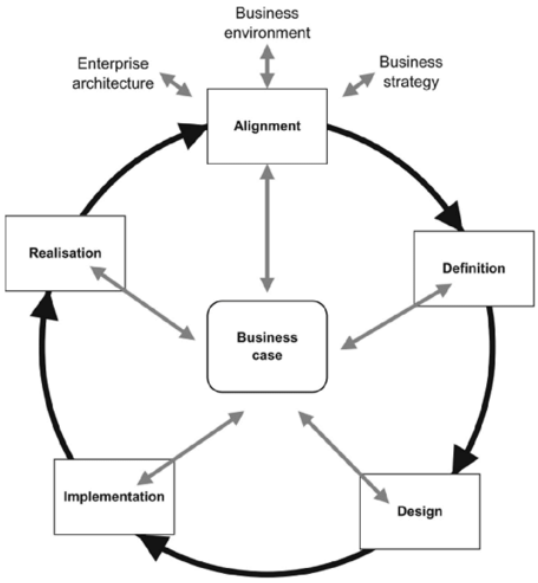


Figure 18 – Business Case Change Lifecycle
(Paul et al., 2010, p. 4)

A significant difficulty is the absence of standard documents and processes. By default, the project owner to justify a project does not use a document that identifies the requirements for the board of directors to support their decision-making process.

As such, using the current process, one makes the mistake of spending more time on project justification than would be ideal.

The process that represents the beginning of a project's lifecycle can be described as follows. It is represented in Figure 19, which shows the representation of the present “as is” (left) and the “to be” as the desired process (right).

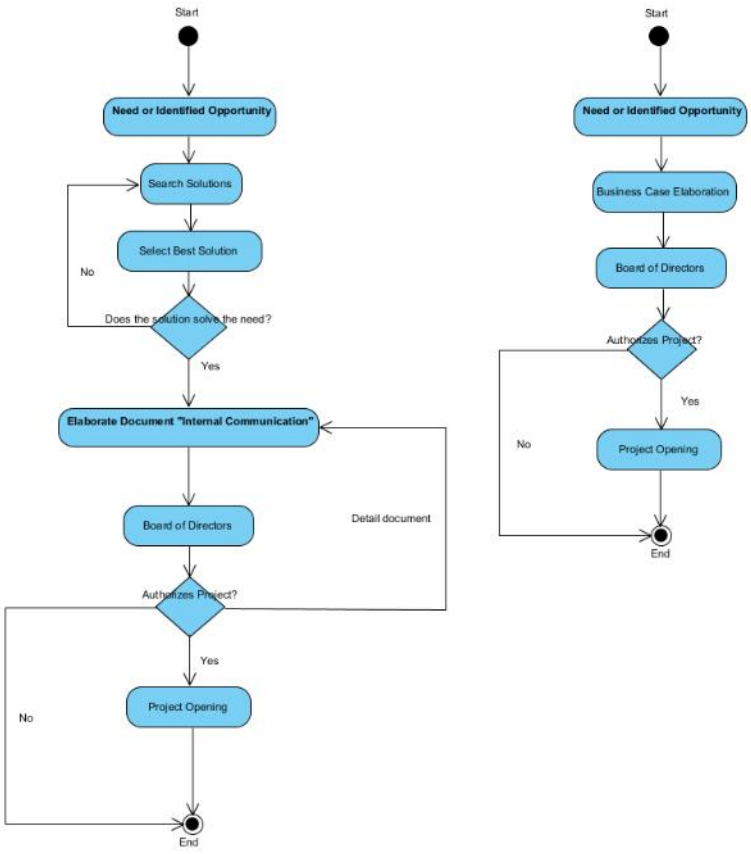


Figure 19 – Procedure for the start of a project

When identifying a need or opportunity, creating or identifying a solution and selecting the one that best suits this issue is necessary. If the solution can solve the identified situation, the owner must fill out an internal document explaining the need.

The main weakness of this process lies in this phase because this document will be filled according to what its author deems pertinent and valid and then submitted to the board of directors.

6.2.1 Practical Action

A project-oriented organisation, whose organisational culture allows it, recognises the importance of a track record of successful project delivery in building and enhancing the trust of various current and potential stakeholders for future partnerships.

According to Kerzner (2021), project managers should focus on planning, organising, directing, and controlling a company's resources, with requirements identified as time and objectives.

The Project Management Institute (PMI) says that PM is the application of knowledge, skills, tools and techniques to the activities of the project in question to meet all its requirements (Project Management Institute, 2017).

Already at its genesis, and according to PRINCE2, the project should be triggered by a Business Case (BC) to demonstrate its feasibility (Axelos, 2017).

The importance of Business Analysis (BA) to enhance the value created in companies is highlighted by the International Institute of Business Analysis (IIBA), allowing a company to articulate the needs and justification for change, describing and designing solutions/projects that can offer value (IIBA, 2015).

One of the BA tools that can enhance the achievement of this result is the Business Case (BC) (IIBA, 2015). Although most companies recognise the importance of making diversity a business consideration, this is generally not a priority.

Other business initiatives that present more compelling factual evidence about the return on investment related to diversity initiatives appear to offer less predictable and tangible benefits. As a result, many managers revert to the "it is the right thing to do" argument and rely on top management to support their suggestions to promote a diversity-based project culture.

The growth of investments in IS and IT has caused more significant concern in organisations and their management to ensure a return in terms of the business value of these investments (Pereira et al., 2017), not least because projects in this area are well-known for their delays, budget slippage, low productivity, and product quality (Ribeiro et al., 2014).

The presentation of a solid BC increases the probability of obtaining the leadership commitment and the necessary resources to initiate and successfully implement projects (Robinson & Dechant, 1997).

The research work from F. R. G. Martins (2017) is justified within this framework and focused on the analysis of a project with innovative characteristics, serving, therefore, as a proof of concept of a solution in an urban transport company with a low level of organisational maturity in project management and without tools to determine their feasibility, the company Transportes Urbanos de Braga, Empresa Municipal (TUB).

The result obtained from the research plan was the creation of a Business Case model that will support the project manager and serve as a guideline for the justification of the project in which the framework was applied and its future scalability. Thus, the result culminated in a Business Case template that would help determine the viability of any idea that would serve as an embryo and originate a project.

6.2.2 Stakeholders

The project comprised some stakeholders, representing a surprise in identifying and cataloguing them.

We start with the first one representing the company, and all companies have multiple scopes. Some exist in business contexts related to industry or commerce activities, others are public entities, and there is still room for those that do not have any profit objective.

Despite this distinction in their scope, they all have internal structures that represent their mission, vision, and strategy and serve as a foundation for all the objectives of these companies.

Transportes Urbanos de Braga (TUB), Figure 20, is a company located in Braga, Portugal, that operates in the urban passenger transport sector, and is certified by the Portuguese standard that regulates Research, Development and Innovation, NP4457:2007 (CT 169 (IPQ), 2007).



Figure 20 – Transportes Urbanos de Braga, Empresa Municipal

This company is heir to a long tradition. Still, its ambition leads it to make the future every present day through its dynamic image and continuity. It is looking for integrated urban mobility that encompasses pedestrian paths, cycle paths, and integration between the various modes of transport.

The dissertation author is also an integral part of this project, assuming roles as project manager, portfolio manager and technical coordinator.

The supervisors of the effort herein are identified as stakeholders since they have identified an interest of the project's success and participate in validating the project requirements.

The team has a member of the Quality Team whose main functions would include validating and integrating the result into the integrated management system.

The elements of the company's administration are also highly important stakeholders since they are interested in success. They allowed the validation and subsequent insertion of the framework in the integrated management system for the project management area and sponsored the publication of the results of this effort.

Although a system cannot be considered a stakeholder, according to A Guide to the Project Management Body of Knowledge (PMBOK® Guide) and The Standard for Project Management by the Project Management Institute (2021), we found necessary the reference to the Integrated Management System and all the requirements that it obliges, such as the NP4457 standard, and that were mentioned throughout this chapter.

Considering the efforts made to validate the Business Case and given that the project that validated it was the project "Connected BUS", we also consider IBM Portugal as a stakeholder and the more than 15 elements associated with this project by this entity, from development elements, solution architects, project managers and elements of the company's top management in question.

With these stakeholders initially identified, it becomes possible to apply the stakeholder identification and classification process and thus carry out the respective assessment according to their influence and impact (Table 17):

Table 17 – Business Case Project - Stakeholder Evaluation

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Business Governing Layer and Steering Layer	Project Sponsor	Owner	Internal	7	6
Steering Layer and Directing Layer	Project Owner	Management	Internal	9	9
Directing Layer	Technology Providers	Provider	External	5	4
Directing Layer and Managing Layer	Project Manager	Management	Internal	8	9
Managing Layer	Academic and Research Institutions	Management	External	8	8
Performing Layer	Project Team	Operational	External	6	4
Regulation Layer	Auditing Body	Compliance and Monitoring	Internal	5	7

This application of the stakeholder identification process in question emphasises their importance and influence in determining the impact of the change that these stakeholders can bring to the project and its objectives.

Relating the various stakeholders directly to their respective classification, we achieve the following list:

- Project Sponsor – Transportes Urbanos de Braga;
- Project Owner and Project Manager – the student/researcher;
- Project Team – elements from TUB;
- Academic and Research Institutions – supervising teachers;
- Auditing Body – element from the Quality Team;
- Technology Providers – architects and engineers from IBM company.

Here, the classification is made according to the respective area, and Figure 21 shows these stakeholders' possible influence and impact on the same project.

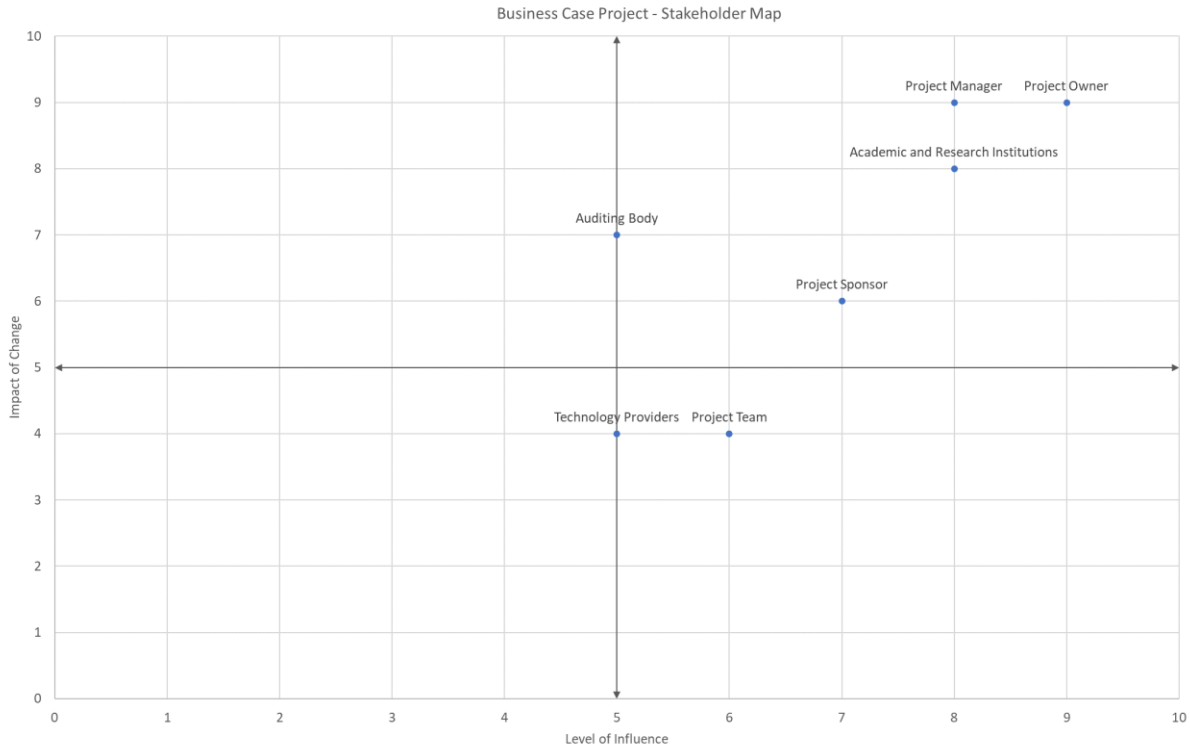


Figure 21 – Business Case Project - Stakeholder Map

The small number of stakeholders involved and the effort associated with this project means that practically all of them have a strong influence and impact, especially when you take into account that this project was also an implementation of the Action Research methodology, where reaction to new inputs and analysis of the reactions was desired to analyse further and evolve the system being developed.

6.2.3 Project Management

The competitive advantage of organisations is increasingly based on their ability to find new solutions and direct their human capital, with all their individual and collective skills and talents, to find those solutions and achieve their goals.

Local government presents a particular type of project management environment, if not absent when viewed in practical terms, related to its own organisational culture, institutional characteristics, and the kind of leadership present.

As has been mentioned several times, this project aimed to implement project management tools applicable in a public company with a low level of maturity in project management or project management following a standard.

Throughout the endeavour described here, several iterations were carried out to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, this would make it possible to help all the stakeholders related to the same project with very interesting success rates.

The exploratory nature, carried out through a critical analysis of this effort, would represent the initial point of the framework to be proposed and later validated.

Project Management Methodology

This project was born in a company whose maturity in Project Management is non-existent. One of the great difficulties identified during this project is the absence of standard documents and processes. By default, the project owner to justify a project does not use a document that identifies the requirements for the board of directors to support their decision-making process or follow any other process.

However, we will discuss the methodology associated with stakeholder management in projects related to products, innovative processes or simply the creation of tools for project management, such as this project.

The aim in this particular case, given that we were looking at this project intending to evaluate it and apply part of the framework developed here, was to assess what we had at the time and, using experience and all the research carried out in the meantime, determine what would be pertinent to have.

So we have the following initial assessment, according to the type of stakeholder management support document (Table 18):

Table 18 – Documents applied to the Business Case Project

Business Case Project			
	Have	Nice2Have	Justified2Have
Business Case	x		
Contract		x	
Project Charter			x
Stakeholder Template	x		
Risk Management	x		

With this, a critical analysis was carried out according to 3 perspectives:

- Have – existing documents that would make sense to keep, given the feedback and success of the project;
- Nice2Have – documents that would be useful considering the course of the project and the difficulties the managers had to deal with. Despite their usefulness, these templates are not essential.
- Justified2Have – documents that, despite not existing, would be considered an asset and highly useful. This result would be implicit in the lessons learnt from the project and would result in these documents being passed on to future projects even though they didn't exist in the current project.

Considering the choice made to represent this effort using a spider map, or a metro line map, the actual framework (Figure 22) has the following scheme:

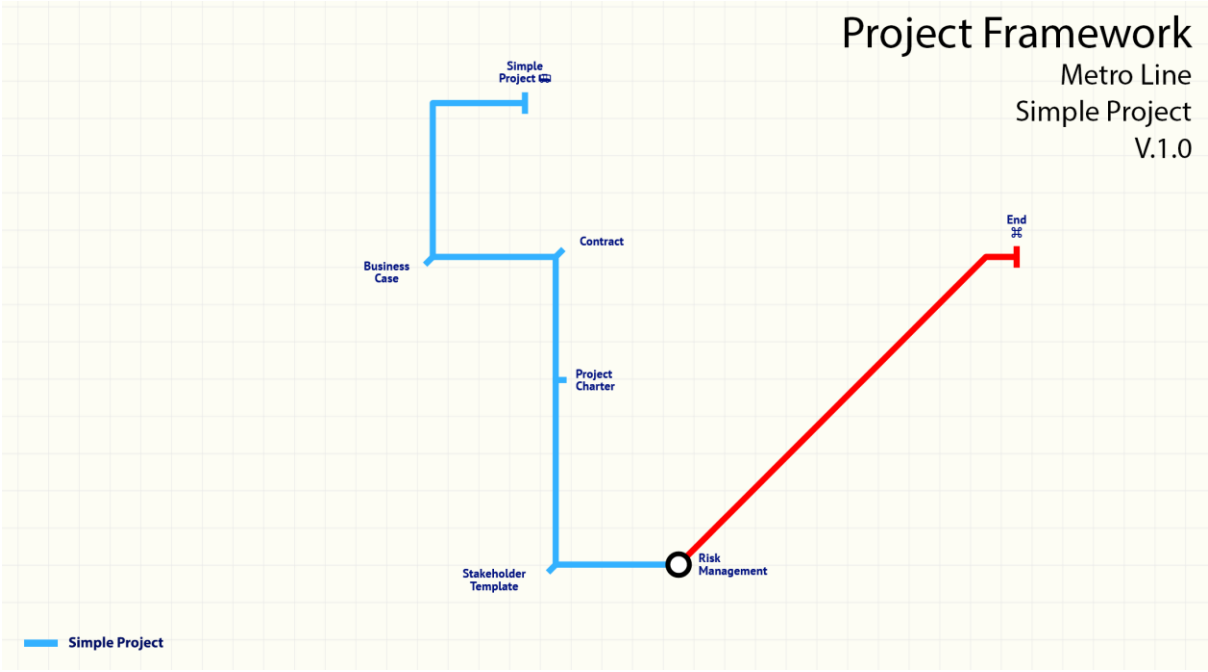


Figure 22 – Preliminary Metro Line for Simple Project V.1.0

Our analysis was carried out according to this criterion (Table 19):

Table 19 – Business Case Project Framework Documents

Business Case Project Documents	
Business Case	The final validation of this effort was during an actual implementation with the application of the Business Case, and therefore we consider it as an existing document to the framework.
Contract	Nice to have in order to monitor and guarantee a commitment between all the parties involved. Although, and considering the final result, it is a nice to have and not a justified to have type of document.
Project Charter	Considering that this is a document that formally authorises the existence of a project and provides the project manager with the authority to apply organisational resources to project activities, this is the type of document to be considered as essential. Also, and considering that the project charter is crucial as it marks the official start of the project and outlines the project's key objectives, scope, and the roles and responsibilities of the project participants, it could serve as well as an alternative to the contract.
Stakeholder Template	This document was considered pertinent and useful, although not essential, given that the team would be short and that the elements presented in the mentioned Business Case would be more than enough to identify all the stakeholders involved.
Risk Management	This artefact was already one of the elements included and considered necessary, not least because the NP4457 standard itself required it.

Therefore, in terms of methodology, it can be said that the efforts made for this project are related to what the various standards for project management require, such as identifying and drawing up solutions to manage the stakeholders efficiently, identifying objectives or even the needed typical procedure manage a project and their stakeholders.

The methodology was established according to the various timings inherent to this type of project. Therefore, a realistic approach was followed by a very dynamic and exploratory approach, where the topic was first discussed with the supervisors of this endeavour and then validated while returning to a project that had already taken place.

The EFQM model and the RADAR approach also ensure that the continuous development of the framework with the established objectives and leasing of means and resources successfully meets all the identified requirements.

Investments and Costs

A constant concern inherent to any project is the investment and cost. In the project in question, considering the academic component linked to obtaining a master's degree, all financial costs would not be considered.

However, the validation of the result of this effort would lead to the execution of a project which in itself already presents costs, and that will be considered for use in the comparison of the matrix table, and that can be seen in Table 20:

Table 20 – Business Case total costs

Project Elements	Quantity	Total Cost
Cisco IR829 Gateway Unit	2	9 354,00 €
Telemetry Unit for OBD-II connection	2	536,00 €
Power User License of the IOC platform	1	23 111,50 €
City Leader App Development	1	7 314,00 €
Implementation, configuration, and parameterization of the IOC platform and training	1	29 680,00 €
	Total:	69 995,50 €

This way, the necessary elements are in place for a quantified application of the elements assigned to project costs and investments.

Considering the type of public procedure and looking at the first five items of the table that an external stakeholder delivered as a supplier, the adopted procedure was a Simplified Direct Adjustment, considering that the value was inferior to 75 000,00 €.

Time and Schedules

One decisive aspect when managing multiple projects in an organisation is the use of standardised processes and documents. So, a first Business Case proposal was made, adapted to the organisational context, resulting from the weighted sum of several criteria present in the BABOK® Guide and PRINCE2 guides, without ever ignoring the NP4457:2007 standard by which TUB is certified.

Confident that employees' contribution is crucial to achieving public entities' objectives, the requirements for a Business Case model were defined, and considering the process defined for its use, several iterations were then carried out to construct a valid model that would run over a certain period.

Thus, the schedule initially proposed, and that would eventually be followed, can be seen in Table 21:

Table 21 – Planning of the project "Connected BUS"

Activity		Planning "Connected BUS" 2016/2017																							
		December				January				February				March				April				May			
1	Literature Review																								
2	Survey and analysis of the company's internal processes in project management practice																								
3	Defining critical success factors in implementing integrated project management processes																								
4	Definition of the integrated project management process																								
5	Creation of templates to support the integrated project management project																								
6	Survey and analysis of the State of the Art in Good Business Case Practices																								
7	Proposal for a Business Case Template suitable for Local Government																								
8	Implementation of the integrated project management process in the "Connected BUS" proof of concept																								

Activity		Planning "Connected BUS" 2016/2017																							
		December				January				February				March				April				May			
9	Validation of the Business Case Template in the Connected BUS Project																								
10	Preparation of a paper for presentation at an international conference																								
11	Writing the dissertation																								

According to Table 21, and in an overview form, we had an effort between September 2016 and May 2017, which was not fully met given that the writing of the dissertation was only finished in September, which pushed the critical path of the project ahead of time with the delivery of the dissertation and its defence on November 23, 2017.

Objectives and Deliverables

Having defined the lifecycle process of a project, requirements, and tools to be incorporated, thus ensuring a thorough understanding of it, it is possible to define what a Business Case Template should address.

The aim was to ensure that the effort required to develop a Business Case was strong enough to be subject to the scrutiny of the quality team and to meet the NP4457 standard.

Considering the reality of a municipal company whose management follows the standards of Local Government and is certified by the NP4457:2007 standard, the creation of a single document covering the entire lifecycle of a project was a core requirement, ensuring the necessary traceability and keeping up with the constantly changing environment that a project requires.

To this end, the guidelines communicated by the TUB Management and Inspection Systems were used to draw up a Business Case that would meet some needs and improve the management of projects themselves, following the formula:

- Define a need;
- Determine the benefits;
- Assess constraints, assumptions and risks;
- Recommend a solution.

Thus, to create some control guidelines, we used the tools and techniques present in the standards PMBOK (PMI, 2013) and PRINCE2 (Great Britain. Office of Government Commerce., 2017) to implement and customise the BC template to facilitate all project lifecycle management. In this way, the Business Case Template will have the following tools and techniques (Table 22):

Table 22 – Tools and techniques of the Business Case Template

	Business Case Pre-Project	Planning and Execution of the Project	Follow up Monitoring and Quality control	Evaluation and Closure
Opening Statement	x		x	
Project Management Plan	x	x	x	
Scope Management	x			
Categorisation of Project Typology				
Time management				
Cost management				
Quality Management	x		x	x
Matrix of Responsibilities	x	x		
Stakeholders		x	x	x
Skills Management		x		
Risk Management				
Lessons Learned	x			x

This would introduce a document and alter several internal processes to positively impact the company's management.

Having the idea explained here, it was then necessary to take this beginning, give it body, and transform it into something that creates value to execute it and achieve the proposed objectives (Carapeto & Fonseca, 2014).

To better understand how these activities were carried out, the initiatives to improve TUB project management were sequenced (Figure 23).

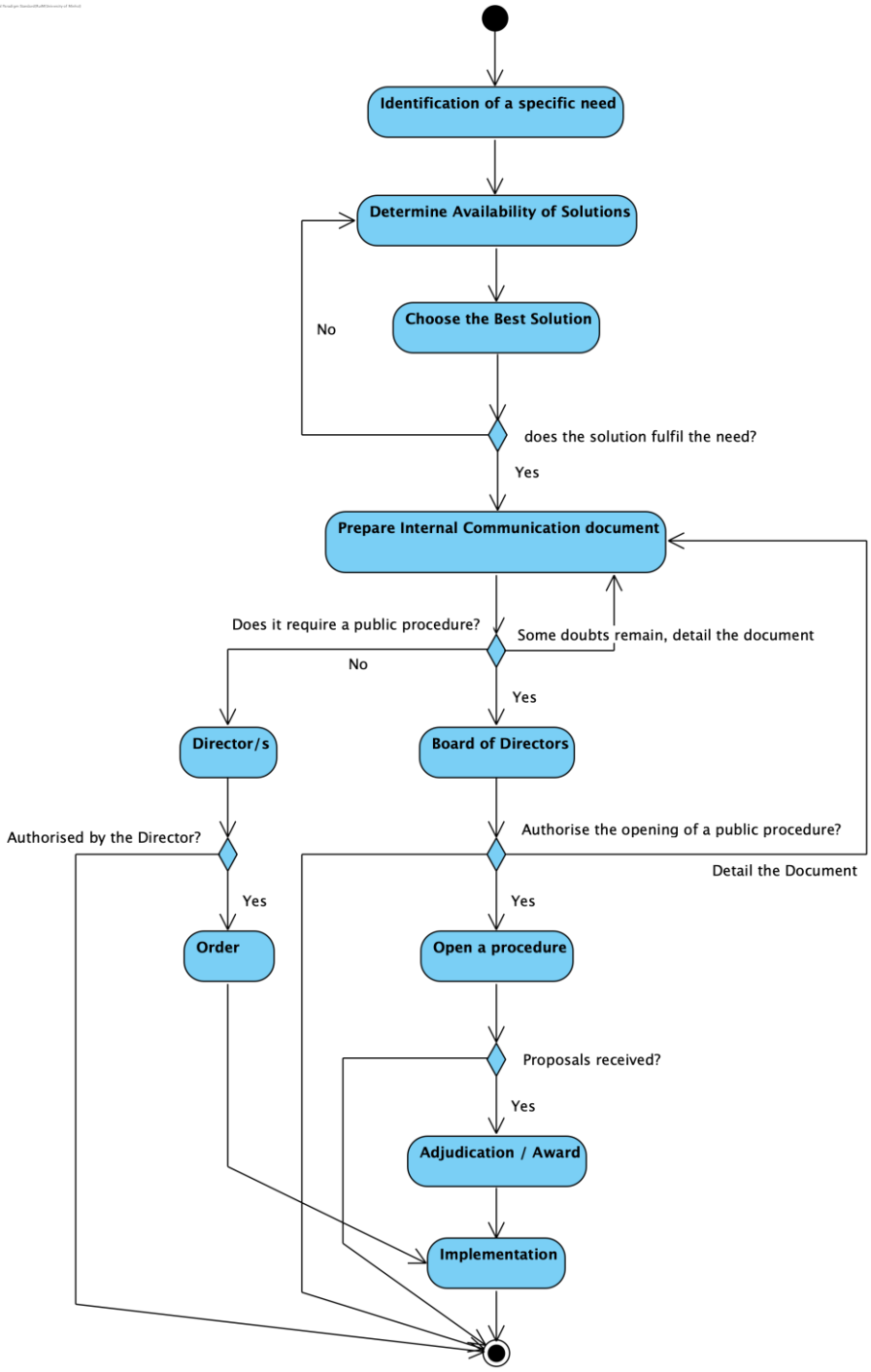


Figure 23 – Needs Identification Process (without Business Case)

This would make it easier to understand the complexity inherent to the whole lifecycle of projects, from identifying the need to searching and selecting a solution for the problem and preparing a document that expresses the need and proposed solution without using a template.

Then, according to the characteristics of the proposed solution, it forces the TUB administration to decide whether to take the proposal to the opening of a public procedure or acquisition, so the document may have several gaps that lead to a new document or to the option of doing nothing about the identified need.

A Business Case Template proposal is intended to simplify the initial part by about 30%, reducing the uncertainty associated with decision-making (Figure 24).

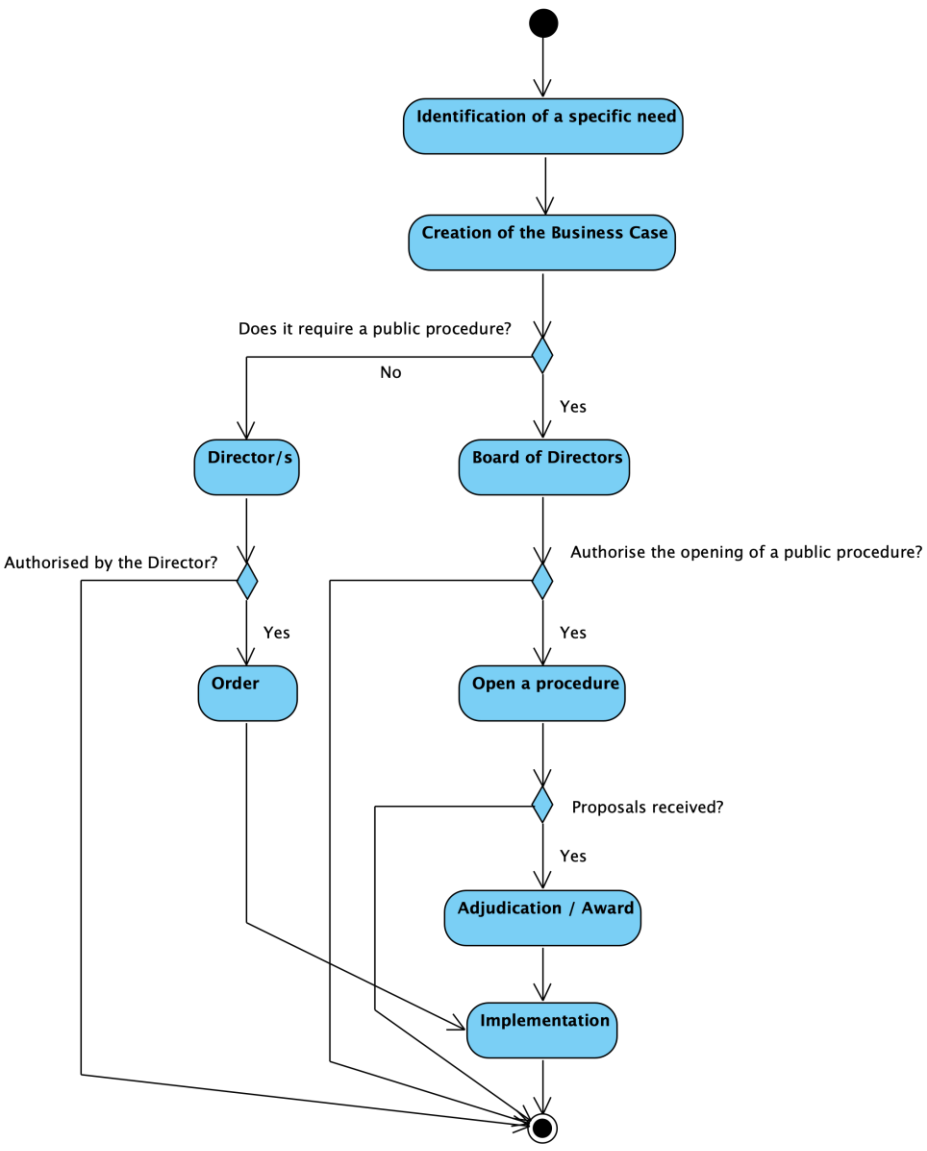


Figure 24 – Needs Identification Process (With Business Case)

The NP4456:2007, NP4457:2007 and NP4458:2007 standards (Instituto Português da Qualidade, 2007a, 2007b, 2007c) were used as input for the creation of the document that allows knowledge to be drawn and value to be created according to the objectives of each, such as:

- NP4456:2007 defines the terminology and definitions used in the standards developed by the Portuguese Technical Committee for Standardization CT 169 "Research, Development and Innovation Activities.
- NP4457:2007: definition of the chain interactions model, an innovation model for the knowledge economy, to enable the design, alignment and evaluation of the core dimensions of the Research, Development and Innovation process in the transition from knowledge to the economy.
- NP4458:2007 defines requirements for an effective Research, Development and Innovation management system.

All this effort was made official in a meeting between the top management of TUB, together with the Departments of Innovation and TUBconsulting and Management and Inspection Systems, on 16 February 2017 that triggered the involvement and commitment among all parties in the development of the Business Case template:

> *"All those present understood the Business Case as an added value to the instruction of TUB's Projects, insofar as management by projects assumes an increasingly relevant dimension in the management systems of TUB, which already has a vast portfolio of innovation projects and partnerships with companies of international references, such as IBM and Bosch, which require an increasingly rigorous discipline and methodology".*

The need to define the process and the desired project lifecycle became evident when elaborating on a first Business Case template proposal.

Thus, mapping the process of identifying a project-originating need becomes vital for elaborating on the Business Case template and the remaining project lifecycle.

The Business Case template is a document that will accompany the entire lifecycle of projects. According to PRINCE2, the Business Case should continuously be updated throughout the project. As a vital management component of the entire project lifecycle, it is valid that this is the main document. Thus, it is divided into four phases:

- Business Case / Pre-Project;

- Project Planning and Execution;
- Follow-up, Monitoring and Quality Control;
- Evaluation and Closing.

Each phase was composed of the introduction of several components. However, considering the effort intended for this doctoral project, the detail can be consulted in the master's thesis entitled "Development of a Business Case Template and application in the lifecycle of a project of a Municipal Company" (F. R. G. Martins, 2017).

Therefore, as defined in the objectives, the main deliverable would be the delivery of a Business Case model (Figure 25) and all the processes underlying this model, which can be seen in detail in the master's thesis mentioned above.

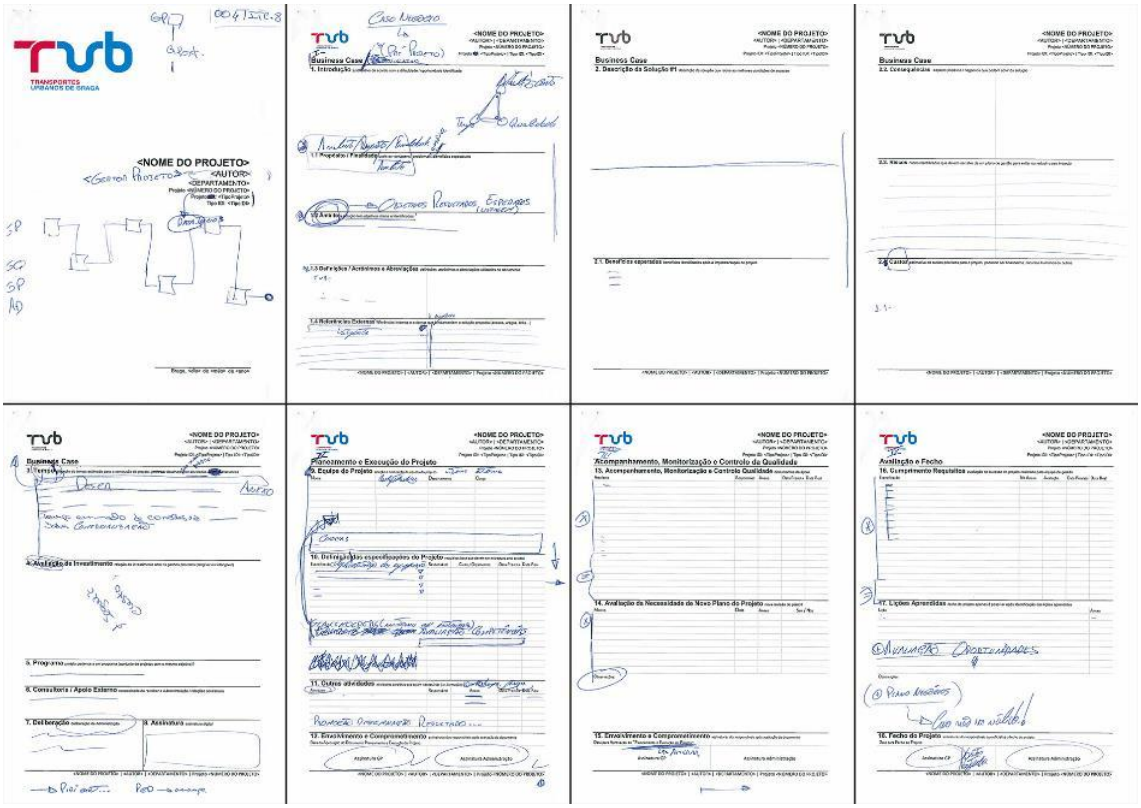


Figure 25 – Business Case V1 Proposal

Another major deliverable was the publication of a scientific paper entitled "Improving Project Management Practice Through the Development of a Business Case: A Local Administration Case Study" (F. Martins et al., 2018).

6.2.4 Metrics and Lessons Learned

This research was carried out to contain a practical and valuable contribution that would guarantee value creation in the company. It is intended to offer PM professionals, particularly in local management companies, such as the company where the study was conducted, to offer processes and instructions on how to improve PM practices in organisations with a low level of management maturity of projects, using a BC model.

As P. Hobbs states (Hobbs, 2009), "Project Management (PM) is the skill of moving from ideas to results and, as such, is applicable to every significant initiative we are given or come up with ourselves. Today, individuals, organisations and nations need more than ever a PM skill that values individual and collective initiative above just about any other attribute".

As such, and to think about PM, it is first necessary to identify the best management practices of existing projects in general and how they are done in a public management environment.

In the long run, and considering the maturation of PM practices, the main objective is to standardise integrated PM processes with the integrated management system of TUB and other local administration companies.

Extracting the necessary knowledge through comparing the results of the respective action, in order to develop the evaluation matrix and the framework to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, we have the following application in Table 23.

Table 23 – Maturity Level Matrix of the Business Case Project

Elements	Attributes to Score	Maturity Level | Business Case Project
Approach	Sound	1
	Integrated	2
Deployment	Implemented	1
	Systematic	1
Assessment and Review	Measurement	1

Elements	Attributes to Score	Maturity Level | Business Case Project
	Learning	2
	Improvement	2

The primary reference elements were the low rating points assigned to the attributes Measurement and Sound, contrasting with the other values and respective ratings on the remaining attributes.

We consider that the Measurement component of the evaluation is low as the necessary intermediate control points to guarantee the correct execution of the project were not carried out.

The Sound attribute received a score of 1 in the maturity level because the various stakeholders had some difficulty identifying the requirements and control points of the plan to ensure the correct development of the deliverable, and only some evidence was visible.

The Integrated attribute, on the other hand, has a more attractive value, 2, given that it is aligned with the desired strategy for its purpose and with the intended objectives.

Once again, this project's effort and the pressure offered by the timings did not leave much space for regular and appropriate measurement of the effectiveness of the approach and deployment.

Considering the success obtained and the maturity that could be found, we see that the attributes Implemented and Systematic have obtained the identified score of 1, given that the identified approach was not implemented, a structured implementation by the method was not used, and it was not present in the various standards and processes mentioned above.

Considering the nature of the project, relating these with Learning and Improvement, and evaluating the various deliverables that resulted from this project as a master thesis and a scientific paper, we considered the level of learning and the possibility that several improvements, continuity projects and even future studies can still be implemented, and therefore the evaluation of 2.

Continuing the application of the matrices created to evaluate each action, it is possible to verify the results of the various metrics applied (Table 24).

Table 24 – Results of the action related to the Business Case Project

#	Metric Scope	Dimension of Analysis	Metric Name	Business Case Project
C1	Complexity	Requirements	Requirements Complexity	3
C2		Cost	Total Predicted Investment	2
E1	Engagement	Quality	Governance	2
E2		Engagement	Communication	2
E3		Quality	Stakeholder Influence	3
E4		Requirements	Change Management	3
E5		Performance	Project Team Experience	2
M1	Monitoring	Quality	Changes to the Team Project	2
M2		Cost	Project Cost	100%
M3		Time	Time Deviation	166%
TP1	Team Perception	Requirements	Team Perception	-

According to the object and scope of the project, we consider that the complexity in terms of requirements has an evaluation with a high internal impact. In the dimension of cost, in the same scope, we consider this to be a large project.

Evaluating Engagement in the various metrics, and going in the order of the respective matrix, we have an evaluation of two given that we only have a project manager and a project team since it is a first effort in an organisation without much maturity and practical knowledge in project management.

The same argument is used in the type of communication used since the involvement would not yet be disseminated and the benefits recognised. This would lead to the effort where coordinators and researchers would always have to request inputs and constantly monitor all parties involved. Assessing the influence of the stakeholders, we consider here that they can change the requirements of the project given that it is aimed precisely at their needs, and the various iterations in the development of this framework prove this.

The change management has an assessment of only three requests for change caused by the introduction of new requirements to comply with the 3 Portuguese standards, which were initially not identified and a new stakeholder.

Considering the performance and the respective experience of the project team, once again, the immaturity in this knowledge area provides a value that we consider to be created by default, with direct

relation to the experience of the one who would be the project coordinator with an experience of only two years.

Relating the monitoring and the respective analysis dimensions, we first address the quality and the changes to the project team. Only one new stakeholder was included, so the metric associated with this change is of value two. The project cost did not suffer any deviation, positive or negative, so it has a normalized value of 100%. The analysis dimension of time was the one that suffered most from the critical path deviation, going from six months to a total of 10 months, translating in a 66% increase in deviation from what was initially predicted.

The team's perception regarding the fulfilment of all the objectives is maximum, given that all the goals were achieved, such as the development of the framework for the Business Case, the development and writing of the master's thesis and the publication of the scientific paper and its subsequent validation.

It is also important to mention that the original table and respective evaluation would only be the lines without grey colouring, sill, the researchers found it pertinent to apply the same to the effort with the knowledge obtained and the interpretation of the experience that evolved over the years that comprise this doctoral project.

The results that are expressed in the previous table are predominant in the understanding of the project and the way it was conducted, also relating the absence of the framework developed with the inexperience verified in project management, despite the presence of a very well-defined project in terms of deadline, effort, and results.

The evidence of success also relates to the need to take the first steps in the organisation's project management discipline.

The lessons learned for the "Business Case Framework" project are:

1. In organisations where there is little or no maturity in project management, the subject must be introduced in manageable phases, from the identification of the idea to its formulation and eventually ending with the implementation of the project that will make it available;
2. The project management themes and best practices should be carefully analysed to have a global idea but to carry out a local implementation according to the constraints identified in each organisation;

3. Project management in an organisation, regardless of its maturity and internal culture regarding project management, should always be supported by the introduction of one or more project management standards and tools that allow for a correct follow-up and also ensure the monitoring capabilities of the respective projects and all the elements that compose them;
4. According to the previous point, a need has been identified in which architecture will be designed throughout this doctoral project that will enhance the resolution of these and other difficulties experienced throughout the various actions and in interaction with all stakeholders;
5. The differences between project management in a public and private organisation are substantial, in particular, due to the introduction of various regulations, such as the Public Procurement Code, and regulatory bodies (i.e. Court of Auditors), which has led to the need to acquire solutions with the "design-build" methodology used, in which, several times, only outlines are identified, and the aim is to deliver a product with the entire lifecycle of the project inserted into it. These circumstances may lead to never reaching comfortable levels in the area of project management knowledge;
6. The initial matrix at the time of this analysis did not consider the grey elements in Table 24, so we considered them as necessary additions:
    a. Engagement – Requirements – Change Management
        i. Changes to the project made by the stakeholders represent an obvious need to be introduced in the matrix from this project, given that they can lead to changes in communication, expectations, cost, time quality, and requirements.
    b. Engagement – Performance – Project Team Experience
        i. The project teams' experience does not have to be directly related to the existing maturity in project management. However, it is an overpowering fact in the pursuit of the objectives.

More abstractly and briefly, the main lesson learned is the differences between public management and private management in terms of posture in project management, especially when we consider that the vast majority of Smart Cities projects always involve several types of stakeholders, both public and private, which leads to difficulties in identifying common ground and some elements that allow a more convenient integration of all efforts made.

This difficulty is further evidenced in the 2nd action highlighted in the next chapter.

The time component and the perception of the various stakeholders represent the most significant difficulty in fulfilling the project in question, something that we believe is related to, once again, the type of project and the changes made to it. However, such slippage in the deadlines only occurred because the calendar would allow it since it was an effort marked by the school calendar and respective time windows for delivery and defence of the final document.

6.2.5 Theory Adjustments

The main adjustment to the theory is the addition of a fundamental requirement: the creation of a framework architecture which allows the joining of project management in companies of private and public origin.

This adjustment involves the best way to control the project concerning the various stakeholders and how to ensure the dissemination of knowledge, sharing and managing expectations.

The theory further takes adjustments to the matrix with greater detail in the classification of this and the inclusion of the following metrics:

- Metric Scope: Engagement
    a. Requirements – Change Management
    b. Performance – Project Team Experience

These changes will be by default when interpreting the project results targeted for further implementation.

To assess and determine relevance, the matrix seen above already shows the maximum maturity level achieved in this PhD project effort. However, the various metrics would not have been applied immediately by default in interpreting the results while implementing it to the mentioned actions.

Thus, the evaluation of these metrics was carried out later, according to the knowledge obtained by the researchers only for the interpretation of the results and validation of the same matrix.

6.2.6 Conclusions

All projects have a common goal, and this goal justifies each project to be possible to validate the final object of this doctoral project.

The aggregating element is the choice and use of the research methodology, the way it fits and allows, in a realistic way, to obtain the necessary comfort in the conclusions achieved and validation of the assumptions.

We are convinced that every research study needs to be supported by an approach and method. After an empirical exercise, this choice is made of numerous possibilities, considering how it fits in the numerous challenges of the various actions and the time that elapses from the beginning of the doctoral project to its delivery.

Throughout this chapter, an effort was made to explain how the Action Research approach is suitable for developing a methodology and framework that can assist the management of stakeholders in projects aimed at Smart Cities.

Considering the multidisciplinary approach, in terms of organisational processes and the various business analyses, the Action Research methodology was the right choice, as its approach successfully validated the various actions and their conclusions.

We have introduced a proven and mature evaluation matrix based on EFQM RADAR to properly evaluate the practical application of the Action Research methodology.

Thus, with our EFQM RADAR-based approach, we intend to evaluate how each action is being executed, applying a series of metrics to assess the results of each of the actions where this approach will be applied.

These metrics include quantifiable values that allow us to compare all the various actions more correctly, thus enabling us to obtain the best conclusions and identify improvements for the evolution of the theory. They are supported by facts and not just mere interpretations with a lack of rigour.

Other metrics inserted in this evaluation are qualitative since only one type of metric would not be sufficient to cover the entire scope of analysis and assessment.

Thus, qualitative analysis is also introduced, even if a scale is put in place for evaluation, where we later try to perform a weighting between all the actions.

Using proven models and reusing them in several contexts, we can justify our option of combining the Action Research methodology and the EFQM RADAR model.

It is also important to mention that with the implementation of the Action Research methodology, the matrix created, based on EFQM RADAR, has undergone some evolutions throughout the various applications in each of the actions.

Even because the analysis of the action "Improving Project Management Practice through the Development of a Business Case: a Local Administration Case Study" was carried out during the PhD project, i.e. it was a later effort, at a different point in time, using existing data and the sensitivity of the various researchers who also participated in that action.

Today, and considering the effort made at the time, it should also be noted that the NP 4457 standard was revised in 2021, being in transition until the end of 2023 and gaining the new nomenclature NP 4457:2021, however, at the time of the implementation of this action, the revision in force would be NP 4457:2007.

These circumstances demonstrate that even though some time has elapsed, the implementation of a new analysis, and the data derived from and for this analysis, allowed for the desired insights and conclusions.

The enabler, in this case, the conclusion of the project, and the analysis of the results obtained, helped to understand why the project did not meet one of the requirements, which in this case were related to the changes requested by the stakeholders, the introduction of a new stakeholder and the lack of common ground, in terms of experience and expectations, of all the elements of the project.

The enabler must be related to this doctoral thesis's main and secondary objectives, thus allowing us to determine if the conditions for stopping the research are validated and justified.

For the project "Improving Project Management Practice through the Development of a Business Case: a Local Administration Case Study", and comparing with the various objectives, we have:

- (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.
    a. The objective was not met since we would not yet have an action whose objective already considered this analysis by default.
- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.

    a. Not achieved, although the implementation of the analysis in this action helped to sustain the justification for the need for a framework to manage stakeholders in innovation projects, even if, in this case, it was only an internal process in a company whose maturity in project management discipline was low.

- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
    a. We did not achieve this objective since we only used the stakeholders identified during the researchers' Master's dissertation effort following the PMBOK definition of stakeholders (PMI, 2017).
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
    a. Partially the objective since changes were created and implemented to the theory, thus allowing it to evolve and be implemented in the next action.
- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.
    a. Negative evaluation since no output for guideline definition was obtained.

Considering the evaluation above and the effort taken into this analysis, we consider that the model and strategy used during the following action are validated.

6.3 Action 2 | Implementation of GDPR on a Local Administration Company

The General Data Protection Regulation came into force in the European Union in May 2018 to meet current challenges related to personal data protection and to help harmonise data protection across the EU.

Although the GDPR was expected to benefit private or public companies by offering consistency in data protection activities and liabilities across the EU countries and enabling more integrated EU-wide data protection policies, it poses new challenges to companies.

The projects to implement the GDPR have emerged frequently, offering new opportunities and challenges to the companies (Tankard, 2016), whether private or public. This situation led these companies to seek

support from consulting firms to increase the likelihood of success and achieve compliance in the shortest time possible.

This is the first action with direct implementation in the framework under development, the implementation and benefit of which will be reflected in its evolution at a later stage, and which can be consulted throughout this chapter and in the subchapters intended for this purpose.

Another point worth mentioning is that the effort in question was also the subject of a scientific article entitled "Implementation of GDPR: Learning with a Local Administration Case Study"(F. Martins et al., 2020), the purpose of this project was to address concerns related to European regulations, the scope of which relates to the General Data Protection Regulation (GDPR).

During this project, with the implementation of a European directive, the first success was achieved in transposing an international directive into national territory and thus substantiating the perspective of evaluation by type of project in relation to an international directive with local implementation.

6.3.1 Purpose of Action

The GDPR was initiated in 2012 by European parliamentarian Viviane Reding, then the vice president of the European Commission.

According to Viviane Reding, the main concern that led to this regulation was "the concern about the big companies, like the American GAFA — the French coinage for Google, Amazon, Facebook, and Apple" and the way they just ignored the old law (Julia Powles, 2018).

The various scandals created around countless data losses, voluntarily or involuntarily, drove all the arguments. For example, the Facebook Cambridge Analytica scandal, if it had happened after May 26th 2018, would have cost Facebook billions of euros, among others (Houser & Voss, 2018).

The GDPR aims to take the high ground to protect all European citizens in defending their personal and sensitive data.

This is driven by philosophical thinking and stance regarding data protection(Goddard, 2017). Its core is based on the concept of privacy as a fundamental human right and seeks to extend to the whole EU (The European Parliament and the Council of the European Union, 2016).

This new regulation is intended to cover the personal data of all EU residents, regardless of where the data can be stored or processed.

The European Parliament and the Council of the European Union, using their legislative powers conferred under European Union law, deliberated on the subject of Data Protection, culminating, as such, in the EU General Data Protection Regulation (GDPR) of the European Parliament and of the Council of 27 April 2016) (The European Parliament and the Council of the European Union, 2016), which has been in force in the EU since 25 May of this year. This regulation should be considered in the practices of organisations, as it "is binding in its entirety and directly applicable in all Member States" (The European Parliament and the Council of the European Union, 2016).

In certain matters under the GDPR, the European legislator allows Member States to specify some internal rules within the GDPR. However, although the Council of Ministers approved Law 120 / XIII (Assembleia da República, 2018) to specify these internal rules, it has not yet been approved, so "until there is national legislation implementing the GDPR repealing Law 67/98 on matters covered by the regulation, Law 67/98 remains in force in everything that does not contradict the GDPR.

According to Article 4 of the Regulation, personal data is information that can, directly or indirectly, identify an individual, in particular by reference to an identifier, such as a name, an identification number, location data, identifiers by electronic means (i.e. e-mail) or a more specific element of the physical, physiological, genetic, mental, economic, cultural or social identity of that individual " (The European Parliament and the Council of the European Union, 2016). This is a more comprehensive regulation than its North American counterpart (Goddard, 2017).

The GDPR is often confused as one that deals only with technology. However, the GDPR protects personal data regardless of the technology used to process it.

The GDPR is technology-neutral and considers both automated and manual processing, provided the data is organised by pre-defined criteria. It also doesn't matter how the data is stored – in an IT system, through video surveillance, or on paper (European Commission, 2019). In all cases, personal data is subject to the protection requirements set out in the GDPR.

6.3.2 Practical Action

The GDPR was “the most contested law in the E.U.’s history, the product of years of intense negotiation and thousands of proposed amendments” (Julia Powles, 2018).

The need to require affirmative consent, which must be freely given, specific, informed, and unambiguous (Tikkinen-Piri et al., 2018), can be seen as an opportunity because it obtains a biddable authorisation for all the treatments. This is then a determining factor in each company's ability to use GDPR and turn that factor into an opportunity.

Regaining control over data stored and managed by enterprises, will yield numerous benefits beyond mere compliance. This includes dismantling data silos and achieving a more systemic perspective of all data and processes accessing the same information.

The need to change how information management is made will produce more accurate and valuable insights (Garber, 2018) and greater clarity across enterprise data.

The biggest threat, and more noteworthy, lies in the time that Portugal took to implement European legislation, which it only saw its final version adopted on June 12, 2019, which entered into force in all the European Union member states for more than a year (Notícias, 2019).

Theatro Circo de Braga's management is not limited to activities directly linked to the planning and execution of cultural programming and its communication with audiences. For Theatro Circo de Braga to position itself as an entity of excellence in its sector, it is also necessary to follow a path of innovation and permanently improve its internal organisation.

This path requires the entire internal stakeholder to be complementary and willing to reflect on its internal processes, identify good practices, potential problems, and opportunities for improvement, then define the measures to be implemented and follow through with their execution.

In 2019, following the entry into force of the General Data Protection Regulation, a project was carried out to implement the new rules/obligations to ensure compliance with this regulation, continuing the privacy and personal data protection measures that had already started in 2018.

Managing the project required the coordination of several stakeholders, such as an external team, specialists in data protection and information security, and an internal team with procedural and organisational knowledge. With this combination, the company was able to achieve an effective result in a short space of time.

The implementation of this project ended in May 2019, with the approval of internal policies to regulate the privacy of personal data and with a plan for dealing with identified risks, where measures have been identified to mitigate the risks to date. This is a new area of action and concern for the company's management, as the entity continually must assess whether the approved measures are correctly applied in daily work.

This implementation was part of a scientific paper written by a member of the internal implementation team, which was presented at the "SmartGov 2019 - EAI International Conference on Smart Governance for Sustainable Smart Cities" conference under the theme "Implementation of GDPR: Learning with a Local Administration Case Study" (F. Martins et al., 2020).

6.3.3 Stakeholders

In an era where data breaches are as frequent as they are damaging, the introduction of the General Data Protection Regulation (GDPR) has been a beacon of hope for protecting personal data.

However, implementing such a comprehensive regulatory framework is no small feat. It requires a concerted effort from various quarters, each holding a critical piece of the puzzle. The strategy for this subchapter was to explore the intricate web of stakeholders involved in the GDPR implementation process in a public administration company, shedding light on their roles, level of influence, and impact of changes introduced to the project.

By starting this project, an implementation whose final outcome would be the subject of particular attention from various municipal companies, not just those geographically located in Braga, would add some additional stakeholder groups.

At the heart of the GDPR implementation is a diverse group of stakeholders, from internal teams to external bodies overseeing compliance and enforcement. Understanding the perspectives and motivations of these stakeholders is crucial for any organisation aiming to align itself with the GDPR requirements and later with the local laws regarding the same subject.

These stakeholders include, but are not limited to, data protection officers (DPOs), legal and compliance departments, external consultants, regulatory bodies, and the data subjects themselves. As we gain a deeper understanding of each stakeholder's roles and responsibilities, we uncover their challenges and, therefore, start to understand how to deal with their perspectives and expectations.

Considering the owner and sponsor of the project and the main target in the implementation, we have a municipal company called Teatro Circo de Braga, E.M., SA, (Figure 26), commonly known as Theatro Circo, a significant cultural institution in Braga, Portugal, with a rich history dating back to its inauguration on April 21, 1915.



Figure 26 – Teatro Circo de Braga EM, S.A.

The Theatro Circo was conceived in 1906 by a group led by Artur José Soares, José António Veloso, and Cândido Martins, who saw the need for a more significant performance space to accommodate the city's growing cultural demands. Construction began in 1911 under architect João de Moura Coutinho and concluded in 1915, it initially hosted operettas and expanded to include cinema and circus performances.

Nowadays, Theatro Circo is recognised as one of Braga's primary cultural venues, offering a rich program that attracts both local and international artists. It has also gained distinction by being part of the European Route of Historic Theatres, which links it with other notable European theatres based on architectural beauty, historical significance, and preservation status.

One of the significant concerns regarding the implementation of the GDPR project is the organisation's sturdiness in dealing with personal data, especially considering the various applications to international funding programmes and also cultural ones such as the Braga 27 project, which aimed to make Braga the European Capital of Culture in 2027.

The project manager is an internal resource whose interest in the project's success is of the highest order, considering that he is also the data protection officer, i.e., a member of the project team and the legal team.

Another element is one researcher of this PhD project, considered a consultant with connection to Theatro Circo de Braga, not only to this project but also regarding the technology and information systems of this company and a member of the privacy group created before this GDPR project.

Other consultants, such as financial and human resources consultants, could not be overlooked, as they are external to the company, have temporary contracts, and offer different scopes of services.

A private company delivered the solution and part of the framework, combined with support regarding human resources in areas such as consultancy and the project management team.

Internally, we can also find many resources in diverse areas such as the project management or project team (differences can be found in these roles and their involvement), legal, auditing, and procurement and contract managers.

All the existing technological providers in web or local solutions that would be implemented on-premises on the company's various servers, ended up being involved because they were direct stakeholders to the project and to the impact that was being delivered, their participation was necessary throughout the project, such as the initial phases of the assessment carried out as with the implementation of measures to mitigate risks or change processes that occurred in later stages.

A significant stakeholder would be the provider of the entire ticketing solution, representing a large percentage of the company's whole financial turnover and whose impact on the compliant component of the regulation would be the most intense.

The final stakeholder, and one that would benefit most from this solution, is the end customer, whether or not they are identified individually but representing a complete group whose expectations and influence on the same process could never be overlooked.

With the previous detailed but anonymous description, it is possible to apply the stakeholder identification and classification process and thus carry out the respective assessment according to their influence and impact:

Table 25 – GDPR Project - Stakeholder Evaluation

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Business Governing Layer and Steering Layer	Project Sponsor	Owner	Internal	6	8
Steering Layer and Directing Layer	Project Owner	Management	Internal	9	9
Steering Layer and Directing Layer	Consultants	Technical	Internal / External	7	8
Directing Layer	Technology Providers	Provider	External	4	4
Directing Layer and Managing Layer	Project Manager	Management	Internal	8	8
Managing Layer	Project Management Team	Management	Internal / External	7	7

Performing Layer	Procurement and Contract Managers	Compliance and Monitoring	Internal	4	6
Performing Layer	Project Team	Operational	Internal / External	6	6
Performing Layer and Regulation Layer	Legal Team	Compliance and Monitoring	Internal / External	3	4
Regulation Layer	Auditing Body	Compliance and Monitoring	Internal	6	5
External Influent Entities Layer	Civil Society	Influencer	External	5	7

According to Table 25, each area is represented by the possible influence and impact of these stakeholders on the same project. The graphical representation can be seen in Figure 27.

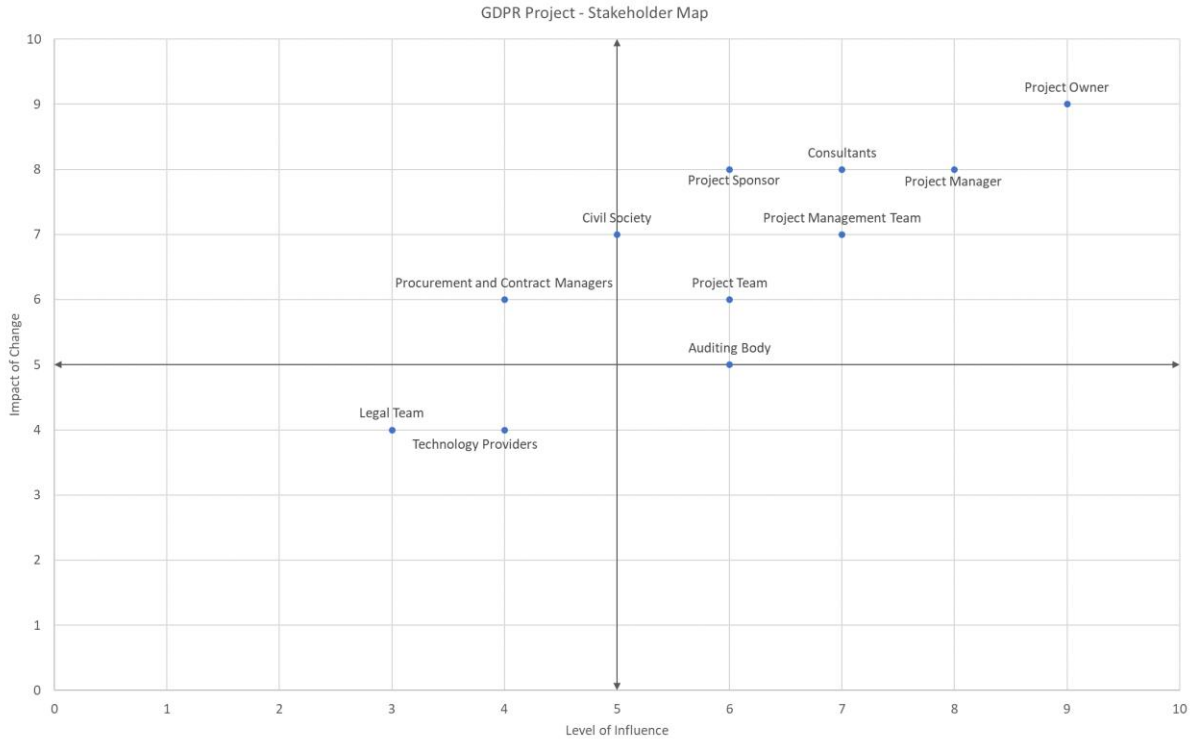


Figure 27 – GDPR Project - Stakeholder Map

Unlike the previous analysis of the Business Case Project, here we have an exciting increase in the number of stakeholders identified, representing the result of a more careful and elaborate application of the framework developed for this PhD endeavour and its constant evaluation throughout this action.

6.3.4 Project Management

Project management methodologies and the stakeholder management framework were applied to succeed in the present effort, considering the presence of various internal and external stakeholders, even if the latter was still preliminary.

The aim was to ensure that all the effort associated with any project was carried out correctly, even one that was more focused on processes but whose result would be tangible and still defined in a contract.

The process associated with project classification (subchapter 7.2) allowed us to define the type of project and the methodology to be applied in terms of stakeholder management, which will be detailed below.

Efforts were also made to identify costs, defined according to the direct costs identified through signing specific contracts for the scope in question and indirect costs.

The existing contract also defines time, schedules, and objectives, in which expectations will always be described among all the stakeholders and thus managed for a correct evaluation of the project in question.

Project Management Methodology

The main concern in these actions would be implementing the respective framework to be developed, evaluating it, and guaranteeing an evolution for a future iteration. Therefore, we will mention here the assumptions that would come from the efforts to achieve these objectives.

Considering the resulting iteration after the first action and the greater maturity of the research carried out rightly after, we created a new version of the framework for a new implementation and respective analysis to move forward with the project documented during the second action.

From this action to the others, and to guarantee some reaction and analysis through observation, the artefacts that came in the initial model and suggested through the previous iterations would be applied.

Later, still during the same action, as long as this was the second action to assess the same project classification, all the stakeholder management artefacts would be applied to refine and mature the respective framework.

As a starting point for this new challenge, we will use the framework currently drawn on the Business Case Project as a basis, but with slight changes introduced by the theoretical research carried out and as a result of the action seen during this subchapter.

The *metro line* for a simple project can be seen in Figure 28:

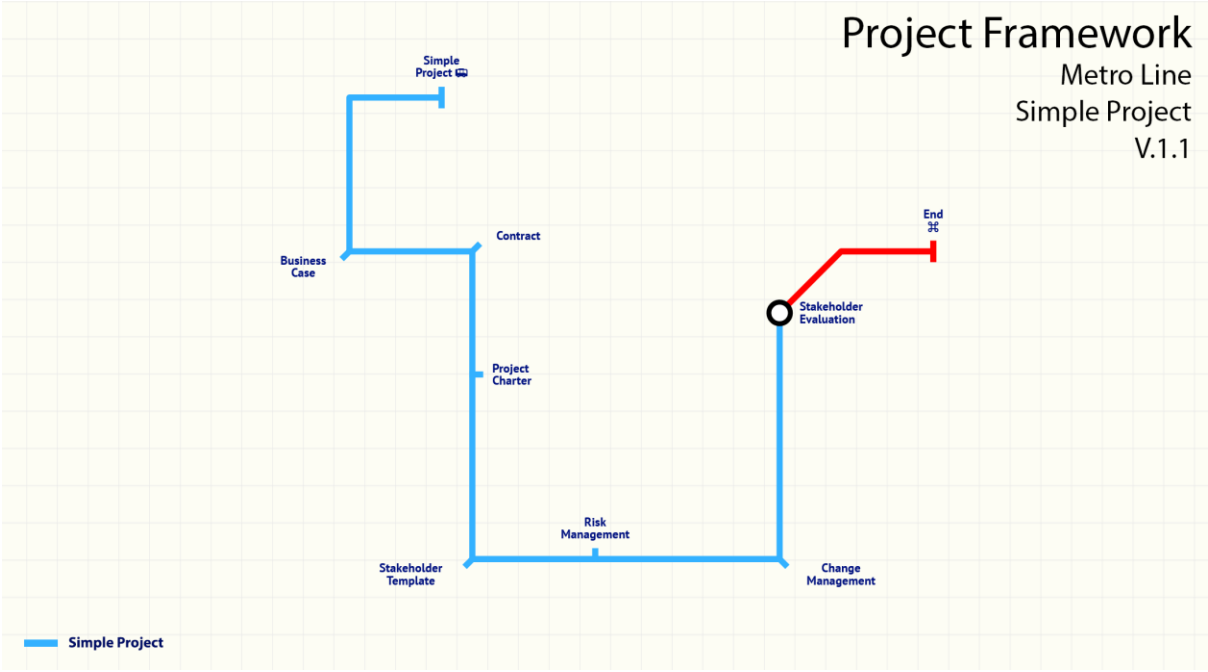


Figure 28 – Metro Line for Simple Project V.1.1

Table 26 shows the artefacts used initially and those subsequently considered useful or essential after or during the project.

Table 26 – Documents applied to the GDPR Project

GDPR Project			
	Have	Nice2Have	Justified2Have
Business Case	x		
Contract	x		
Project Charter	x		
Stakeholder Template			x
Risk Management	x		
Change Management			x
Stakeholder Evaluation			x

The analysis evaluated each of the documents used to determine which documents were necessary for the additional project management process, aiming to prevent unnecessary effort from being put into stakeholder management in an already complex project management system.

Thus, in Table 27, we have the following analysis according to the criteria defined and detailed above:

Table 27 – GDPR Project Framework Documents

GDPR Project Framework Documents	
Business Case	Considering the type of company in question, being a public organisation, it is necessary to define the business case, where we will have to identify the problem *a priori* and make suggestions for resolving it. We also analysed the feasibility of the project and the various constraints inherent to it. There is a preliminary definition of the respective resources, whether financial, material or human, thus serving as a first

	analysis of which internal and/or external stakeholders are to be used. Considering the range of values identified, it was possible to adapt the effort to the type of procedure to be carried out and apply the model worked on here to carry out the respective stakeholder management. We consider this document to be vitally important for future internal auditing efforts to initiate other projects. This document was used in the run-up to the project itself to support the opening of the public procedure needed to contract the effort required for it. Its use doesn't stop at the initial stages, during the course of the project, several inputs and updates were made to the document, given that it ends up being a consultation document for top management and high-level control of the project. Access to this document is considered open to anyone involved in the project or the company management team.
Contract	A document aimed at the commitment of all those involved is important and will never cease to be relevant. Identifying the responsibilities of each of the partners and suppliers involved helps to manage expectations and define the scope and main success metric: delivering a solution to the problem identified in the business case. This document was used one time before the start of the project and was considered confidential due to the elements present in the document.
Project Charter	The Project Charter is a document guiding all the efforts throughout the project, and its scope is highly likely to be changed. This iteration led to some changes and inclusions that we figured could be more interesting for the effort. Therefore, it ended up with several updates to the document's structure and data inputs throughout the project, such as introducing the project requirements (updated once), the project scope point (updated three times throughout the project) and the list of risks. This is a freely accessible document for the entire project team and the client company's management team.
Stakeholder Template	The Stakeholder Template is a document considered necessary during the project and had not been considered pertinent in a first analysis right at the start. Over the course of the project, considering its timeframe and the need to identify all the roles played by all the stakeholders, we identified the need to have a document whose basic role would be to create a real repository of all the stakeholders involved and the possible impact that each of these elements would have on the project itself. Having a critical perspective on the project made it possible to characterise all the stakeholders in detail, both internal and external, thus ensuring greater accountability in defining each role, assessing their influence and expectations and the associated risk management. Because of this gap that was found, and given the potential demonstrated by the inclusion of this document, it was considered necessary in the respective framework and, therefore, included
Risk Management	Every project presents risks that can be identified over time and whose associated measures can and should change. This includes the risk inherent in the stakeholder or group of stakeholders. This is a document that has been identified since the previous action and whose validity was also justified in this project with correct risk management between stakeholders, allowing comfort in exposure to certain risks, such as the entry and exit of employees from the project team and the impact that these changes had. This approach has made it possible to increase concerns about the recording of knowledge and greater rigour in its transfer. This document has restricted access to the project management team, and its importance is more implicit in the project execution phase.
Change Management	One of the inherent results of careful risk management is implementing change management at the same level. Change management is a measure that is carried out continuously throughout the execution phase of the project, and its benefits can be seen even in shorter projects such as the one involved in this action. It was possible to manage the change in the project caused by the change in some partners, particularly technological ones, and also in the internal platforms that support the entire integrated management system. This change management went above the project itself and affected the company's day-to-day management throughout the project. This confidential document is only accessible to the project manager and the senior

	management team. This document was included in the project after it had started, through the need to control and manage the change of the same project.
Stakeholder Evaluation	Using documented records for stakeholder evaluation helps bring immense value to any project's lessons learnt. This is a document in which its results led to an early termination of the contractual relationship that stemmed from an unsatisfactory assessment of a stakeholder who supported one of the technologies used and whose involvement was disappointing for the continuity of the partnership. Throughout the project, considering the entire journey, we considered it to be a necessary element, not only for the project but also for the required respective conclusions for this doctoral endeavour.

All the previous documents that were applied, maintained, and updated throughout the various phases of this project, such as preparation and initiation, planning, execution, and closure, helped to keep the project within the desired success metrics, taking into account a slight delay that would be caused internally by the top management itself to guarantee a correct cultural change in organisational terms.

Investment and Costs

Costs are an undeniable concern in the planning of any project and the following phases, such as execution and closure. The public management environment in which most innovation projects occur means a considerable need exists to create mechanisms for monitoring and reporting on all expenditures.

Considering all the attention that this topic raises, we thought it best to highlight the issue and use the same costs for classifying projects clearly and pragmatically, thus giving increased justification to the classification of the project according to the existing inputs in the business case and the efforts necessary for the respective public procurement.

Evaluating only the internal impact on costs and carrying out a cost projection, the initial expectation, according to the benchmarking carried out, was that we would always have a cost of less than 50,000 euros for the respective implementation of the initial project. These assumptions changed when a business case was used to conduct a market study and analyse the time associated with each human resource. Throughout the preparatory period, it was possible to determine that the cost assessment should take into account not only the direct cost of the project but also the internal cost of using the various human resources allocated to the project owner.

This situation then led to the development of a process with a slightly higher level of complexity but which would make it relatively easy to determine the company's total internal cost, including social charges that are usually taken into account when paying employees' salaries.

Applying the process in question, presented in the Business Case, gives access to estimated indirect costs, which can be consulted in the following Table 28:

Table 28 – GDPR Project - HR costs

Human Resources	% Allocated to the Project	Working Days	Days of Absence	Days Worked	Daily Hours	Hours Worked	Base Salary	Salary Total Time	Cost / Hour	Cost/Hour RDI	Total Value*	Social charges	Total Amount with Charges
DPO (int)	70%	131	0	131	7,0	917	1 600,00 €	6,24	10,88	7,62 €	6 986,67 €	8 663,47 €	15 650,13 €
CEO (int)	30%	30	0	30	2,0	60	3 200,00 €	1,43	76,19 €	22,86 €	1 371,43 €	1 700,57 €	3 072,00 €
Consultant (ext)	50%	80	0	80	3,0	240	1 000,00 €	3,81	15,87 €	7,94 €	1 904,76 €	2 361,90 €	4 266,67 €
Internal Resource #1 (int)	25%	30	0	30	3,0	90	3 000,00 €	1,43	47,62 €	11,90 €	1 071,43 €	1 328,57 €	2 400,00 €
Internal Resource #2 (int)	25%	20	0	20	3,0	60	1 200,00 €	0,95	19,05 €	4,76 €	285,71 €	354,29 €	640,00 €
Internal Resource #3 (int)	25%	30	0	30	1,5	29	1 050,00 €	1,43	52,63 €	13,16 €	375,00 €	465,00 €	840,00 €
Internal Resource #4 (int)	25%	15	0	15	1,5	14	900,00 €	0,71	47,62 €	11,90 €	160,71 €	199,29 €	360,00 €
Internal Resource #5 (int)	50%	10	0	10	1,5	9	2 000,00 €	0,48	112,04 €	56,02 €	476,19 €	590,48 €	1 066,67 €
Total Value* = Hours Worked * Cost/Hour										**Total:**	12 631,90 €	15 663,56 €	28 295,47 €

By absorbing all the inputs needed by the top management to decide to open a project effectively, we also consider it necessary to quantify all the costs required for a project to be successful, whether it's the purchase of equipment or even the essential preparation of the respective human resources, such as the training of these resources.

Therefore, we consider the evolution of the cost determination process in the business case of special requirements that would be necessary and, thus, justified for the project in question.

Table 29 shows the combination of all the costs, HR costs, special requirements, and the public procedure.

Table 29 – GDPR Project - total costs

Special Requirements	Total Amount
Specific Training	2 000,00 €
Total	2 000,00 €

Public Procedure	Total Amount
Contract Value	6 240,00 €
Total	6 240,00 €

Total Project Cost	Total Amount
Contract Value	6 240,00 €
Internal Human Resources	28 295,47 €
Special Requirements	2 000,00 €
Total	36 535,47 €

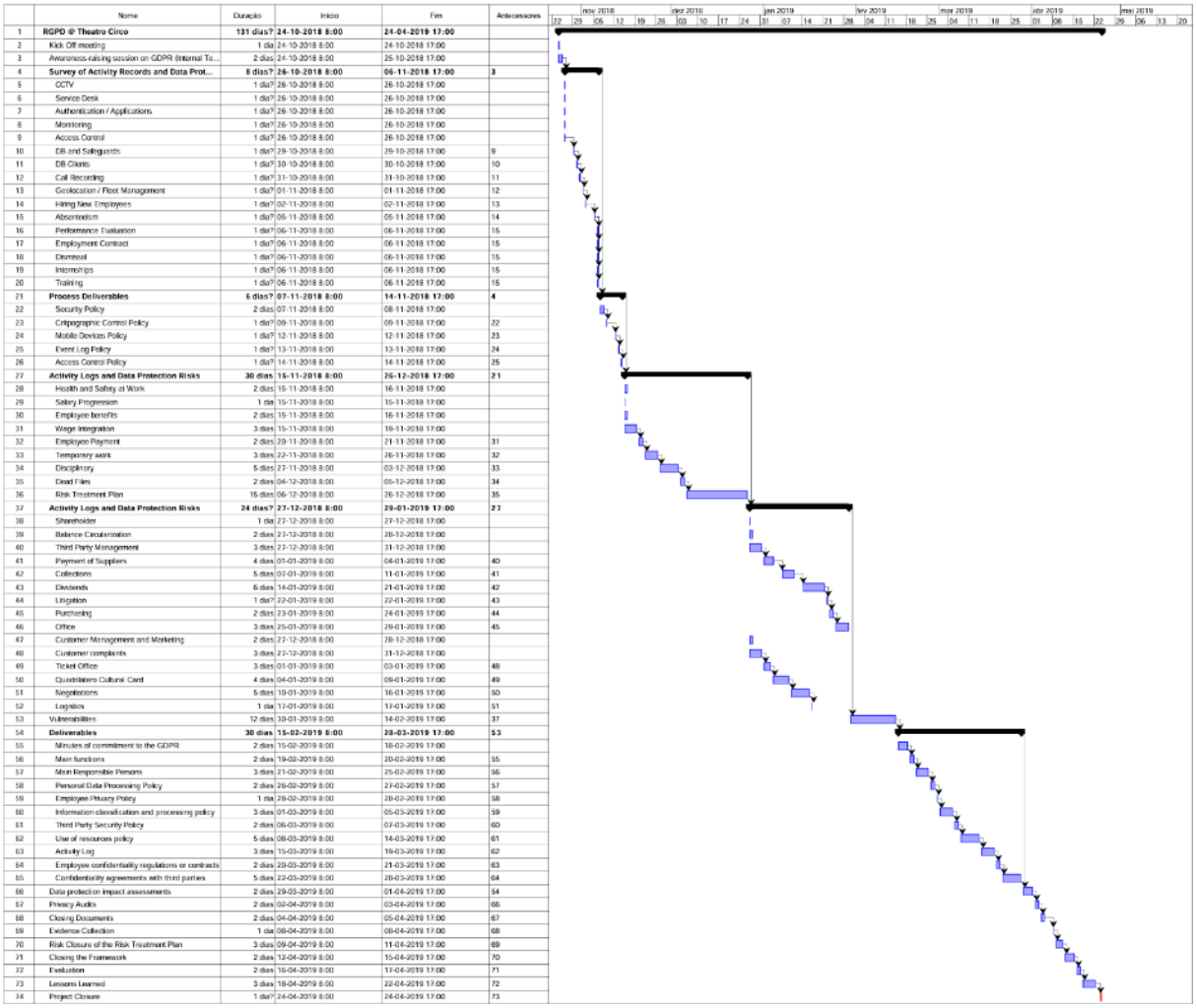
A total cost of 36 535,47 € would lead us to the application of the stakeholder management framework to manage a simple project. This involves dedicating the necessary effort and attention required to address stakeholder needs effectively.

The risk of the project reaching a point of no return while respecting the success criteria and inherent costs, which are primarily internal, made it very interesting to apply the Action Research methodology to bring about change and thus assess its impact.

Time and Schedules

This project's lifespan was around 131 days (Figure 29), and it was just in its execution until it reached closure.

Considering this period, and how it would be possible to fit this project into the PHD effort, we believe that the trigger for closing this action would be precisely to achieve the success of this project.



	Nome	Duração	Início	Fim	Antecessoras
1	**RGPD @ Theatro Circo**	**131 dias?**	**24-10-2018 8:00**	**24-04-2019 17:00**	
2	Kick Off meeting	1 dia	24-10-2018 8:00	24-10-2018 17:00	
3	Awareness-raising session on GDPR (Internal To...	2 dias	24-10-2018 8:00	25-10-2018 17:00	
4	**Survey of Activity Records and Data Prot...**	**8 dias?**	**26-10-2018 8:00**	**06-11-2018 17:00**	**3**
5	CCTV	1 dia?	26-10-2018 8:00	26-10-2018 17:00	
6	Service Desk	1 dia?	26-10-2018 8:00	26-10-2018 17:00	
7	Authentication / Applications	1 dia?	26-10-2018 8:00	26-10-2018 17:00	
8	Monitoring	1 dia?	26-10-2018 8:00	26-10-2018 17:00	
9	Access Control	1 dia?	26-10-2018 8:00	26-10-2018 17:00	
10	DB and Safeguards	1 dia?	29-10-2018 8:00	29-10-2018 17:00	9
11	DB Clients	1 dia?	30-10-2018 8:00	30-10-2018 17:00	10
12	Call Recording	1 dia?	31-10-2018 8:00	31-10-2018 17:00	11
13	Geolocation / Fleet Management	1 dia?	01-11-2018 8:00	01-11-2018 17:00	12
14	Hiring New Employees	1 dia?	02-11-2018 8:00	02-11-2018 17:00	13
15	Absenteeism	1 dia?	05-11-2018 8:00	05-11-2018 17:00	14
16	Performance Evaluation	1 dia?	06-11-2018 8:00	06-11-2018 17:00	15
17	Employment Contract	1 dia?	06-11-2018 8:00	06-11-2018 17:00	15
18	Dismissal	1 dia?	06-11-2018 8:00	06-11-2018 17:00	15
19	Internships	1 dia?	06-11-2018 8:00	06-11-2018 17:00	15
20	Training	1 dia?	06-11-2018 8:00	06-11-2018 17:00	15
21	**Process Deliverables**	**6 dias?**	**07-11-2018 8:00**	**14-11-2018 17:00**	**4**
22	Security Policy	2 dias	07-11-2018 8:00	08-11-2018 17:00	
23	Cryptographic Control Policy	1 dia?	09-11-2018 8:00	09-11-2018 17:00	22
24	Mobile Devices Policy	1 dia?	12-11-2018 8:00	12-11-2018 17:00	23
25	Event Log Policy	1 dia?	13-11-2018 8:00	13-11-2018 17:00	24
26	Access Control Policy	1 dia?	14-11-2018 8:00	14-11-2018 17:00	25
27	**Activity Logs and Data Protection Risks**	**30 dias**	**15-11-2018 8:00**	**26-12-2018 17:00**	**21**
28	Health and Safety at Work	2 dias	15-11-2018 8:00	16-11-2018 17:00	
29	Salary Progression	1 dia	15-11-2018 8:00	15-11-2018 17:00	
30	Employee benefits	2 dias	15-11-2018 8:00	16-11-2018 17:00	
31	Wage Integration	3 dias	15-11-2018 8:00	19-11-2018 17:00	
32	Employee Payment	2 dias	20-11-2018 8:00	21-11-2018 17:00	31
33	Temporary work	3 dias	22-11-2018 8:00	26-11-2018 17:00	32
34	Disciplinary	5 dias	27-11-2018 8:00	03-12-2018 17:00	33
35	Dead Files	2 dias	04-12-2018 8:00	05-12-2018 17:00	34
36	Risk Treatment Plan	15 dias	06-12-2018 8:00	26-12-2018 17:00	35
37	**Activity Logs and Data Protection Risks**	**24 dias?**	**27-12-2018 8:00**	**29-01-2019 17:00**	**27**
38	Shareholder	1 dia	27-12-2018 8:00	27-12-2018 17:00	
39	Balance Circularization	2 dias	27-12-2018 8:00	28-12-2018 17:00	
40	Third Party Management	3 dias	27-12-2018 8:00	31-12-2018 17:00	
41	Payment of Suppliers	4 dias	01-01-2019 8:00	04-01-2019 17:00	40
42	Collections	5 dias	02-01-2019 8:00	11-01-2019 17:00	41
43	Dividends	6 dias	14-01-2019 8:00	21-01-2019 17:00	42
44	Litigation	1 dia?	22-01-2019 8:00	22-01-2019 17:00	43
45	Purchasing	2 dias	23-01-2019 8:00	24-01-2019 17:00	44
46	Offers	3 dias	25-01-2019 8:00	29-01-2019 17:00	45
47	Customer Management and Marketing	2 dias	27-12-2018 8:00	28-12-2018 17:00	
48	Customer complaints	3 dias	27-12-2018 8:00	31-12-2018 17:00	
49	Ticket Office	3 dias	01-01-2019 8:00	03-01-2019 17:00	48
50	Quotidiano Cultural Card	4 dias	04-01-2019 8:00	09-01-2019 17:00	49
51	Negotiations	5 dias	10-01-2019 8:00	16-01-2019 17:00	50
52	Logistics	1 dia	17-01-2019 8:00	17-01-2019 17:00	51
53	Vulnerabilities	12 dias	18-01-2019 8:00	14-02-2019 17:00	37
54	**Deliverables**	**30 dias**	**15-02-2019 8:00**	**28-03-2019 17:00**	**53**
55	Minutes of commitment to the GDPR	2 dias	15-02-2019 8:00	18-02-2019 17:00	
56	Main functions	2 dias	19-02-2019 8:00	20-02-2019 17:00	55
57	Main Responsible Persons	3 dias	21-02-2019 8:00	25-02-2019 17:00	56
58	Personal Data Processing Policy	2 dias	26-02-2019 8:00	27-02-2019 17:00	57
59	Employee Privacy Policy	1 dia	28-02-2019 8:00	28-02-2019 17:00	58
60	Information classification and processing policy	3 dias	01-03-2019 8:00	05-03-2019 17:00	59
61	Third Party Security Policy	2 dias	06-03-2019 8:00	07-03-2019 17:00	60
62	Use of resources policy	5 dias	08-03-2019 8:00	14-03-2019 17:00	61
63	Activity Log	3 dias	15-03-2019 8:00	19-03-2019 17:00	62
64	Employee confidentiality regulations or contracts	2 dias	20-03-2019 8:00	21-03-2019 17:00	63
65	Confidentiality agreements with third parties	5 dias	22-03-2019 8:00	28-03-2019 17:00	64
66	Data protection impact assessments	2 dias	29-03-2019 8:00	01-04-2019 17:00	54
67	Privacy Audits	2 dias	02-04-2019 8:00	03-04-2019 17:00	66
68	Closing Documents	2 dias	04-04-2019 8:00	05-04-2019 17:00	67
69	Evidence Collection	1 dia	08-04-2019 8:00	08-04-2019 17:00	68
70	Risk Closure of the Risk Treatment Plan	3 dias	09-04-2019 8:00	11-04-2019 17:00	69
71	Closing the Framework	2 dias	12-04-2019 8:00	15-04-2019 17:00	70
72	Evaluation	2 dias	16-04-2019 8:00	17-04-2019 17:00	71
73	Lessons Learned	3 dias	18-04-2019 8:00	22-04-2019 17:00	72
74	Project Closure	1 dia?	24-04-2019 8:00	24-04-2019 17:00	73

Figure 29 – Schedule and Gantt Chart for the GDPR Project

The project was carried out without any significant deviations from what would otherwise have been unforeseen events, which is a good demonstration of the success of the framework's scope to extend

project management practices for innovation projects in Smart Cities, focusing on stakeholder management.

Objectives and Deliverables

The main objective of this endeavour was to implement a data protection process, implementing the principles identified in the General Data Protection Regulation, directly impacting the various internal processes of a local administration company, whose primary mission is to focus on culture and its dissemination to diverse audiences.

This effort was successful in the terms identified, and there are still some positive risks that materialised into success through careful implementation of risk management, such as the completion of a scientific article under the theme "Implementation of GDPR: Learning with a Local Administration Case Study" (F. Martins et al., 2020).

Another objective that was achieved, again identified throughout the project in the risk management document as a desirable risk, was to secure some stakeholders' commitment to being the first local government company to comply with the GDPR in Braga.

With everything that has been mentioned, whether in terms of costs, time and objectives, all the assumptions were met and thanks to greater maturity and exposure, it was possible to achieve other gains that were identified throughout the project, gains that would have more external visibility than others that would have more internal visibility.

6.3.5 Metrics and Lessons Learned

The project Implementation of GDPR on a Local Administration Company was accomplished within a very well-defined timeframe and is still under the scrutiny of the various project team members or even the company's senior management team.

The benefits mentioned above and the deliverables helped to create a huge commitment, which would always be validated by the effort that we had been making throughout the various actions. Given that on numerous occasions, the exposure that these documents brought to each of the stakeholders would help the project manager guarantee the alignment of the entire effort.

We can see that the maturity levels were already satisfactory by applying the respective maturity assessment matrix for implementing GDPR on a Local Administration Company project.

Table 30 – Maturity Level Matrix of the GDPR Project

Elements	Attributes to Score	Maturity Level | GDPR Project
Approach	Sound	3
	Integrated	3
Deployment	Implemented	3
	Systematic	3
Assessment and Review	Measurement	3
	Learning	4
	Improvement	3

The primary differences, in relation to the previous action and what would come of it, are present throughout all the elements and attributes scored, which helps to justify the methodology used and demonstrate the intensity of the effort described.

The sound attribute received a maturity rating of three because we believed that some effort would still be needed to define the process in the early stages and also to identify the needs of the respective stakeholders. This was not least because we would not be well prepared for the inclusion of new stakeholders throughout the project. This situation led to several changes to some documents to ensure the resilience of the developed framework.

As mentioned earlier, introducing new stakeholders identified some gaps that had to be quickly filled in, which also led to the integrated, implemented, and systematic attributes having a rating of three points.

The evaluation may not seem ideal at first glance, three points instead of four points, but we believe that this approach was well supported by the policy and strategy, interesting levels of implementation were achieved, and the respective development was also carried out in a way that met the Action Research and structure outlined here and was executed correctly.

In the assessment and review elements, we achieved three points on all attributes except the learning attribute with four, although we met all the objectives and rigour implemented here since all the effort made is evidenced here.

In the measurement attribute, we have several checkpoints where the impacts of the changes implemented would be measured, both by the group of researchers of this PhD and with the project management team, since the latter would also be aligned with expectations created in the final result of this effort that would run in parallel.

The second and third attributes, learning and improvement, also had a rating of three due to the identification of enhancements and respective adjustments to the theory worked on here, which will be detailed in the next section of this document.

The learning attribute received a high value, four, resulting in the opportunity to identify the best practices and improvement opportunities.

A final evaluation of the action is carried out using the following matrix (Table 31):

Table 31 – Results of the action related to the GDPR Project

#	Metric Scope	Dimension of Analysis	Metric Name	GDPR Project
C1	Complexity	Requirements	Requirements Complexity	4
C2		Cost	Total Predicted Investment	1
E1	Engagement	Quality	Governance	3
E2		Engagement	Communication	3
E3		Quality	Stakeholder Influence	4
E4		Requirements	Change Management	4
E5		Performance	Project Team Experience	3
M1	Monitoring	Quality	Changes to the Team Project	2
M2		Cost	Project Cost	95%
M3		Time	Time Deviation	107%
TP1	Team Perception	Requirements	Team Perception	complete

metric scope not yet implemented at this phase

Complexity was assessed as having a maximum level in terms of requirements, given that we are talking about a project whose main requirements were identified by a European regulation that would not take into account the organisational culture, so the complexity of this understanding and then moving on to business analysis led to complex requirements.

The cost was given a score of one, as it was considered a project of simple complexity, as the respective project classification process allows.

Observing engagement regarding governance, we set a rating of three since the project has a certified project manager on its internal team, even though he is not the project manager but an integral part of the project team and a project coordinator in the technology area.

In the communication dimension of the analysis, the majority of the work was "pull" since there were numerous concerns about deadlines. The project manager, therefore, established a criterion of proximity so as to be able to follow all the phases more closely. There was also, albeit to a lesser extent, interactive communication, but this only occurred towards the end of the project after the project had been set up and some quick wins had been obtained.

Throughout the project, great attention was paid to the stakeholders. As observed in the matrix of influence and impact of the stakeholders of this project, we consider it correct to have a maximum evaluation since they would have the influence and capacity for the whole project, outside the possibilities offered by the lower points.

Assessing something more quantitative and focusing on change management, there were 4 changes imposed by greater knowledge of the project and detail of various requirements or even imposed by top management.

On the last point of engagement and performance evaluation, the average experience in years in projects of this kind would be 3 years.

Now, evaluating the various components of monitoring and starting with quality, which is impacted by changes to the project team, we had two changes, one of which was the entry of an important stakeholder, a technological partner, and the other which was the replacement of one of the members due to illness.

Looking at the cost and comparing the initial cost with the final cost, we saw a reduction in the value associated with the internal cost because we were able to safeguard the hours related to the requirements survey of the existing technological implementation more efficiently.

The project's time deviation, around 7%, was due to a delay in disseminating the results and closing the project. This dissemination of the results refers to communicating them to the company's workforce, as they would be an interested and targeted part of this project.

Considering all the points raised and why the project was slightly delayed, we believe that the team's final perception of the initial requirements, those that were added and those that were successful, is complete, hence the extremely positive final evaluation.

This evaluation was carried out according to the constraints of the project in question and its particularities, such as its inherent challenges, like the project team and the entire ecosystem. For the above reasons, this evaluation is only suitable for this project, so it is unlikely to be represented in other projects and should not be transposed to others.

6.3.6 Theory Adjustments

By constantly applying the methodology to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, bringing the metrics and lessons learnt from the previous action and applying the theory adjustments from it, it was possible to expand this framework and reach, as far as we could see at that moment, an interesting level of maturity.

Despite this, and considering the methodology applied, we made some improvements according to the analysis of the entire system and the lessons learnt.

Thus, the main changes were the addition of the following templates/artefacts to our framework dedicated to extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management, which can be seen below:

- Stakeholder template
    - Having a template that helps document every stakeholder's presence and impact on a project is vitally important. It also helps to enrich the elements present in the Business Case and Project Charter, keeping them accessible only to those with a deep management profile within the project to maximise tactics for dealing with each stakeholder.
- Change Management
    - The need for and subsequent importance of a template to manage change focused on stakeholders and all associated impacts became apparent throughout this project. When we carry out a stakeholder matrix, concerning influence and impact, introducing a tool

of this kind is inevitable to mitigate or minimise the undesirable damage that could come from each of the stakeholders.

- Stakeholder evaluation
    - Maintaining a document that clearly and systematically allows stakeholders to be evaluated is extremely important. Unfortunately, this became clear when we identified a technical and human constraint offered by a stakeholder, a technology supplier, which was quickly resolved by the constant presence throughout the project of a document that allowed performance to be assessed according to the benefits, or lack thereof, of any stakeholder throughout the project.

New requirements have also been added to the content of some artefacts to allow for greater coverage of their scope, for example:

- Business Case
    - A cost classification process was developed and subsequently included to enhance the classification of the type of project when creating the business case to make the methodological method of identifying costs even more methodological.
- Project Charter
    - A document template was considered necessary in the previous action and has undergone some evolution in the application during this action. The following point has been included here: Project Authority and Governance

The adjustments to the applied matrix made during this project include the inclusion of the following metrics, which were also evaluated during the project in question:

- Metric Scope: Complexity
    - Cost – Total Predicted Investment
- Metric Scope: Engagement
    - Requirements – Change Management
- Metric Scope: Monitoring
    - Quality – Changes to the Team Project

- Metric Scope: Team Perception
    - Requirements – Team Perception

Some changes were only noticeable after a certain period, having already reached the end of the project, which resulted from a critical analysis of all this effort.

- Metric Scope: Engagement
    - Engagement – Communication
    - Performance – Project Team Experience

As mentioned in the previous action, these changes will be, by default, used to interpret the project results that will be targeted for further implementation. This procedure is in line with that carried out in the previous action since the final matrix was applied, where all the metrics present were also evaluated.

6.3.7 Conclusions

According to our project classification process, the second action still relates to a simple project, in terms of complexity, and we are confident of how far we have come and still have to go.

The results obtained from this action demonstrate the convenience offered by the methodology applied here, the Action Research, be it in the various iterations that we provoke for later analyses, in the changes created in the theory developed or even in the conclusions obtained and the assurance that this whole process inflicts.

Here, we have made significant changes to the metrics used, using an approach based on EFQM's RADAR model. We have evaluated this action and evolved it to the rigour desired for the following actions.

We have qualitative, quantitative, and quantifiable qualitative metrics, and we can have evaluation approaches that may be subject to some scrutiny but will always be justifiable from the perspective given in each of the actions, which are always presented as unique, just as a project should be.

The enabler in the action detailed here would be the closure of the project on which it focused, either with success or failure, especially as this doctoral effort would easily accommodate the total time associated with the project in question.

Unquestionably, the enabler must be associated with the main and secondary objectives, so comparing the results of this action with the respective objectives of this doctoral endeavour, and therefore, for the Implementation of the GDPR Project and comparing with the various objectives, we have:

- (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.
    a. The objective was partially met since we are present before an action whose objective already considered this analysis by default and allowed us to implement the framework developed, although it is at a low maturity level.
- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.
    a. Partially met since implementing the analysis in this action helped evolve the respective framework for managing stakeholders in innovation projects, further maturing already existing points.
- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
    a. The objective was partially achieved as we believe that this endeavour still needs some maturity and effort to improve the process developed here.
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
    a. The objective was met since changes were created and implemented in the theory, thus allowing it to evolve and be implemented in the next action.
- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.
    a. Negative evaluation since no output for guideline definition was obtained.

Considering the above evaluation and the effort taken into this analysis, we assume that the model and strategy used during the following action are validated.

6.4 Action 3 | Traffic Flow Prediction Using Public Transport and Weather Data

With the increase in vehicles on the roads, traffic jams in urban areas have become a problem. There are countless figures, all of which can be quantified, considering that traffic jams cause damage in several areas: they pollute the environment, cause high noise levels, and risk public health.

There is a need to manage traffic in such a way as to avoid congestion on the roads without increasing the number of infrastructures, which has proved challenging. New traffic management solutions have been developed to combat these difficulties, such as one of this project's deliverables: Traffic Flow Prediction Using Public Transport and Weather Data.

For this project, various techniques were used, such as data mining, databases, operating data consisting of historical and real-time operating data from a public transport company, and data from complementary datasets on the environment, calendars of events in the city or special events.

Using various inputs and perspectives in totally innovative research, it was hoped to predict traffic behaviour to optimise bus routes and divert traffic according to forecasts of large vehicle crowds in certain locations. This would reduce fuel consumption and costs, reduce the carbon footprint, and improve forecasting and reliability in the public transport offer.

In addition to its innovative characteristics, this project saw the protagonist of a complex relationship between a university, a research unit, several researchers, and a public company in the field of public urban transport.

The action envisaged here has the solution delivery as a stopping condition, considering the time and classification of this project.

6.4.1 Purpose of Action

Traffic flow forecasting is a critical problem in intelligent transport systems (Zhao et al., 2017). Nowadays, cars and other vehicles are not just a convenience, and they are practically a necessity. They are so common that a family usually has more than one, in fact there is around one car per person, even though most can carry multiple passengers.

With the development of the social economy, the number of vehicles in cities is increasing dramatically, and roads are running out of capacity to keep up, causing traffic jams (Zhao et al., 2017). The transport sector is relevant in this work due to the growing number of vehicles in large cities, making good traffic management challenging in the context of Smart Cities (Ning et al., 2017).

Undoubtedly, this mobility revolution has brought new comfort and made it possible to share knowledge and experiences even before the Internet became a popular means of communication. These means of locomotion also made it easier to travel to workplaces, which could now be further away from home.

However, over time this mobility has perhaps become too widespread. Several vehicles occupy the roads simultaneously, and at peak times, there are enormous delays, dozens of times longer than the time needed to travel that stretch of road.

Every year, traffic jams cause millions of losses in fuel, pollution, and reduced productivity (Ma et al., 2015). For a passenger transport company, in this case buses, traffic jams are a real problem. Routes are planned according to the usual schedule, and the bus is expected to arrive at the scheduled time at the bus stop.

However, there can be abnormal days when traffic intensity increases. For example, suppose many road users decide to stay home because the previous day was a public holiday and the following day is a weekend, the so-called bridges. In that case, traffic is expected to be less concentrated, which could lead to a bus running ahead.

On the other hand, if there's a football match in the area and the local fans are heading to the stadium, the traffic in that area will probably be more concentrated, which could lead to the bus being delayed. These kinds of unforeseen events happen more often than you might think.

There are constant changes in the road, in general, every day there are accidents, every day in some part of the city there is an event and every year there are public holidays in the calendar, and the weather varies constantly, which in itself also influences traffic flow.

Sometimes public transport isn't considered a business; it's just seen as a service that is always there. However, in reality, every person waiting at the bus stop is a customer. If this customer often misses the bus or is late because of the bus, they will potentially look for alternatives. Perhaps they'll start using their car, exacerbating the traffic problem. It is necessary to optimise the routes offered so that these problems are minimised.

This project proposes the use of Data Mining techniques and methodologies, which can be applied to different data sets (Kantardzic, 2011), on historical data, so that it is possible to obtain a model that, knowing what kind of events and weather will occur in the future or are occurring at present, can indicate the traffic that will be experienced so that a public transport company can choose the best route to take to serve all customers and at the same time not frustrate them with surprising events. It is hoped that the models obtained by this approach will form part of the core of the decision support system for the client.

6.4.2 Practical Action

The concepts of Smart City and Smart Mobility are recent and closely linked. Many cities around the world are in a state of constant flux and exhibit complex dynamics (Caragliu, del Bo, et al., 2011). This complexity and constant flux make them difficult to manage.

The need for control and management solutions arose, and the solution to this problem came with the name Smart City. The label Smart City should point to intelligent solutions that allow modern cities to thrive (Caragliu et al., 2011. However, like cities that need to be improved, the concept of Smart City is complex and needs to be improved.

A Smart City is a vague concept that is not well defined; however, all definitions agree that a Smart City is an urban space that tends to improve the daily lives of citizens (Negre et al., 2015). Although there is no formal and generally accepted definition of a Smart City, the ultimate goal is to make better use of public resources, improve the quality of services offered to citizens, and reduce the operating costs of public administrations (Zanella et al., 2014).

As proposed by this project, an urban IoT system can bring many benefits to managing and optimising traditional public services, such as transport and parking, lighting, and surveillance(Zanella et al., 2014).

The part that brings intelligence to the transport section is what is known as Smart Mobility. A project of the Centre for Regional Science at the Vienna University of Technology, according to the article "Smart Cities in Europe", Caragliu et al. (2011) identify Smart Mobility as one of the six main axes of Smart Cities.

According to the author of "Cagliari and Smart Urban Mobility: Analysis and Comparison", it is stated by Chun & Lee (2015) that Smart Mobility is a concept of smarter and more comprehensive future traffic

service in combination with smarter technology (Garau et al., 2016). These authors have implied that Smart Mobility is a part of the overall system of a Smart City, and it is within Smart Mobility that transport-related improvements fall.

It is evident here, especially considering innovative projects involving numerous stakeholders, that the first concepts of Smart Cities apply, relating to the existing standard and the correct pursuit of objectives inherent to any project in a city, whether in a street from a specific neighbourhood or something more comprehensive, exploring pilot projects or a mass implementation.

This project, Traffic Flow Prediction Using Public Transport and Weather Data, seeks to develop a solution to help predict traffic flow with a Machine Learning approach to what is traffic prediction in the city of Braga through regression-type models. The data used as a basis for this project is various geographical points collected by buses from Transportes Urbanos de Braga (TUB) merged with information about events, holidays and weather.

Several projects have tried to address the problem of predicting traffic flow, for example, and according to the existing business case to justify this project, we have reached the conclusion that traffic flow (in the present) is strictly related to the flow felt in the previous minutes (in the past), so this previous data on traffic flow can be used to predict future traffic.

There are numerous studies and results from a variety of perspectives, such as:

- predicting speed using data from thousands of vehicles every two minutes, using Neural Networks and Bayesian Networks (Fusco et al., 2016);
- short-term traffic flow prediction through the modelling of the effects of construction zones, events and accidents on the traffic flow (Polson & Sokolov, 2017), using Deep Learning;
- prediction of the travel time in urban areas using multiple variables instead of relying only on positional data (Liu et al., 2009), using a model based on a Neural Network;
- prediction of traffic on some roads in the UK up to fifteen minutes in the future (Goves et al., 2016), also using a model based on a Neural Network.

This project would differentiate itself from previous perspectives by offering a new approach to urban traffic forecasting, seeing it from a smart mobility perspective for an entire city that wants to be smarter, and by allowing the decision-maker to see the forecast not only in the short term, but also in the long

term, allowing this information to be used in a multitude of different applications, such as the creation and optimisation of routes for a public transport company.

Most work in this area is carried out in controlled locations, using only vehicle data as a source of information, which is not enough for an urban transport company. Therefore, this innovative project will expand traffic forecasting to an entire medium-sized city, and forecasts that use the surrounding environment as a source of information are expected to be more accurate.

6.4.3 Stakeholders

In the field of project management, as mentioned earlier in this document, stakeholders are fundamentally defined as entities or individuals who can affect project outcomes or who are affected by them (S. Freeman & Cavusgil, 1984).

This broad definition highlights the importance of identifying and managing stakeholders as a cornerstone of effective project management practices. When approaching innovation projects, in line with the diverse existing literature, the complexity of this task is significantly amplified in the context of innovation projects, which are inherently characterised by their new ventures and the collaborative efforts required to bridge the gap between theoretical research and practical application.

These projects often involve many players, from academic researchers and engineers from public or private companies, research units and various individuals, each with different interests and levels of influence and impact.

An illustrative example of this complexity is represented in this Traffic Flow Prediction Project, which, in addition to the result, also seeks to promote collaboration between a university, a research unit and a public company.

A project manager leads this project from a public company, who is also a researcher at the same university, an element of this PhD effort, and specialises in the field of mobility, supported by a team of specialist engineers, and with researchers from the university playing a key role in the development work.

This composition of stakeholders shows a multi-layered scenario in which the relevance and influence of each stakeholder group is subject to continuous evolution throughout the project's lifecycle, leading to the expression of the importance of correct management of all these stakeholders, which would enhance corrections and improvements to the theory that the group of researchers in this doctoral project are

looking for in the framework of extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management.

We believe that identifying the stakeholders in an innovation project for Smart Cities of this type requires a differentiated approach, recognising not only the direct contributors, but also those indirectly affected by the project's results.

As mentioned earlier, the list of stakeholders has undergone some changes, as has the respective assessment of influence and impact. Therefore, the assessment that can be seen in Table 32 refers to the final stakeholder list and the respective evaluation with the level of maturity at the project closure.

Table 32 – Traffic Flow Prediction Project - Stakeholder Evaluation

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Business Governing Layer and Steering Layer	Project Sponsor	Owner	Internal	8	6
Business Governing Layer	Investors	Influencer	External	8	8
Business Governing Layer	Partners	Influencer	External	8	7
Steering Layer and Directing Layer	Project Owner	Management	Internal	9	9
Steering Layer and Directing Layer	Technical Experts	Technical	Internal / External	8	9
Directing Layer	Technology Providers	Provider	External	6	5
Directing Layer and Managing Layer	Project Manager	Management	Internal / External	8	8
Managing Layer	Academic and Research Institutions	Management	External	6	8
Performing Layer	Project Team	Operational	External	7	7
External Influent Entities Layer	Utility Providers and Infrastructure Managers	Provider	External	4	6

Unlike the previous projects, here we have the presence of three project sponsors whose level of influence is extremely high, but whose impact on change is a little more reserved, since other stakeholders belong to these sponsors who are experts on the topic being addressed. The stakeholders mentioned here are the Minho University, LabSecIoT and Transportes Urbanos de Braga (TUB) (Figure 30).



Figure 30 – Traffic Flow Prediction Project - main stakeholders – Minho University, LabSecIoT, TUB

The low impact assumes that the project should follow the scope and objective defined during the business case, thus limiting the change imposed by these stakeholders.

As investors, we have DigitalSign, LabSecIoT, and TUB, as they have offered the necessary conditions, whether financial, physical, or human, for making this innovation project possible.

The partnerships are related to interested partners whose attention was obtained as the project progressed. In addition to those mentioned above, we also have Zoom, Smart City Business Institute and various schools at Minho University.

The project owner will be the principal researcher, whose return on the project would be the highest, in personal and professional terms, since he would derive from the success, in addition to the solution, the success of his master's thesis and also the publication of a scientific paper.

The experts, including the researcher of this doctoral project, are stakeholders with a high level of influence and impact in the face of change, as they can alter the project according to the assumptions that lie ahead.

Due to the nature of the project, the technology suppliers and external organisations have low levels in both classifications.

The project manager and the project team also have high levels, since the exploratory nature of the project and the numerous steering meetings would make them highly important for the project and the timings involved.

Finally, there are the respective academic institutions and research units, which have little influence throughout the project but have a strong impact on change, particularly because of how they control and allocate funds, which could lead, for example, to the project being closed ahead of schedule.

Accordingly, and in line with the table above, Figure 31 shows a graphic representation of each stakeholder's respective identification and the possible influence and impact of each on this smart city innovation project.

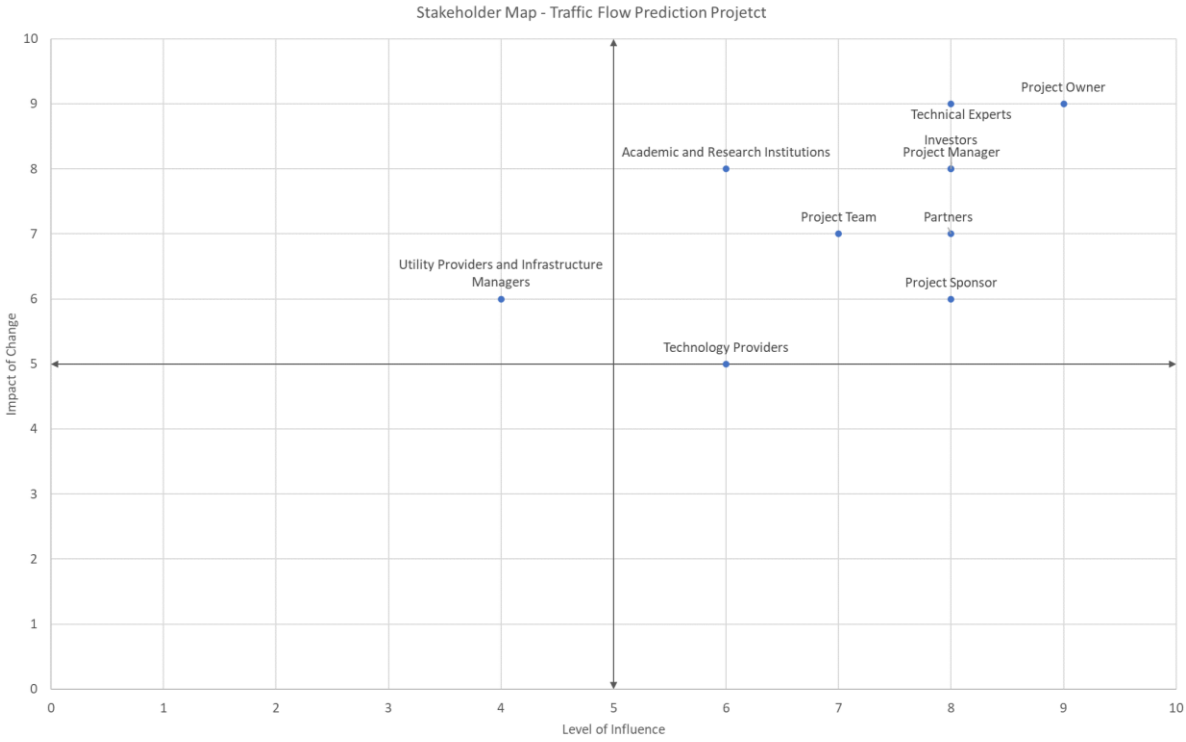


Figure 31 – Traffic Flow Prediction Project - Stakeholder Map

Stakeholder management in innovation projects represents a complex but critical challenge, requiring meticulous identification and continuous reassessment of the importance of stakeholders.

The dynamic nature of these projects, particularly those that bridge the gap between academic research and practical application, requires a flexible and reactive approach to stakeholder engagement. By recognising and addressing each stakeholder group's evolving influences and interests, project managers can strengthen collaborative efforts, mitigate conflicts, and steer the project towards successful outcomes.

Thus, effective stakeholder management emerges not only as a component of project management best practices but also as a strategic imperative that underpins the innovative process itself.

6.4.4 Project Management

In the quest to enhance urban mobility and mitigate the adverse effects of traffic congestion, the intersection of academic research and practical application presents a fertile ground for innovation, and it will be no different when we seek to implement an exploratory methodology such as Action Research that would see an effort being based on a theory that was still trying to find its footing.

Considering all the experience gathered previously with simple projects, the approach in this endeavour would be to port the model currently in use and use it as a baseline for the project and as a launch pad for stakeholder management in innovation projects.

Therefore, by identifying the assumptions that help our project classification process, we have the following:

- Expected cost: < 75 000,00 €
- Available at suppliers: no
- Are there partners/suppliers available to research: yes

Thus, according to the aforementioned project classification process, we have identified the following path (light pink) and the respective innovation project classification.

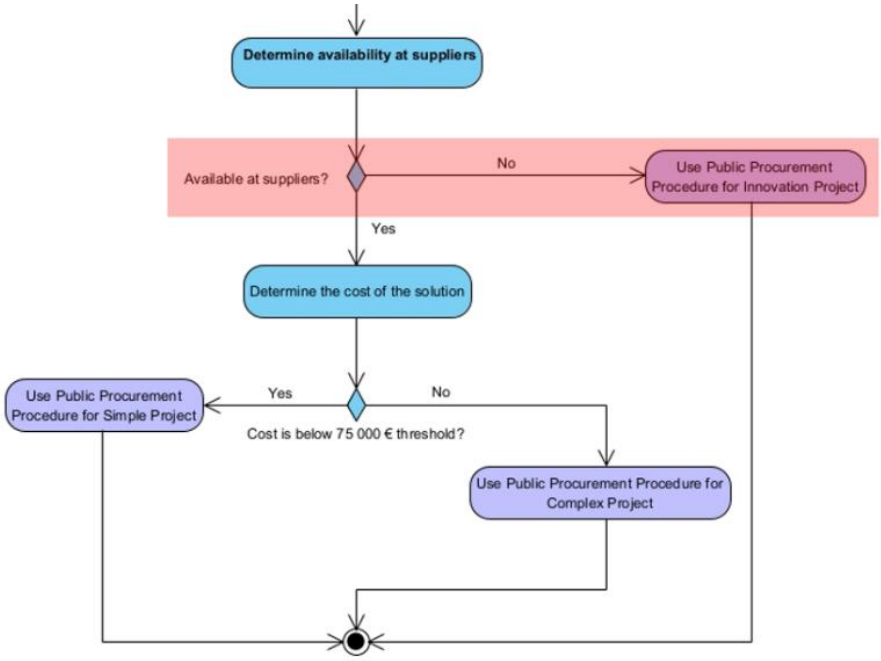


Figure 32 – Innovation Project Classification of the Traffic Flow Prediction Project

In the diagram, we have also used blue to represent the initial logical process and purple for the sub-processes that are an extension of the previous one and, therefore, deserve more detail. More details on the process mentioned for innovation projects can be consulted in Chapter 7.

The respective classification will directly impact the type of methodology to be implemented in project management, which can be seen below.

Project Management Methodology

This project introduces a collaborative project between several stakeholders, each one of them with very different scopes, aimed at developing a predictive model for traffic flow. The initiative offers extensive datasets derived from bus operations, weather conditions, and calendar events to forecast urban traffic patterns.

The Traffic Flow Prediction Project embodies an integrative effort to employ our framework to extend project management practices for innovation projects in Smart Cities. By focusing on stakeholder management, the project contributes to the enhancement of the aforementioned framework, especially when considering a different type of project, such as an innovation project.

The methodology employed here is already aimed at validating a model developed with all the experience gained in previous projects, such as simple projects, and in the various experiments carried out during the doctoral process and which would have the following path defined at this point:

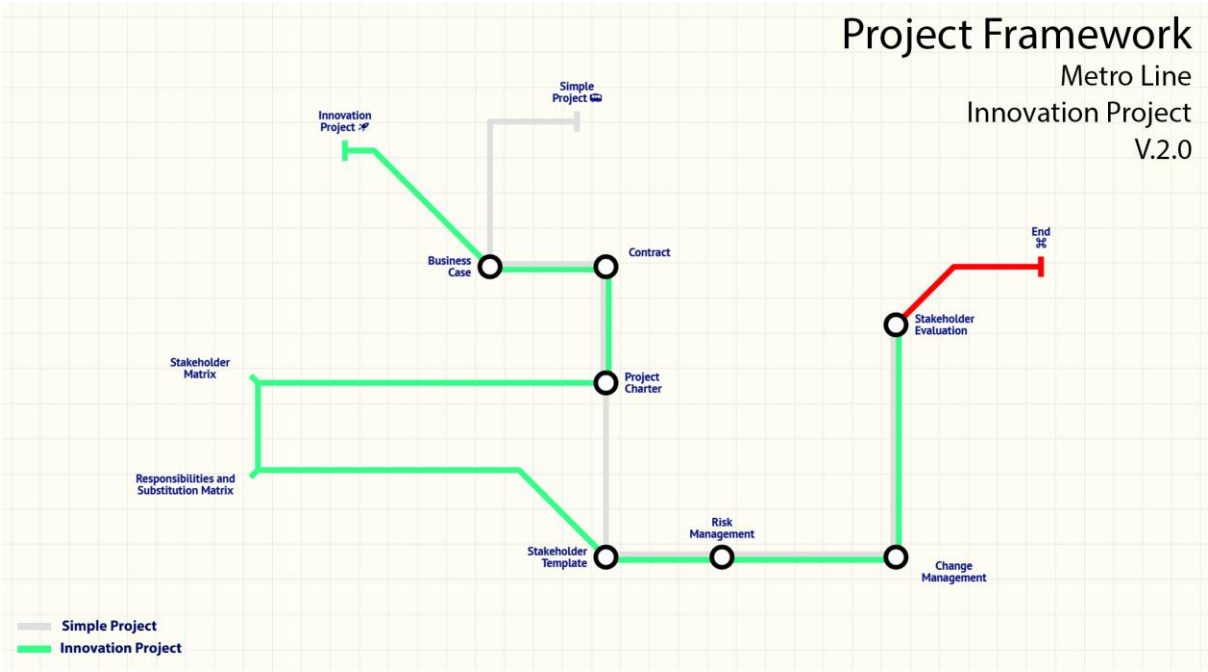


Figure 33 – Metro Line for Innovation Project V.2.0

For this type of project, we opted to maintain precisely the "route" taken in the simple projects and increase the complexity to incorporate the necessary new perspectives. We also created some rules in a project that, being complex, will thus present a more volatile and exploratory environment in terms of the concepts and technologies used.

The model shown in the image above subsequently resulted from all the validations and evolutions of it, which we will now describe as the artefacts used initially and those that were subsequently considered valuable or essential after or during the project (Table 33).

Table 33 – Framework evolution and documents applied to the Traffic Flow Prediction Project

Traffic Flow Prediction Project			
	Have	Nice2Have	Justified2Have
Business Case	x		
Contract	x		
Project Charter	x		
Stakeholder Matrix			x
Responsibilities and Substitution Matrix			x
Stakeholder Template	x		
Risk Management	x		
Change Management	x		
Stakeholder Evaluation	x		

By evaluating each of the documents used on simple projects and found necessary through experimentation or even research during this PhD effort, the analysis aimed to determine which documents were required for the additional project management process to prevent unnecessary effort from being put into stakeholder management in an already complex project management system.

Thus, we have the following analysis (Figure 34) according to the criteria defined and detailed above, where we will try to give some more detail to the changes offered to this new path:

Table 34 – Traffic Flow Prediction Project Framework Documents

Traffic Flow Prediction Project Framework Documents	
Business Case	The Business Case was a document that outlined the rationale, benefits, costs, and risks associated with the project. It justified the investment of resources and effort into the project by demonstrating its expected value and alignment with strategic goals. Creating a compelling Business Case was crucial for securing buy-in from key stakeholders.
Contract	A contract, especially considering innovation projects, is crucial for defining the terms of the partnership, roles, responsibilities, deliverables, timelines, and how intellectual property (IP) will be handled. A contract outline ensures that all parties understand their commitments and responsibilities clearly, providing a solid foundation for a successful collaboration.
Project Charter	A Project Charter is a formal document that authorises the start of a project, outlining its purpose, objectives, scope, and the roles and responsibilities of all participants. Creating a detailed Project Charter ensures that all parties involved have a shared understanding of the project's goals, scope, and operational framework. It served as a reference document throughout the project lifecycle, helping to keep the project on track and aligned with its original objectives.
Stakeholder Matrix	A fundamental document for innovation projects, given its collaborative nature between various stakeholders, several coordinators and top management elements. For innovation projects, we consider that a stakeholder matrix is not just a tool for stakeholder management, it is a critical component of project planning and execution.

	It facilitates informed decision-making, enhances communication, and supports aligning project objectives with the interests and influences of those involved or affected. This document was an evolution in its insertion, as it was not considered in the initial model, but was deemed pertinent after the challenge inherent in the presence of numerous stakeholders and to the conclusions obtained during the research of the subject
Responsibilities and Substitution Matrix	This document explicitly defines who is responsible for each task or deliverable, who must be consulted or informed about decisions or progress, and who is accountable for the task's completion. This clarity helps prevent overlapping responsibilities and covers all necessary tasks without redundancy. Due to the blending of organisational structures, roles are naturally complex in a collaborative project involving different organisations. This document helps delineate roles across organizational boundaries, ensuring that all project members understand their roles and how they fit into the larger project team.
Stakeholder Template	A Stakeholder Template is a document designed to systematically capture and organize key information about stakeholders involved in a project. It enhances the effectiveness of stakeholder management by ensuring that all relevant data is consistently collected and easily accessible to all stakeholders.
Risk Management	Incorporating a stakeholder approach into risk management recognises the importance of stakeholders' perceptions, interests, and influences on the project's risk. This approach not only identifies and mitigates risks inherent to project execution but also those arising from stakeholder interactions and expectations.
Change Management	Incorporating a stakeholder approach into change management accentuates the importance of understanding and addressing the needs, expectations, and concerns of all stakeholders affected by changes within a project. This means actively involving stakeholders in the change process to ensure their buy-in and support, which is crucial for the successful implementation of changes.
Stakeholder Evaluation	Stakeholder evaluation, which is considered a stakeholder approach, involves systematically assessing stakeholders' engagement, influence, satisfaction, and impact. For a complex initiative like the Predictive Traffic Flow Project, evaluating stakeholder dynamics was critical to ensuring that the project remained aligned with the needs and expectations of all involved parties.

All the previous documents were applied, maintained, and updated throughout the various phases of this project, such as preparation and initiation, planning, execution, and closure. This approach helped to keep the project within the desired success metrics, where the secondary objectives were also achieved, because of efforts related to the risk management that led to them.

As mentioned earlier, we introduced around five new artefacts to describe the necessary way to manage innovation projects, with a focus on stakeholder management and the desired success rate.

Investment and Costs

Costs are a key part of a business case, while innovation projects often focus on creating new products, services, or processes, they still need to be economically viable to justify investment and resource allocation.

However, for the project in question, the difficulty here is to obtain all the costs in all the participatory elements of the project, so this limitation only covers the costs associated with the company Transportes Urbanos de Braga.

Thus, for the Traffic Flow Prediction Project, we only considered the costs associated with the human resources involved in the project management, expert monitoring and specialised human resources in heavy vehicle engineering. These requirements can be seen in Table 35.

Table 35 – Traffic Flow Prediction Project - HR costs

Human Resources	% Allocated to the Project	Working Days	Days of Absence	Days Worked	Daily Hours	Hours Worked	Base Salary	Salary Total Time	Cost / Hour	Cost/Hour RDI	Total Value*	Social charges	Total Amount with Charges
Internal Resource #1 (int)	70%	63	0	63	3,0	189	1 800,00 €	3,00	28,57 €	20,00 €	3 780,00 €	4 687,20 €	8 467,20 €
Internal Resource #2 (int)	25%	60	0	60	1,5	90	1 200,00 €	2,86	38,10 €	9,52 €	857,14 €	1 062,86 €	1 920,00 €
Internal Resource #3 (int)	25%	40	0	40	1,5	39	1 050,00 €	1,90	51,95 €	12,99 €	500,00 €	620,00 €	1 120,00 €
Total Value* = Hours Worked * Cost/Hour										**Total:**	5 137,14 €	6 370,06 €	11 507,20 €

Throughout the project, the costs involved also took into account the focus given to publicising a scientific article that would evaluate the project results and which would have been used as an enabler for specific objectives, such as positive exposure for the project. These costs, together with the totals, can be seen in Table 36.

Table 36 – Traffic Flow Prediction Project - total costs

Special Requirements	Total Amount
Article Publication	1 200,00 €
Travel	200,00 €
	1 200,00 €

Public Procedure	Total Amount
Contract Value	0,00 €
Total	0,00 €

Total Project Cost	Total Amount
Contract Value	0,00 €
Internal Human Resources	11 507,20 €
Special Requirements	1 200,00 €
Total	12 707,20 €

While innovation projects may involve uncertainties and risks that make cost estimation challenging, we propose a tool to manage costs effectively throughout the project lifecycle. By integrating cost considerations into the overall project management approach, organisations can enhance the likelihood of successful innovation outcomes while ensuring financial sustainability.

It should be noted here that the costs would not determine the project's classification, but rather the absence from the market of a solution like the one developed here, allowing the classification as an innovation project. The cost component is always present in various documents with different levels of detail and access, such as the business case, contract, project charter, team charter and change management.

Time and Schedules

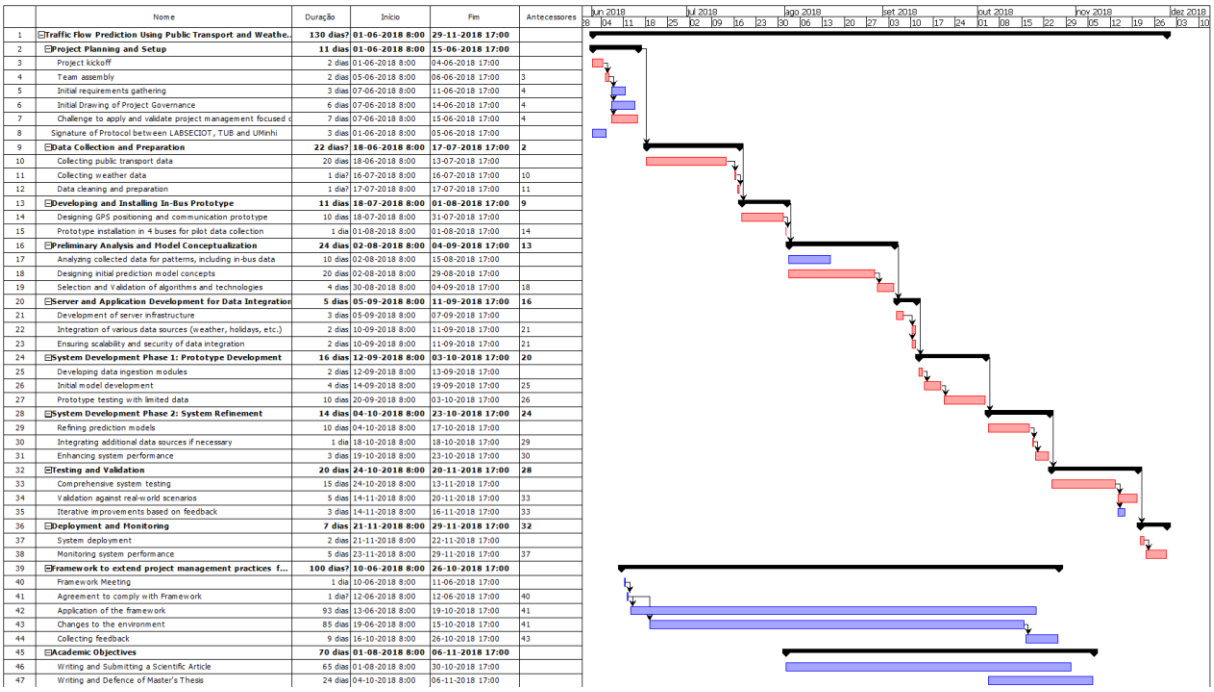
Incorporating a stakeholder approach into time management involves recognising and accommodating the diverse time-related needs, expectations, and constraints of all project stakeholders.

During the Traffic Flow Prediction Project, this approach ensured that the project met its deadlines and respected its stakeholders' time commitments and priorities, enhancing collaboration and support.

This approach facilitated smoother project implementation and built stronger relationships with stakeholders, particularly the operational ones, enhancing their engagement and support for the project.

We are aware that this approach of working out the time schedule according to the availability and alignment of the stakeholders is not always feasible and would rarely be possible to accommodate, but it was one of the elements inserted into this project in order to assess their reaction to this flexibility.

Thus, the timetable that resulted from the availability of all those involved and with the accommodation of all the changes suggested by them at the beginning and during the project is the one that can be seen in Figure 34.



	Nome	Duração	Início	Fim	Antecessores
1	**Traffic Flow Prediction Using Public Transport and Weathe..**	**130 dias?**	**01-06-2018 8:00**	**29-11-2018 17:00**	
2	**Project Planning and Setup**	**11 dias**	**01-06-2018 8:00**	**15-06-2018 17:00**	
3	Project kickoff	2 dias	01-06-2018 8:00	04-06-2018 17:00	
4	Team assembly	2 dias	05-06-2018 8:00	06-06-2018 17:00	3
5	Initial requirements gathering	3 dias	07-06-2018 8:00	11-06-2018 17:00	4
6	Initial Drawing of Project Governance	6 dias	07-06-2018 8:00	14-06-2018 17:00	4
7	Challenge to apply and validate project management focused c	7 dias	07-06-2018 8:00	15-06-2018 17:00	4
8	Signature of Protocol between LABSECIOT, TUB and UMinhi	3 dias	01-06-2018 8:00	05-06-2018 17:00	
9	**Data Collection and Preparation**	**22 dias?**	**18-06-2018 8:00**	**17-07-2018 17:00**	**2**
10	Collecting public transport data	20 dias	18-06-2018 8:00	13-07-2018 17:00	
11	Collecting weather data	1 dia?	16-07-2018 8:00	16-07-2018 17:00	10
12	Data cleaning and preparation	1 dia?	17-07-2018 8:00	17-07-2018 17:00	11
13	**Developing and Installing In-Bus Prototype**	**11 dias**	**18-07-2018 8:00**	**01-08-2018 17:00**	**9**
14	Designing GPS positioning and communication prototype	10 dias	18-07-2018 8:00	31-07-2018 17:00	
15	Prototype installation in 4 buses for plot data collection	1 dia	01-08-2018 8:00	01-08-2018 17:00	14
16	**Preliminary Analysis and Model Conceptualization**	**24 dias**	**02-08-2018 8:00**	**04-09-2018 17:00**	**13**
17	Analyzing collected data for patterns, including in-bus data	10 dias	02-08-2018 8:00	15-08-2018 17:00	
18	Designing initial prediction model concepts	20 dias	02-08-2018 8:00	29-08-2018 17:00	
19	Selection and Validation of algorithms and technologies	4 dias	30-08-2018 8:00	04-09-2018 17:00	18
20	**Server and Application Development for Data Integration**	**5 dias**	**05-09-2018 8:00**	**11-09-2018 17:00**	**16**
21	Development of server infrastructure	3 dias	05-09-2018 8:00	07-09-2018 17:00	
22	Integration of various data sources (weather, holidays, etc.)	2 dias	10-09-2018 8:00	11-09-2018 17:00	21
23	Ensuring scalability and security of data integration	2 dias	10-09-2018 8:00	11-09-2018 17:00	21
24	**System Development Phase 1: Prototype Development**	**16 dias**	**12-09-2018 8:00**	**03-10-2018 17:00**	**20**
25	Developing data ingestion modules	2 dias	12-09-2018 8:00	13-09-2018 17:00	
26	Initial model development	4 dias	14-09-2018 8:00	19-09-2018 17:00	25
27	Prototype testing with limited data	10 dias	20-09-2018 8:00	03-10-2018 17:00	26
28	**System Development Phase 2: System Refinement**	**14 dias**	**04-10-2018 8:00**	**23-10-2018 17:00**	**24**
29	Refining prediction models	10 dias	04-10-2018 8:00	17-10-2018 17:00	
30	Integrating additional data sources if necessary	1 dia	18-10-2018 8:00	18-10-2018 17:00	29
31	Enhancing system performance	3 dias	19-10-2018 8:00	23-10-2018 17:00	30
32	**Testing and Validation**	**20 dias**	**24-10-2018 8:00**	**20-11-2018 17:00**	**28**
33	Comprehensive system testing	15 dias	24-10-2018 8:00	13-11-2018 17:00	
34	Validation against real-world scenarios	5 dias	14-11-2018 8:00	20-11-2018 17:00	33
35	Iterative improvements based on feedback	3 dias	14-11-2018 8:00	16-11-2018 17:00	33
36	**Deployment and Monitoring**	**7 dias**	**21-11-2018 8:00**	**29-11-2018 17:00**	**32**
37	System deployment	2 dias	21-11-2018 8:00	22-11-2018 17:00	
38	Monitoring system performance	5 dias	23-11-2018 8:00	29-11-2018 17:00	37
39	**Framework to extend project management practices f...**	**100 dias?**	**10-06-2018 8:00**	**26-10-2018 17:00**	
40	Framework Meeting	1 dia	10-06-2018 8:00	11-06-2018 17:00	
41	Agreement to comply with Framework	1 dia?	12-06-2018 8:00	12-06-2018 17:00	40
42	Application of the framework	93 dias	13-06-2018 8:00	19-10-2018 17:00	41
43	Changes to the environment	85 dias	19-06-2018 8:00	15-10-2018 17:00	41
44	Collecting feedback	9 dias	16-10-2018 8:00	26-10-2018 17:00	43
45	**Academic Objectives**	**70 dias**	**01-08-2018 8:00**	**06-11-2018 17:00**	
46	Writing and Submitting a Scientific Article	65 dias	01-08-2018 8:00	30-10-2018 17:00	
47	Writing and Defence of Master's Thesis	24 dias	04-10-2018 8:00	06-11-2018 17:00	

Figure 34 – Schedule and Gantt Chart for the Traffic Flow Prediction Project

Accommodating numerous availability on the part of all the stakeholders involved made it possible to guarantee greater availability of these same resources. However, we feel that the additional time of almost two weeks added to the project does not represent justifiable gains (15% more time).

This situation arises from reconciling different agendas according to the availability or convenience of all the stakeholders, causing a high level of effort on the part of the project manager in the respective communication, which is not only dynamic but also constantly present to guarantee the most concise understanding possible.

For instance, efforts must be made to assess their time-related needs and constraints by understanding their schedules, deadlines, and availability. This includes identifying critical periods for stakeholders, such as fiscal year ends, public holidays, or other significant events that might impact their involvement or expectations regarding the project timeline.

Therefore, evaluating this change and the gains made, we believe that the social benefits would not justify the costs inherent in the project, specifically the time, not least because the product's final quality did not benefit.

Observing the timetable, this project lasted 130 days and followed all the assumptions previously defined in terms of schedule.

Objectives and Deliverables

The core of this project is a system that, using data mining, would use the historical data provided by the TUB to determine what, under identical conditions, could happen in the future with regard to traffic flows, thus supporting decision-making to avoid congestion that could occur at non-crucial points on the routes of the respective public transport offer.

It was hoped that this system could be adapted to work with new data and with data that reaches it in real-time, thus obtaining a more accurate and responsive forecast for a city that, like a living organism, never stops.

In addition to the aforementioned TUB data, this project can be framed within a Smart City framework. Working on this project within LabSecIoT, a research unit that owns a system called EDGE, ensures that its qualitative value increases.

Through EDGE, we see the addition of data obtained through various partnerships such as city councils, garbage collection companies, and transport companies (such as TUB), thus offering very varied data, always relating to cities and their traffic flow and the constraints that affect it, such as temperature and humidity and how these indicators can influence traffic.

The contribution of this work is represented in Figure 35 (blue polygon) and the respective integration and development of the solution, and it is hoped that this developed solution can be at least a construct of what the future will be with connected devices in a Smart City.



Figure 35 – Traffic Flow Prediction Project Deliverable (adapted)

Taking advantage of this opportunity, the final product obtained was the creation of another module for the EDGE, which contains information on traffic flow, especially on TUB routes. To obtain this information, data mining of the data provided by the TUBs was used to create the model and the real-time data available on the EDGE (which also includes Internet of Things (IoT) devices placed on the TUB buses, assuming the planned evolution of this system) was used to predict what will happen in both the short and long term.

This effort was successful in the terms identified, and there are still some positive risks that materialised into success through careful implementation of risk management and the stakeholder matrix, such as the completion of a scientific article under the theme "Traffic Flow Prediction Using Public Transport and Weather Data: A Medium Sized City Case Study" (Silva & Martins, 2020).

6.4.5 Metrics and Lessons Learned

This was the first project whose implementation of the framework to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, was affiliated as a mandatory requirement, whose exploratory objective would be aligned with all the stakeholders present.

Thus, the thoroughness associated with the analysis was much more intense and subject to greater scrutiny, given that the maturity of the proposed framework and the researchers on the subject developed here would be substantialy greater.

With greater rigour associated with the analysis, we still have an extremely satisfactory result, maintaining high levels at various points, as seen in Table 37.

Table 37 – Maturity Level Matrix of the Traffic Flow Prediction Project

Elements	Attributes to Score	Maturity Level | GDPR Project
Approach	Sound	4
	Integrated	3
Deployment	Implemented	4
	Systematic	4
Assessment and Review	Measurement	3
	Learning	3
	Improvement	3

Now, to evaluate all the components, we'll start with the sound attribute, which we give a maturity rating of four because it was fully implemented from the start of the project until its conclusion and to the knowledge of all the stakeholders involved.

This perspective of applying the solution developed here and how it is carried out, based on the Action Research methodology, guarantees an evaluation of four in maturity in the attributes implemented and systematic.

Since this project would be the third project in which we would implement our framework, we used the influence associated with the position and prominence in terms of project management to have the initial feasibility of the implementation of the said framework on this project, even though it did not yet have the desired maturity, but which would reach a higher level with these efforts. This is why the integrated attributes have a maturity rating of three.

It is precisely because maturity has not yet been fully achieved that the measurement, learning, and improvement attributes receive a rating of three in the maturity attributes for each.

A final evaluation of the action is carried out using the following matrix present in Table 38:

Table 38 – Results of the action related to the Traffic Flow Prediction Project

#	Metric Scope	Dimension of Analysis	Metric Name	Traffic Flow Prediction Project
C1	Complexity	Requirements	Requirements Complexity	4
C2		Cost	Total Predicted Investment	3
E1	Engagement	Quality	Governance	3
E2		Engagement	Communication	4
E3		Quality	Stakeholder Influence	2
E4		Requirements	Change Management	6
E5		Performance	Project Team Experience	5
M1	Monitoring	Quality	Changes to the Team Project	2
M2		Cost	Project Cost	100%
M3		Time	Time Deviation	115%
TP1	Team Perception	Requirements	Team Perception	complete

In most cases, a project with innovative and exploratory characteristics is complex, from the requirements that are defined and subsequently validated, to the definition of new objectives according to the comfort that the whole team finds in the more agile management that this type of project requires. Even so, and evaluating the formula of this metric, we see this project as having a high internal impact, due to the direct correlation between the product developed here and the expected improvements in terms of route optimisation and resource allocation.

Evaluating the costs and their classification was challenging, as we had only realised the cost from one stakeholder's perspective. However, the type of project and the product developed led us to classify this as an innovation project, hence the rating of three.

Considering the metric scope involvement and its five dimensions of analysis, we have governance a rating of three, given that we would have a certified project manager on the team whose leadership would be associated with the delegation of competencies inherent to a project manager.

Communication was a mix of push and interactive (predominant), this turned out to be a much-needed requirement as we were experimenting with scheduling and timeline management, and the way communication was managed was vital.

Stakeholder influence: we felt that stakeholders would have an influence on the respective project phases and timings. Change management and its value of six is directly related to the previous dimension, due to the changes brought about by the same stakeholders and the clarification of specific project requirements throughout the project. The average experience of the project team would be five years.

The follow-up of a project always has its respective monitoring and analysis dimensions, so from the quality perspective and in its dimension that assesses the number of changes to the project team, we have recorded two changes, which represent the addition of two elements to the project in the role of specialists. Cost and time, because of constant attention to these two metrics, have behaved as expected and have not changed from what was initially planned, having been carried out in full and without time or cost deviation, both representing a 100% rating.

Evaluating the final metric of the team's perception, considering the monitoring carried out and the involvement of the various stakeholders, by using steering meetings and project status meetings, the team's perception of the fulfilment of all the objectives and requirements identified was complete.

This evaluation was carried out according to the constraints of the project in question and its particularities, such as its inherent challenges, like the project team and the entire ecosystem present here.

For the above reasons, this evaluation is only suitable for this project. It is unlikely to be represented in other projects and should not be transposed to others.

6.4.6 Theory Adjustments

Throughout this project, we carried out more experimentation activities, which led to various adjustments, particularly in defining the process for stakeholder-focused project management. This was due to greater comfort, higher confidence among the researchers in the research being carried out, and a more in-depth knowledge of the Action Research methodology.

Proper stakeholder management in innovation projects is only possible after understanding the success factors inherent in this effort. According to Fernandes et al. (2023), the main factors in stakeholders' perception of success in research and development projects are:

- Senior management commitment;
- Effective communication;
- Stakeholder engagement;
- Good leadership;
- Clear & realistic goals;
- Mutual trust and respect;
- Teamwork;
- Clear roles and responsibilities.

This helps facilitate the development of strategies and plans to ensure the fulfilment of essential critical successful factors, thus increasing the odds of attaining a successful project (Fernandes et al., 2023).

Taking this into consideration, and as mentioned earlier, the assumption here was that we would take the process developed for simple project management and experiment throughout the project by adding various documents and different perspectives, so according to the analyses carried out and feedback obtained, this led to the addition of the following templates/artefacts:

- Stakeholder Matrix
    - The stakeholder matrix stands out as an essential tool in the project manager's arsenal, particularly in stakeholder management. Its strategic application enables stakeholders' identification, prioritisation, and engagement efficiently and effectively. In the complex interaction of interests and influences that characterizes contemporary projects, the stakeholder matrix provides a structured approach to navigating stakeholder dynamics, thereby enhancing the potential for project success.
- Responsibilities and Substitution Matrix
    - Responsibilities and Substitution Matrix emerges as a critical tool for delineating roles, ensuring continuity, and enhancing stakeholder engagement throughout the lifecycle of

a project. This discussion elaborates on the theoretical underpinnings, practical implications, and strategic importance of integrating a Responsibilities and Substitution Matrix into project management practices. The precise delineation of roles and responsibilities and the identification of substitutes ensure that all stakeholder efforts are aligned with the project's objectives. This alignment is crucial for efficiently allocating resources and achieving project goals within stipulated timelines.

- Team Charter
    - The Team Charter is a foundational document, pivotal for delineating the governance structure, roles, and expectations within a project team. It is integral to effective project management, bridging the gap between theoretical stakeholder management principles and practical project execution strategies. It ensures that all project activities are aligned with stakeholder expectations, facilitates efficient governance, and promotes a collaborative project environment. Our experience helped us identify that the team charter exemplified a critical tool for engaging stakeholders, managing resources, and navigating the complexities of project execution.
- Communication Plan
    - Considering the diversity of stakeholders, both companies and human elements, it is necessary to define a communication process. The presence of a Communication Plan brings a strategic implementation that ensures that stakeholder communications are purposeful, targeted, and effective, underpinning the project’s capacity to meet its objectives.
- Stakeholder Engagement Toolkit
    - This toolkit comprises a collection of strategies, practices, and tools and is designed to facilitate effective engagement with project stakeholders, emerging as an important framework for navigating the intricate setting of stakeholder relationships.

Considering that the matrices have not seen the addition of more attributes, perspectives or dimensions, efforts have been made to increase the rigour of the respective assessment of all attributes due to greater maturity in managing this project and future projects.

6.4.7 Conclusions

The development of a structured stakeholder management framework is indispensable in the context of innovation projects. It serves as a strategic tool for navigating the complexities of stakeholder dynamics and a catalyst for raising an environment where innovation can thrive.

The Traffic Flow Prediction Project stands at the confluence of academic inquiry and practical application, offering significant contributions to urban planning, transportation engineering, and data science.

It addresses a critical gap in the existing literature by comprehensively analysing the intricate factors influencing urban traffic flow. Collaboration between different stakeholders enriches the research with theoretical depth and operational insights, ensuring the development of a robust model grounded in empirical evidence and applicable to real-world contexts.

Companies incrementally recognise the value of collaborating with universities and the innovation capacity they offer (Fernandes et al., 2021). Research and development activities are seen as essential inputs for innovation and are encouraged by governments (Fernandes & O'Sullivan, 2021) to boost national competitiveness and wealth creation, leading directly to a more favourable attitude towards these efforts by all public bodies.

A project, its evolution and the changeability of all external and internal factors, using the stakeholder identification and classification process developed, it is possible to carry out a granular analysis of how the relevance of stakeholders can change as the project progresses from conceptualisation to implementation.

The changing nature of the relevance of stakeholders in smart city innovation projects requires a dynamic approach to managing direct and indirect stakeholders. Regular stakeholder management and analysis becomes imperative, allowing project leaders to adapt their strategies in response to changing power dynamics and emerging interests, a factor considered in creating various processes such as the stakeholder identification and classification process in question.

Such analyses facilitate targeted communication strategies, ensuring all stakeholders remain involved and informed, favouring a collaborative environment conducive to innovation. In addition, project leadership must remain alert to potential conflicts arising from divergent stakeholder interests, employing proactive conflict resolution techniques to maintain project cohesion.

By ensuring that stakeholder interests are meticulously managed and aligned with project goals, the framework to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, enhances the project's capacity for successful innovation.

It is unquestionable that the enabler must be associated with the main and secondary objectives, so comparing the results of this action with the respective objectives of this doctoral endeavour, and therefore, for the Traffic Flow Prediction Project, and comparing with the various objectives, we have:

- (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.
    a. This is the first action where the main goal was achieved. We are present before an action whose objective is already considered in this analysis by default, allowing us to implement the developed framework more maturely. The respective research method allowed for it to evolve into a final model for innovation projects.
- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.
    a. Achieved partial success in the secondary objective in that it boosted the development of the global framework in this area and also implemented the know-how brought from the previous action.
- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
    a. The objective was partially achieved as we believe this endeavour still needs some maturity and effort to improve the process developed here.
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
    a. Met partially the objective since changes were created and implemented to the theory, thus allowing it to grow and be implemented in the next action.
- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.
    a. The objective was met since changes were created and implemented to the theory to incorporate the theme of Smart Cities in the framework. A small chapter was also introduced in this thesis (subchapter 4.3).

Considering the evaluation above and the effort taken into this analysis, we consider that the model and strategy used during the following action are validated.

6.5 Action 4 | Braga Urban Innovation Laboratory Demonstrator

The Braga Urban Innovation Laboratory Demonstrator (BUILD) project is a living lab that aims to foster an urban environment open to innovation in Braga, north of Portugal.

The BUILD project, part of the Living Laboratories for Decarbonization program and supported by the Portuguese Government's Ministry of the Environment (Figure 36), through the Environmental Fund, is an urban intelligence project that creates an environment of innovation with the support of scientific and strategic partners, as well as having a high impact on civil society.



Figure 36 – Presentation of the BUILD project with the Assistant Secretary of State for Mobility, José Mendes

The BUILD project, which cost 800,000 euros and is 49.4% co-financed, began in April 2018 and will reach its final stage in 2022. It promotes the development, validation, and testing of new technologies, services, and their applications in a real context, intending to reduce greenhouse gas emissions and carbon intensity from the activities and services carried out in this space.

6.5.1 Purpose of Action

The general objectives of the BUILD project are those of a Living Laboratory for Decarbonization, seeking to promote active citizenship, raise awareness among the population of the benefits of more sustainable behaviour, and the appropriation by the local community of the new technologies experienced in the area where the project is being implemented.

In terms of the economy, the aim was to provide a real-world test area for technological solutions developed by companies, both public and private, and by the scientific community, thereby promoting innovation and attracting investment through partnerships with national and international companies and institutes.

In the context of public management, it aimed to encourage the demonstration of integrated technological solutions in a real context that would lead to decarbonization, increase efficiency and reduce energy consumption, ensuring the replicability of these pilot tests for the entire city of Braga and also the elasticity to be successfully introduced in other cities with many different characteristics, thus creating a new concept of city that is more innovative, sustainable, inclusive and resilient, always with a focus on improving the quality of life of the community.

6.5.2 Practical Action

The BUILD project represents a complete project made up of numerous endeavours. Given the various projects with shared resources, it could almost be considered a portfolio of projects.

The main objective of the component with which we will be involved is to develop an urban platform and its respective integrations in terms of existing verticals or those to be introduced by the BUILD project.

When we research urban areas, we realise that all those areas worldwide are experiencing unprecedented growth, leading to complex infrastructure and resource management challenges. An integrated urban platform that consolidates data from various city operations, such as building monitoring, energy and water usage, traffic flow, public transport systems, and environmental conditions, can provide comprehensive insights to address these challenges effectively.

All these themes represent the various layers that make up a smart city, without anyone representing greater or lesser importance, but rather something whose sum represents something much greater than the isolated parts, implying a systemic and aggregated behaviour by its managers.

The integration of diverse urban data sources on a single platform offers multiple benefits:

- Improved Decision Making: Real-time data empowers city officials to make informed decisions quickly, reducing response times in critical situations such as public safety and disaster response;
- Enhanced Public Services: By analysing integrated data, cities can optimise public transport routes, reduce energy consumption, and manage water resources more efficiently, benefiting the community;
- Economic Benefits: Streamlined operations and resource savings lower city expenditures, while infrastructure modernisation can attract business investments and enhance the city's economic profile;
- Environmental Sustainability: Effective data use helps monitor and manage environmental impacts, aiding cities in achieving sustainability goals and improving quality of life.

With these premises in mind, it is then necessary to define the key components of an urban management platform, which involves determining the scope of the project in question, without jeopardising future projects that could be integrated into this solution.

Thus, for the challenge proposed here, we have the integration of the following sources of information and core requirements:

- Data Sources: This platform will incorporate data from IoT sensors in buildings, GPS data from public transport, traffic cameras, and environmental sensors;
- Technology Infrastructure: Utilizing cloud computing for storage, advanced data analytics for processing, and vigorous cybersecurity measures to protect the data integrity and privacy;
- User Interface: Designed to be user-friendly, it will provide customised dashboards for different stakeholders, including city planners, emergency services, and the general public;
- Integration Complexity: Overcoming the technical challenges of standardizing and integrating heterogeneous data sets from multiple sources into a cohesive platform;
- Scalability and Maintenance: Ensuring the platform can evolve with advancing technologies and expanding city needs without significant overhauls.

The simplified architecture that has been proposed can be seen in Figure 37, where an effort has been made to describe the respective sources of information and interaction at a high level in the mentioned diagram.

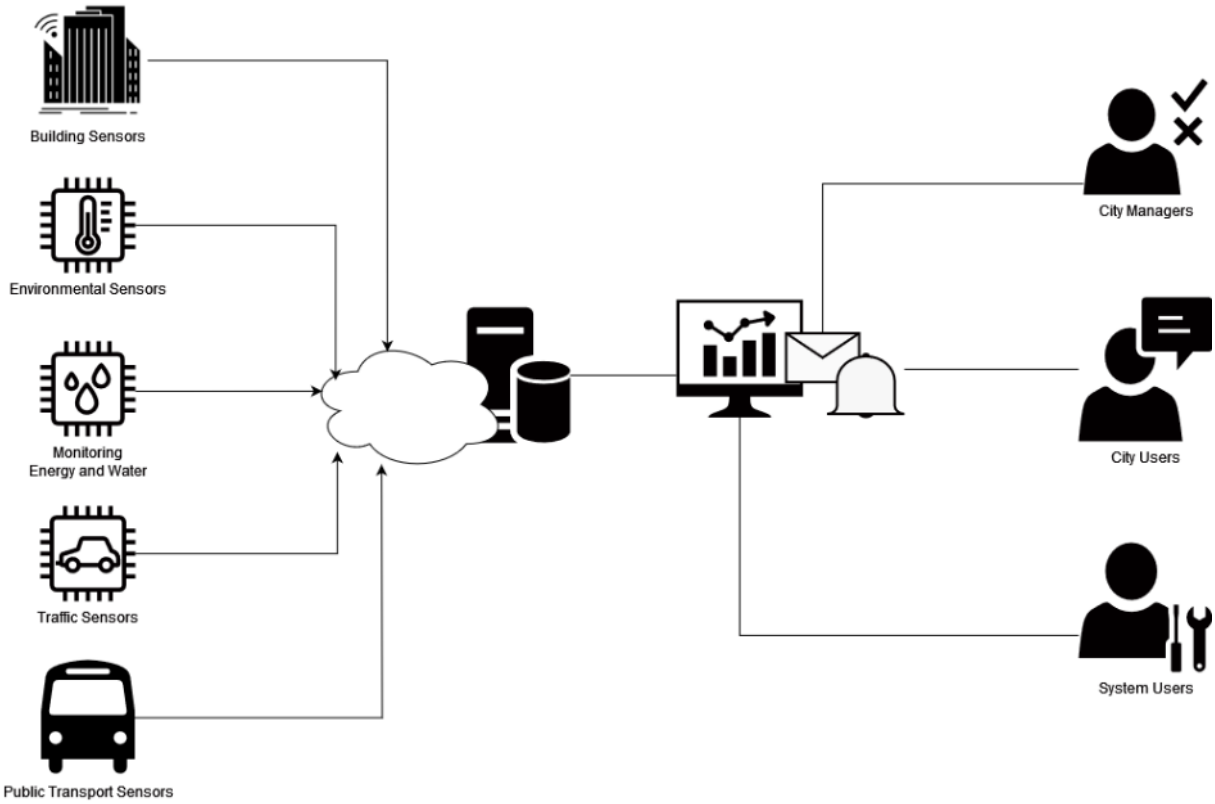


Figure 37 – BUILD Project Architecture

Developing an integrated urban platform is significant in managing city infrastructures and resources. By embracing this technology, Braga can enhance its operational efficiency, improve residents' quality of life, and achieve sustainability targets.

The strategy implemented in the actions described here involves identifying the stop condition resulting from the application of the Action Research methodology, which may, for example, be:

- Temporal: definition of a period of time in which changes are planned and then implemented to assess their impact and relevance;
- Objectives: to achieve certain goals, whether related to the doctoral project or the project itself, which can be successful or unsuccessful.

The action envisaged here has the delivery of the first phase of the urban platform and its verticals as a success stop condition, knowing that failed intermediation after 6 months of all the effort will also be a stop condition in the failure factors.

6.5.3 Stakeholders

The success of an urban platform depends critically on the active participation and collaboration of a wide range of stakeholders. These stakeholders include many entities, such as local government entities, technology providers, data professionals, public transport authorities, utility companies, residents, community groups, academic researchers, and non-governmental organisations. Each group plays a vital role in the platform's development, implementation, and utilization, bringing unique interests and contributions that must be recognised and harmonized.

Any current project will inevitably be compared with other projects from the past, and the same will happen with future ones, especially when experience is crucial for the respective managers and their comfort with the various methodologies applied.

This is a project that, due to its complexity, size and impact on the management of a city, has a number of unique characteristics and proximity to the various stakeholders, given the exploratory nature of the different use cases defined here, but also due to the favourable exposure that the project can create within various national and international organisations, both public and private.

As mentioned above, the level of detail will be limited and exclusive to the scope of inference of the technological components described here, knowing in advance that the global project would be even larger.

It should also be noted that the project had several coordinators of the effort, who would have numerous stakeholders under their influence and who would follow their own methodology according to their governance model.

Taking the above as an acceptable constraint, the stakeholders that would be identified and evaluated in the BUILD project are under the inference of the researchers and the company they would represent, would these stakeholders be public or private organisations as well as research units (Figure 38).



Figure 38 – BUILD Project - Main Stakeholders
República Portuguesa, Fundo Ambiental, Município de Braga, IBM, TUB, CCG

This project had two distinct phases in terms of project management. The first phase was marked by a project manager from one of the organisations, whose responsibilities were assigned to him by the main stakeholder (Braga Municipality) but who would be changed during the project.

This change led to a second phase of project management in which the assigned project manager would be a member of Transportes Urbanos de Braga and who, once again, would be one of the researchers on this doctoral project.

The list of stakeholders listed here, Table 39, has undergone some changes throughout the project, particularly when the project manager changed due to a more in-depth analysis following the researcher's implementation of the framework under development.

Table 39 – Build Project - Stakeholder Evaluation

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Business Governing Layer and Steering Layer	Project Sponsor	Owner	Internal	9	9
Business Governing Layer	Government Officials and Policymakers	Influencer	External	9	9
Business Governing Layer	Investors and Financial Institutions	Influencer	External	8	8
Business Governing Layer	International Organisations and Partners	Influencer	External	8	6
Steering Layer and Directing Layer	Project Owner	Management	Internal	8	7
Steering Layer and Directing Layer	Technical Experts and Consultants	Technical	Internal / External	7	7
Directing Layer	Technology Providers and Vendors	Provider	External	5	5
Directing Layer and Managing Layer	Project Manager	Management	Internal / External	8	7
Managing Layer	Project Management Team	Management	Internal / External	6	5
Managing Layer	Academic and Research Institutions	Management	External	6	6
Performing Layer	Procurement and Contract Managers	Compliance and Monitoring	Internal	4	3
Performing Layer	Project Team	Operational	External	4	4

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Performing Layer and Regulation Layer	Legal Team	Compliance and Monitoring	Internal	3	3
Regulation Layer	Assessment and Auditing Body	Compliance and Monitoring	Internal	6	6
External Influent Entities Layer	NGO and Civil Society	Influencer	External	3	5
External Influent Entities Layer	Utility Providers and Infrastructure Managers	Provider	External	4	5

Despite the size of the project, we have a fairly traditional model. We have a project sponsor, and as such, their level of influence and impact is the highest. This came to pass during the project with some changes to deliverables and objectives.

Considering that this project is funded by the Ministry of the Environment of the Government of the Portuguese Republic, more specifically through the Environmental Fund, we have identified Government Officials and Policymakers, as well as Investors and Financial Institutions, with high marks for their influence and respective impact on change.

Given the objectives of this project and that we are talking about national funds, there would still be some entities from the European Commission present, but with a relatively low impact on change but a considerable level of influence.

The project owner represents the specific area belonging to Braga City Council, where the main contract managers are located. This justifies the considerably high rating on both points, as seen in the table above.

The project human resources consisted of numerous experts and consultants, particularly at the application stage, which subsequently led to the initiation of this project. Thus, they represent elements with an influence and impact of seven.

Suppliers have a moderate rating of five on both points, given that all the options would have been evaluated initially and only subsequently contracted.

In both phases, the project manager represents the most significant influence and impact on the project and its management.

The project management team and the academic organisations score fairly equally due to their involvement in the same project in their respective areas.

Other stakeholders with similar scores are the contracting officers, the project team, the legal team, non-governmental organisations, civil society, utility providers, and infrastructure managers.

Lastly, the assessment and auditing teams have a high rating, six in the two target elements, as these are the stakeholders who, if the requirements and objectives are not met, can negatively influence the funding available to continue the project.

Accordingly, and in line with the table above, Figure 39 shows a graphic representation of the respective area and the possible influence and impact of each stakeholder mentioned above on the complex BUILD project.

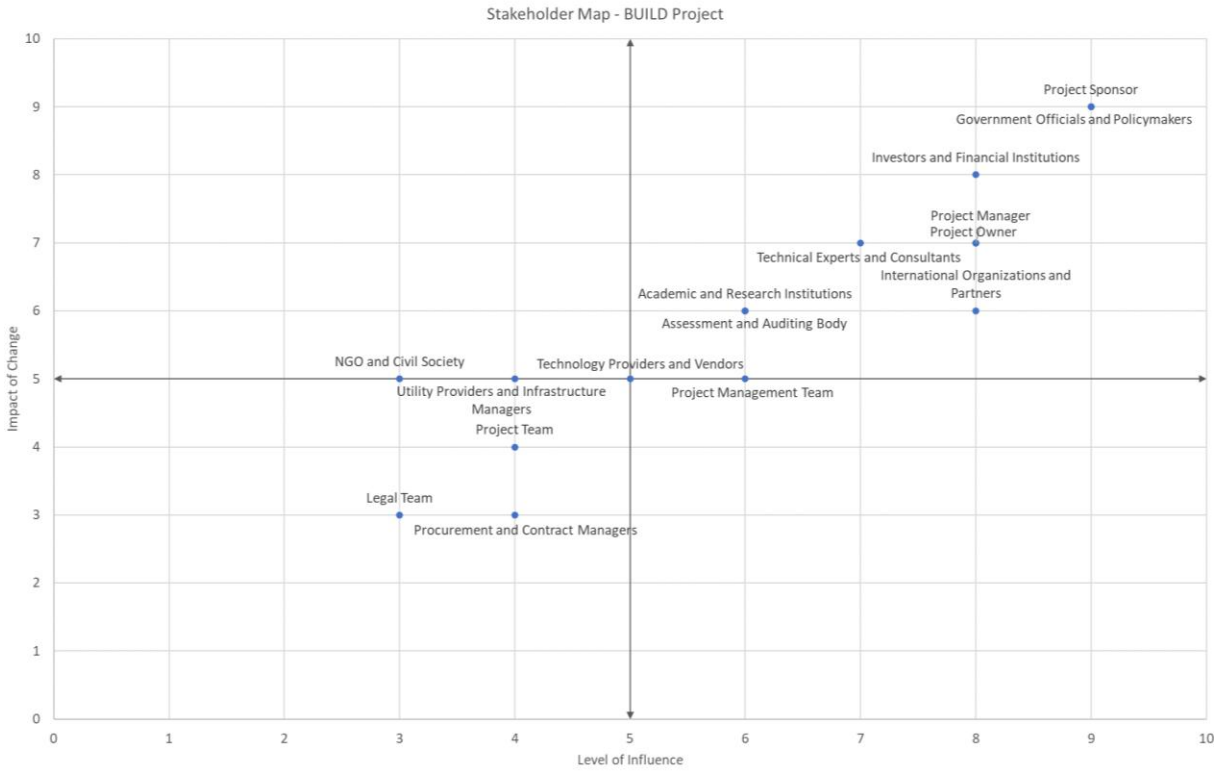


Figure 39 - BUILD Project - Stakeholder Map

With greater assertiveness and strictness in the identification of stakeholders, followed by a more careful analysis of their influence and respective impact on change, we have a map with greater coverage of these two overlapping factors, thus demonstrating greater maturity in the stakeholder identification process of the framework to extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.

6.5.4 Project Management

The BUILD Project represents a transformative approach to city management. By effectively engaging all stakeholders and aligning their roles and interests with the project's objectives, the platform can achieve its full potential, offering significant improvements in urban infrastructure, efficiency, and quality of life. Through this comprehensive stakeholder integration, the project will handle the inherent challenges and realize its vision for a smarter, more sustainable urban future.

Throughout the research carried out during this doctoral project, it has been quite clear that all project frameworks represent a path to be followed to achieve a certain goal. However, it is precisely these frameworks that indicate that a certain level of customisation is required to adapt the chosen framework to the project in question.

In these cases, tailoring is defined by the effort to modify the standard project management processes and methodologies to suit a specific project's unique constraints and opportunities. This may include scaling processes up or down, omitting certain steps that are not applicable, or incorporating additional steps to address specific needs.

Since managing large-scale, complex, and innovative projects is crucial, tailoring is a much-needed effort because these projects often deviate from the norm regarding scope, required technologies, stakeholder expectations, and risk profiles. Using a standard approach without adjustments may not effectively address these unique characteristics.

Following this prerogative, we used the process that existed at the start of the project in its most exhaustive and present version, i.e. the innovative project management model, and thus served as a baseline for what would be the endeavour of the Action Research methodology to ensure its evolution and maturity.

Project Management Methodology

Developing an integrated urban platform involves multiple stakeholders, each with distinct needs and expectations. To manage this complexity, a robust project management methodology is essential. This methodology should focus on technical and operational aspects and prioritize effective stakeholder management to ensure the project's success.

This project, during the period in which this action is taking place, saw a circumstance arise that would lead to a challenging condition in terms of change and its management, and that only substantiates the assumptions that helped justify the subject of this doctoral project.

The departure of a project manager poses significant risks to the continuity and success of a project. In developing an integrated urban platform, the absence of a structured framework for managing this change can aggravate these risks, particularly affecting stakeholder relations and project governance.

If the mere possibility would create discomfort in any project management team, the materialisation of this fear into something real highlighted the gap in project management, particularly in the focus given to stakeholder management and the respective monitoring and follow-up practically and concisely.

The absence of a structured framework for managing this change can exacerbate these risks, particularly affecting stakeholder relations and project governance. As a starting point for this new challenge, we will use as a basis the framework currently developed for innovation projects but with a slight change introduced by the theoretical research carried out, where we would incorporate the Team Charter to create some support in the management of the teams present and which can be seen in the same preliminary version in Figure 40.

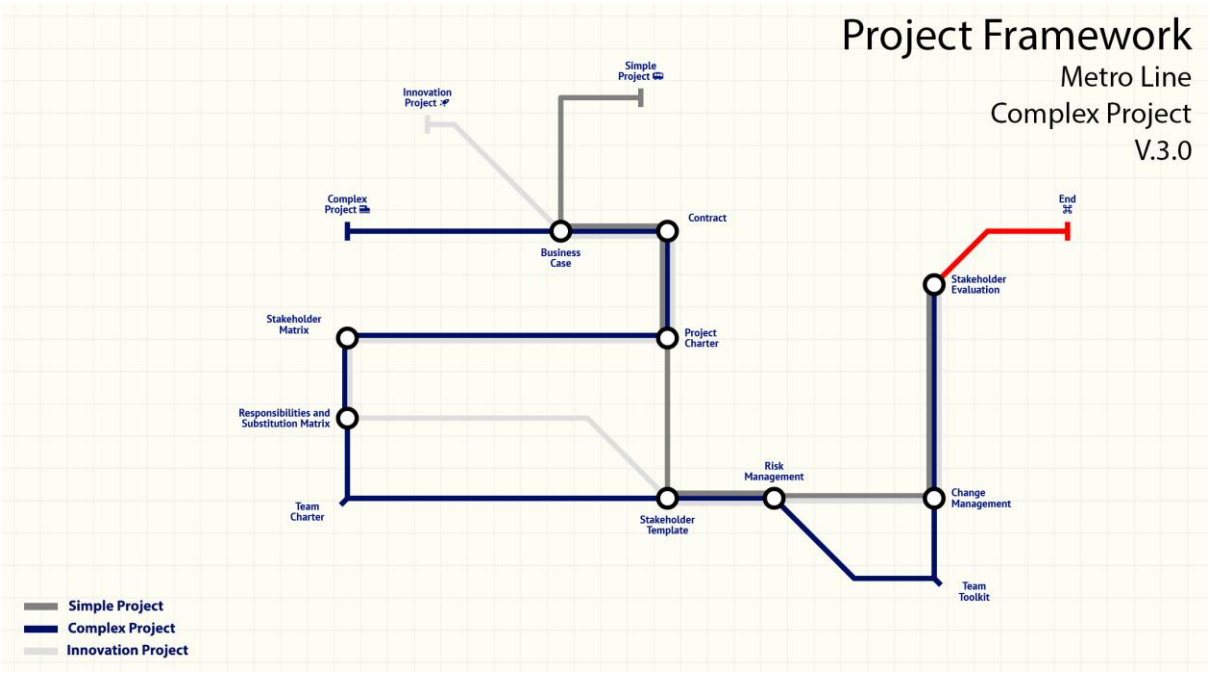


Figure 40 – Preliminary Metro Line for Complex Project V.3.0

When the situation in which the previous project manager would have left the project was detailed, it was clear that the only supporting document, particularly in the initiation phase, would be the Contracts created to substantiate the respective contracts and thus formalise the start of the project.

This project began in April 2018 and was subjected to numerous disruptions and even a stoppage caused by the global pandemic and the infectious disease COVID-19. When we got the project back on track in the second half of 2021, it was the resumption of a cold start, with all the existing teams completely out of sync.

This factor was even more marked by the departure of numerous human resources, including the aforementioned project manager, which led to numerous changes in the project's governance model and the assignment of project management responsibilities to Transportes Urbanos de Braga.

After this assignment of responsibilities to this stakeholder, an individual delegation of responsibilities was made to a member of this stakeholder as project manager, in this case, Rui Martins, one of the research team members for this doctoral project.

This constraint and the lack of material to support the entire project justified the application of the framework to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management, to resume the project and achieve the objectives that were initially defined and would serve as factors in determining its success.

Given that various documents are interlinked in fields and values, it was decided to obtain or fill in each document that forms part of the proposed framework.

The model shown in Figure 40 was the one that subsequently resulted from all the validations of the framework proposed for innovative projects, with a minor change, and that served as a foothold for the challenge brought by a complex project.

The evolution obtained from applying the same framework will now be described, combining the artefacts used initially and those subsequently considered valuable or essential after or during the project (Table 40) through the methodology of Action Research.

Table 40 – Framework evolution and documents applied to the BUILD Project

BUILD Project			
	Have	Nice2Have	Justified2Have
Business Case	x		
Contract	x		

Project Charter	x		
Stakeholder Matrix	x		
Responsibilities and Substitution Matrix	x		
Team Charter	x		
Communication Plan			x
Stakeholder Engagement Toolkit			x
Stakeholder Template	x		
Risk Management	x		
Team Toolkit			x
Change Management	x		
Stakeholder Evaluation	x		

Below can be seen the classification and respective perspectives given in terms of documents and justification (Table 41):

Table 41 – BUILD Project Framework Documents Pt1

BUILD Project Framework Documents Pt1	
Business Case	The departure of a project manager is a essential event that can disrupt project continuity and impact stakeholder confidence. A well-documented business case is essential during such transitions as it serves multiple critical functions, providing a foundation for new leadership and ensuring the project remains aligned with its original goals and business objectives. This event helped demonstrate that a strong business case is indispensable in managing the transition of project leadership effectively. It ensured that the project remained on track, aligned with its original goals, and transparent to stakeholders, thereby mitigating the risks associated with changes in project management.
Contract	The only document that ended up being easily obtained and subsequently used to fill in some documents, even if only in a preparatory way such as the project charter and the stakeholder matrix. Also in this document, and with an analysis of the various prices of the respective public procedures, it was possible to work on and optimise the framework, in terms of project classification, that would present a new path totally dedicated to complex projects.

From this point onwards, it was considered that any effort to obtain additional elements for the project would be fruitless given the numerous unsuccessful attempts to get the necessary elements for correct monitoring, and so all the management documents were created from this point in the BUILD project (Table 42).

Table 42 – BUILD Project Framework Documents Pt2

BUILD Project Framework Documents Pt2	
Project Charter	Considering that a project charter serves as the foundational document for any project, outlining its scope, objectives, and stakeholders, its importance was an enabler for the effort associated with creating it. It provides the formal authorisation for the project and defines the roles and responsibilities of the project team, giving authority to the new project manager. Facing a project charter that was incomplete, to say the least, led to significant challenges, necessitating the creation of a new, comprehensive charter to ensure project success. For a project to thrive and meet its intended outcomes, every aspect of the charter must be meticulously defined and aligned with the project's strategic objectives.

Stakeholder Matrix	Understanding and managing stakeholders is crucial in the lifecycle of any project, particularly one that is complex or even experiencing a change in project management. A stakeholder matrix is vital for identifying stakeholder influence and interest and formulating strategies to effectively manage their expectations and involvement. The absence of this tool could lead to significant challenges, especially during a leadership transition. It provided a structured approach to stakeholder management, ensuring that all parties were appropriately engaged and managed throughout the project's continuation.
Responsibilities and Substitution Matrix	The absence of a Responsibilities and Substitution Matrix could create a significant challenge in project management, especially considering complex projects. This matrix was crucial for defining team roles, and responsibilities, and identifying substitutes for key positions to ensure uninterrupted project progression and its value was recognised by all existing stakeholders, especially during the change management related to the loss of many human resources was still undergoing. This helped to ensure that every team member was clear on their roles and responsibilities and that the project was prepared for any personnel changes without losing momentum or focus.
Team Charter	Creating a Team Charter was considered especially critical in a complex project like this one. This document sets the foundation for team operations, communication norms, and collaborative practices, which are essential for maintaining alignment and productivity. The team charter started with a clear statement of the project's purpose and its specific objectives. This clarity helped all team members understand the overarching goal they were working towards and ensured that every effort was aligned with these goals and that they were contractually obliged. It's the foundation upon which the project's direction is set. Due to its relevance, the same document was introduced during the early stages of the project. This document is classified as restricted to some members to facilitate its scope, although many elements that compose this document will be present in other documents free to all the members.
Communication Plan	We are confident that a well-defined Communication Plan is critical for the success of complex projects. The communication plan was a document that was introduced after some difficulties inherent in communication when 30% of the effort was already accomplished and feedback from users helped determine that the lack of a detailed workflow and document regarding communication was a shortcoming that didn't help with the noise and speed of communication channels. It is a document whose main objective was building a collaborative environment where every participant feels informed, valued, and engaged. This structured approach to communication supports the project's success by ensuring alignment, attending stakeholder engagement, and facilitating smooth and effective communication across all phases of the project.
Stakeholder Engagement Toolkit	A Stakeholder Engagement Toolkit is essential for managing and enhancing interactions with all parties interested in or affected by a project. It provides structured methods and tools to identify, engage, and communicate with stakeholders effectively, ensuring their needs, concerns, and contributions are considered throughout the project lifecycle. This was a necessary document that allowed us to identify some benefits to ensure greater commitment to the project team. This proactive approach to stakeholder engagement enhances project transparency, promotes trust, and contributes to the project's success. This was a confidential document that was mostly used by the project manager.
Stakeholder Template	A Stakeholder Analysis Template is an indispensable tool in managing stakeholder relationships in complex projects, especially those undergoing many changes. It helped systematically capture and organize key information about stakeholders involved in a project, enhancing the effectiveness of stakeholder management by ensuring all relevant data is consistently collected and easily accessible to all stakeholders and maintaining effortless access to all the updated information. Comparing this document to the stakeholder engagement toolkit, this was only available to project team members.
Risk Management	This project substantiated and justified all the effort put into creating and updating any artefact created for risk management. The practical value of risk management in

	complex projects is immense. The PMBOK, PRINCE2, and PM² methodologies provided several inputs that enhanced the efficacy of risk management practices. A stakeholder-centric approach to risk management is particularly effective in complex projects, where stakeholder interests and project outcomes are deeply intertwined.
Team Toolkit	This toolkit is comprised of various methodologies, strategies, and tools, is indispensable for the successful navigation and management of complex projects involving diverse stakeholder groups. Its components, ranging from analytical and communication tools to conflict resolution and adaptive strategies, play a crucial role in ensuring that the project meets its objectives and aligns with its stakeholders' needs and expectations. The effective deployment of this toolkit is essential for the successful execution of complex projects, marking it as a critical area of focus for project managers and their teams.
Change Management	Change management in projects involves preparing, supporting, and helping individuals, teams, and organisations make organisational change. Integrating change management with stakeholder-centric risk management is essential in complex projects, where multiple stakeholders significantly influence project outcomes. This approach ensured that changes were smoothly implemented and stakeholders remained engaged and supportive throughout the transition. Using a structured methodology and focusing on stakeholder engagement helps deal with changes more smoothly.
Stakeholder Evaluation	Once we had reached the trigger to start the shutdown, it became necessary to collect all the inputs and draw up a social assessment of the state of grace of all those involved. By conducting a systemic assessment of all the constraints, we created a document that would enhance the success and the real use of all the lessons learnt, with a greater focus on project management from a stakeholder perspective.

All the previous documents were applied, maintained, and updated throughout the execution phase of this project. However, considering the changes that impacted this project when this action took place, an effort was made to emulate the various stages of a project, particularly preparation, initiation and closure. This approach helped to keep the project within the desired success metrics.

As mentioned earlier, we introduced around four new artefacts to help us manage complex projects, focusing on stakeholder management, with the desired success rate.

Investment and Costs

Throughout the efforts of this doctoral project, the realisation that the careful allocation and management of financial resources are pivotal in delineating the scope, scale, and ultimate success of projects.

Financial considerations are relevant in project management as they influence strategic decision-making, risk assessment, and comprehensive project planning. Projects that require considerable financial costs, typically above the limit of 75,000 euros, are inherently complex and entail extensive operational demands, sophisticated technology applications, significant resource utilization, and a broad spectrum of stakeholders.

This was the assumption made during the project classification process, where projects such as those described above were costly and complex and necessitated a robust management approach to mitigate associated risks and ensure that the financial investments were optimised.

Following the process for project classification developed and matured in the previous actions, we determined the following costs directly with the TUB team from 1 February 2022 to 30 November 2022 (Table 43).

Table 43 – BUILD Project - HR costs

Human Resources	% Allocated to the Project	Working Days	Days of Absence	Days Worked	Daily Hours	Hours Worked	Base Salary	Salary Total Time	Cost / Hour	Cost/Hour RDI	Total Value*	Social charges	Total Amount with Charges
Internal Project Coordinator	35%	60	0	60,00	3	180	2 000,00 €	3	31,75 €	11,11 €	2 000,00 €	2 480,00 €	4 480,00 €
Internal Resource #1 (int)	15%	260	0	260	7,0	1820	2 000,00 €	12,38	13,61 €	2,04 €	3 714,29 €	4 605,71 €	8 320,00 €
Internal Resource #2 (int)	15%	200	0	200	2,0	400	1 600,00 €	9,52	38,10 €	5,71 €	2 285,71 €	2 834,29 €	5 120,00 €
Internal Resource #3 (int)	15%	105	0	105	3,0	315	900,00 €	5,00	14,29 €	2,14 €	675,00 €	837,00 €	1 512,00 €
Internal Resource #1 (int)	15%	260	0	260	7,0	1820	2 000,00 €	12,38	13,61 €	2,04 €	3 714,29 €	4 605,71 €	8 320,00 €
Total Value* = Hours Worked * Cost/Hour										**Total:**	12 389,29 €	15 362,71 €	27 752,00 €

These costs would then be associated with the costs previously identified for executing the entire project since, in our opinion, the internal costs and the new requirements assumed by the TUB stakeholder should be transposed into the project's overall cost (Table 44).

Table 44 – BUILD Project - total costs

Special Requirements	Total Amount
IOC - Intelligent Operations Center	20 000,00 €
Total	20 000,00 €

Public Procedure	Total Amount
Contract Value	800 000,00 €
Total	800 000,00 €

Total Project Cost	Total Amount
Contract Value	800 000,00 €
Internal Human Resources	27 752,00 €
Special Requirements	20 000,00 €
Total	847 752,00 €

This project entails high complexity and risk, particularly regarding time management, cost, scope, and requirements. These factors are closely linked to stakeholder management and the extent to which stakeholders are effectively managed or involved.

The stopping condition of this action, related to success, was the implementation of the urban platform, the involvement of the various stakeholders, and the subsequent implementation of the verticals, which directly impacted costs and the analysis mentioned above.

Complex projects with high investment costs face increased scrutiny from stakeholders, including investors, clients, and regulatory bodies. Such projects require detailed planning, dynamic management

practices, and adaptable governance structures to create management principles with which all stakeholders directly involved can be comfortable.

Time and Schedules

Time management has long been recognised as crucial in achieving the objectives that determine a project's success. Time management intersects directly with cost control and stakeholder satisfaction, especially in complex projects where delays can lead to substantial financial repercussions and frustration among all stakeholders.

In the context of high-cost projects, the ramifications of poor time management are amplified due to the scale of investment and the breadth of stakeholder impact. Delays can result in increased costs, missed market opportunities, and diminished stakeholder trust, compromising the project's return on investment and overall success.

Considering the delay in the previous project, where we gave greater freedom to all the stakeholders, we opted for a more traditional stance where we would be reserving the time slot with the justification of the responsibilities assumed in the light of the objectives outlined.

So we have a timetable, Figure 41, for which an effort was made to follow up and monitor, where various intermediate points of contact would also be made, which would also be recorded in the respective governance model and communications plan.

	Nome	Duração	Início	Fim	Ante...
1	**BUILD Project**	**1.238 dias?**	**10-04-2018 8:00**	**05-01-2023 17:00**	
2	**Project Initiation and Planning**	**107 dias**	**10-04-2018 8:00**	**05-09-2018 17:00**	
3	Project kickoff meeting to establish project objectives, scope, and stakeholders	20 dias	10-04-2018 8:00	07-05-2018 17:00	
4	Development of project plans, including risk management and stakeholder engagement plans.	37 dias	08-05-2018 8:00	27-06-2018 17:00	3
5	Finalization of project scope, budget approvals, and resource allocations.	50 dias	28-06-2018 8:00	05-09-2018 17:00	4
6	**Design and Development Phase**	**381 dias?**	**06-09-2018 8:00**	**20-02-2020 17:00**	**2**
7	**Design and development of individual systems**	**380 dias**	**06-09-2018 8:00**	**19-02-2020 17:00**	
8	Sensor deployment for public transport	90 dias	06-09-2018 8:00	09-01-2019 17:00	
9	Smart lighting systems	50 dias	10-01-2019 8:00	20-03-2019 17:00	8
10	Energy management sensors	60 dias	21-03-2019 8:00	12-06-2019 17:00	9
11	Water management systems	70 dias	13-06-2019 8:00	18-09-2019 17:00	10
12	Traffic management solutions	50 dias	19-09-2019 8:00	27-11-2019 17:00	11
13	Smart building technologies	60 dias	28-11-2019 8:00	19-02-2020 17:00	12
14	Integration tests for individual systems to ensure compatibility and efficiency before deployment.	1 dia?	20-02-2020 8:00	20-02-2020 17:00	13
15	**Pause and Constraints Due to COVID-19 Pandemic**	**487 dias**	**21-02-2020 8:00**	**03-01-2022 17:00**	**6**
16	Project activities are paused due to global restrictions and impacts on supply chains and workforce availability	487 dias	21-02-2020 8:00	03-01-2022 17:00	
17	**Deployment and Initial Integration**	**62 dias**	**04-01-2022 8:00**	**30-03-2022 17:00**	**15**
18	Deployment of sensors and initial setup of infrastructure.	35 dias	04-01-2022 8:00	21-02-2022 17:00	
19	Initial integration of deployed systems into the urban management platform for testing and adjustments	27 dias	22-02-2022 8:00	30-03-2022 17:00	18
20	**Pilot Testing and Refinements**	**100 dias**	**31-03-2022 8:00**	**17-08-2022 17:00**	**17**
21	Pilot testing in selected urban areas	60 dias	31-03-2022 8:00	22-06-2022 17:00	
22	Analysis of pilot test results and implementation of necessary refinements to systems and platform functionalities.	40 dias	23-06-2022 8:00	17-08-2022 17:00	21
23	**Full Scale Roll-out**	**51 dias**	**18-08-2022 8:00**	**27-10-2022 17:00**	**20**
24	Gradual roll-out of the platform and systems across the target urban areas.	21 dias	18-08-2022 8:00	15-09-2022 17:00	
25	Final adjustments, user training, and handover to city management.	30 dias	16-09-2022 8:00	27-10-2022 17:00	24
26	**Project Closure and Review**	**50 dias**	**28-10-2022 8:00**	**05-01-2023 17:00**	**23**
27	Formal project closure activities including documentation and dissemination of outcomes.	30 dias	28-10-2022 8:00	08-12-2022 17:00	
28	Post-implementation review to assess project impacts and long-term sustainability plans.	20 dias	09-12-2022 8:00	05-01-2023 17:00	27
29	**Project Management Constraints**	**220 dias**	**01-02-2022 9:00**	**06-12-2022 9:00**	
30	Change of Project Management	220 dias	01-02-2022 9:00	06-12-2022 9:00	
31	**Framework to extend project management practices for innovation projects in smart cities, fo...**	**182 dias**	**18-02-2022 9:00**	**01-11-2022 9:00**	
32	Framework Meeting	1 dia	18-02-2022 9:00	21-02-2022 9:00	
33	Agreement to comply with Framework	1 dia	21-02-2022 9:00	22-02-2022 9:00	32
34	Application of the framework	180 dias	22-02-2022 9:00	01-11-2022 9:00	33
35	Changes to the environment	100 dias	25-03-2022 8:00	11-08-2022 17:00	
36	Collecting feedback	12 dias	12-08-2022 8:00	29-08-2022 17:00	35

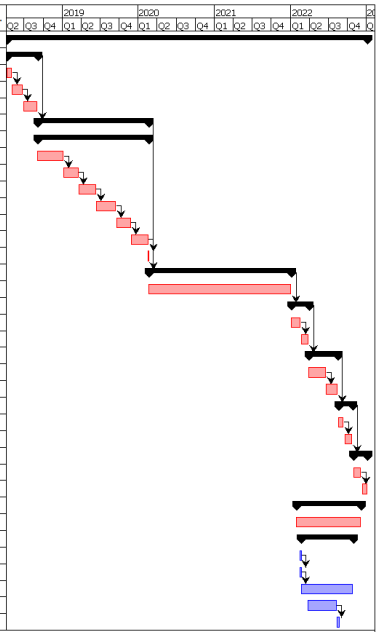


Figure 41 – Schedule and Gantt Chart for the BUILD Project

The major constraints were the difficulties inherent in a period of pandemic and all the impact it offers. The entire timetable underwent an unforeseen change in some periods, but this was accepted by all the stakeholders, including those who would have a regulatory and auditing role, precisely for the unforeseen reasons identified here.

This impact was not only in the period of isolation it caused but also in the slow return to normality, and once again, these externalities were difficult to perceive. Looking at the timetable, this project lasted 1 238 days and followed all the assumptions previously defined in the schedule.

Objectives and Deliverables

In complex project management, clearly defining objectives and deliverables is essential for successful execution. The process of identifying these requires meticulous planning and a strategic approach to ensure that all project goals are aligned with stakeholder expectations and organisational outcomes.

The identification of objectives and deliverables is always linked to numerous documents that form part of the proposed process, such as the documents referenced below:

- Contract;
- Business Case;
- Project Charter;

- Stakeholder Matrix;
- Team Charter.

Each major document referred to before, provides guidance on documenting stakeholder responsibilities. Thus, as part of the BUILD project, we have been allocated the following responsibilities for coordinating the project concerning the following efforts, broken down by the various main stakeholders (Table 45):

Table 45 – Project BUILD - Objectives and Deliverables by Stakeholders

	Objectives by Stakeholders
Braga City Council	• Effort management and monitoring; • Conflict resolution and stakeholder mediation.
Transportes Urbanos de Braga	• Management and coordination of the effort; • Participation of technical teams in mobility issues; • Definition of functional and non-functional solution requirements;
Centro de Computação Gráfica (CCG)	• Open Data Platform (based on the CKAN solution); • Smart City Server (server for data from the citizen's application, namely the processing of the "brácaro" virtual currency developed by the CCG) • Information portal focussed on resident citizens and users, in an area to be designated that communicates the most relevant aspects, and respective mobile application, namely through: o Structuring the architecture of the information portal, defining the main information it should contain (front office) and the sources of information to be used; o Defining the methodologies to be implemented to ensure the constant updating of the information portal (Backoffice); o Development of the information portal; o Demonstrating the functionality of the information portal and supporting its implementation; o Implementation of corrective measures, if necessary; o A mobile information application and an information portal will be developed to collect information from citizens for crowdsourcing. • Coordination of supplies associated with the implementation of SMART technologies in the city of Braga, namely the following: o Sensor systems: Various supplies will include sensor systems that will have interfaces via their APIs and will need to be adapted for centralised use (sensors for water/electricity consumption, air quality, traffic, etc.); o Lighting: With the change from traditional lighting systems to LED lighting with remote control and monitoring and which develops measures to minimise electricity; o Traffic: which will include vehicle traffic monitoring tools with their respective sensors. It will also include the creation of an intelligent zebra crossing that detects pedestrians and adapts the lighting level to minimise consumption; o Displays: which will serve as a means of communication with residents and drivers in order to present information relevant to the project in order to inform, but also to influence behaviour conducive to decarbonisation; o Management and control platforms: A pre-existing municipal platform will be adapted and expanded to gather information

	from the various systems and their respective sensors and control some of their parameters

IBM	• Integration and parameterisation of the Intelligent Operations Centre (IOC) platform with the integration of the following vertical:
	  ○ Environmental Sensors and Water Level Platform;
	  ○ Lighting Platform;
	  ○ Consumption Monitoring Platform;
	  ○ Traffic Management Platform.
	• The software supplied should provide data aggregation to the following platforms (developed by the CCG):
	  ○ Open Data Platform (based on the CKAN solution);
	  ○ Smart City Server (server for data from the citizen's application, developed by the CCG).
	• To include the following services:
	  ○ Integration, via API, of data from the four vertical platforms identified above;
	  ○ Provision of 2 (two) web services to transfer data aggregated by the software supplied to the Open Data platforms and the Smart City Server;
	  ○ Development of 6 (six) operating procedures (SOPs or Standard Operations Procedures) to be defined;
	  ○ Development of six Key Performance Indicators (KPLs);
	  ○ Development of 6 reports;
	  ○ Creation of a visualisation profile in the supplied software with read-only access to selected data, based on the map and existing data sources;
	  ○ Parameterisation of integration with GIS solutions, such as Open Street Maps;
	  ○ Parameterisation of profiles for use in the supplied software.

We also recognise the existence of other stakeholders (Table 46), still, their involvement was at a stage when this action would not have been part of it, although their reference is relevant:

Table 46 – Project BUILD - Other Stakeholders by Scope

Other Stakeholders by Scope	
Sensors	• VPSEnergy • Soltrafego
Illumination	• Signify
Public Information	• Edigma • Innovation Point
Integration	• CCG • KYNDRYL

These efforts were successful in the terms identified, and there are still some positive risks that materialised into success through the inclusion of other stakeholders and the identification of new verticals to be included in the BUILD urban platform, but that will be a topic for the near future to address and discuss.

6.5.5 Metrics and Lessons Learned

We reached a point that represents around 70 percent of the doctoral project's journey, which has been as interesting as challenging. The researcher has also been increasing his experience and maturity in project management and gaining the confidence and courage needed to introduce new changes to the managed projects using the framework developed here.

Increasing rigour has been a constant commitment, combined with an ever-present critical and inquisitive spirit. The result of this approach can be seen in the rigour associated with assessing the project's maturity level, as seen in Table 47.

Table 47 – Maturity Level Matrix of the BUILD Project

Elements	Attributes to Score	Maturity Level | GDPR Project
Approach	Sound	4
	Integrated	3
Deployment	Implemented	3
	Systematic	4
Assessment and Review	Measurement	3
	Learning	4
	Improvement	3

We have some small differences, considering the evolution and stage of this research. Over time, and considering all the changes made and the scale used, small changes may not materialise in an impactful way at first reading.

Turning to the components assessed in the maturity level matrix, we have the sound attribute, which reflects that it was fully implemented during the period in which this action took place in the BUILD project.

Since this project represented the first complex project, and the approach was somewhat exploratory, particularly in the early stages, the integrated maturity attribute receives a rating of three.

The deployment elements, in this case implemented and systematic, receive a rating of three and four, respectively, for the same reason mentioned above, since the framework is still being addressed in a complex project and changes have occurred over the period associated with this action.

The Assessment and Review elements, with the measurement and improvement attributes scoring three, and learning, unlike the previous assessment, increased to a score of four.

Continuing with the final evaluation of the project where the fourth action took place, we have the results that can be seen in Table 48:

Table 48 – Results of the action related to the BUILD Project

#	Metric Scope	Dimension of Analysis	Metric Name	BUILD Project
C1	Complexity	Requirements	Requirements Complexity	4
C2		Cost	Total Predicted Investment	2
E1	Engagement	Quality	Governance	4
E2		Engagement	Communication	4
E3		Quality	Stakeholder Influence	3
E4		Requirements	Change Management	15
E5		Performance	Project Team Experience	7
M1	Monitoring	Quality	Changes to the Team Project	3
M2		Cost	Project Cost	100%
M3		Time	Time Deviation	127%
TP1	Team Perception	Requirements	Team Perception	satisfactory

We consider this a project with a high external impact, i.e. on society, and one that has gone beyond internal management to offer external benefits, hence the four rating, which the Business Case and the stakeholder identification process determined.

The cost, and after implementing the process of determining the type of project, the more than 800,000 euros of investment determined that this was a complex project.

Considering the existence of a Project Management Office, this project receives a governance rating of four.

Communication was a mixture of pull and interactive, with the latter being the most prevalent and, therefore, the one mentioned here.

The assessment through the stakeholder process developed, with their respective influence and impact, led us to believe that they would only be able to cause changes to the project's requirements, which turned out to be the case. This project, due to its inherent public funding, could not be stopped, or the entire investment would be returned, and that would be unacceptable.

Numerous changes have occurred due to the pandemic and the change of the original project manager and team members, particularly the revisiting of requirements and new use cases because of the project's maturity at a given time and timing. This ends up being transposed into the change management document present in the framework developed.

The project management team had an average of seven years' experience in similar projects. The stakeholder matrix is one of the core documents used to identify this metric.

Regarding monitoring and assessing quality concerning changes to the project team, we have an impact rating of four. This indicator, aligned with the requirements change indicator, is also in the change management document.

Judging the high level of scrutiny from various stakeholders, the project's cost does not deviate.

The time deviation, justified by the pandemic period, deviated by around 27 per cent. Although not insignificant, this deviation was accepted by all stakeholders and did not impact this project's various assumptions and objectives.

The team's perception of the assumptions and fulfilment of requirements was satisfactory. This assessment is directly related to the large number of project requirements that were changed and also to the change in stakeholders at the project team level and over time at various points in time and the difficulties inherent in recognising a correct understanding of success before the period completes the project.

This evaluation was carried out according to the constraints of the project in question and its particularities, such as its inherent challenges, like the project team and the entire ecosystem present here. For the above reasons, this evaluation is only suitable for this project, so it is unlikely to be represented in other projects and should not be transposed to others.

6.5.6 Theory Adjustments

The adjustments proposed here have to do with the fact that we are using a path designed for the management of innovation projects, which have some very unique characteristics, but at the same time provide a basis for starting the process of managing complex projects.

Here can see an evolution of the documents used and their characteristics, for example:

- Business Case
    - It is helpful to include the expected costs per type of stakeholder, whether with reference to direct costs or indirect costs, thereby also using these costs to assess their interest in the projects. This will make it possible to determine whether developing or buying a solution is better.
- Stakeholder Template
    - Considering all the changes this project has undergone, we consider to be relevant to incorporate an impact analysis and strategies for interaction with a given stakeholder into the Stakeholder Template document. This is feedback necessary for the creation of a Communication Plan.
- Risk Management
    - Creation of a structured approach to identify risks such as supply chain delays, regulatory changes, and technical failures.

We believe that the inclusion of the following documents was beneficial, and they are even listed in the project's lessons learnt:

- Team Charter
    - This is an essential document in complex projects where tasks are interdependent and multiple team members may be involved in similar activities. By specifying roles, the team charter helps ensure that all necessary tasks are covered without redundancy, and that everyone knows who is accountable for each part of the project.
- Communication Plan

- In complex projects, especially those undergoing changes in project management like the BUILD Project, a well-structured Communication Plan is essential for maintaining continuity and alignment among team members and stakeholders. The absence of a Communication Plan can lead to significant disruptions in project execution and stakeholder relationships. In this way, we make the project more resilient and elastic, with the certainty that even in the absence of a stakeholder, communication will be normalised by the identification of communication processes and redundancy offered. We must always consider that a communication plan facilitates the consistent flow of information by tailoring communication strategies and ensuring that all project participants are informed about project updates, decisions, and changes. We have observed that messages became inconsistent or misaligned with project objectives without a formal plan, which led to confusion and misinterpretation among project teams and stakeholders.

- Stakeholder Engagement Toolkit
    - A Stakeholder Engagement Toolkit is an essential set of tools, guidelines, and templates designed to aid project teams in effectively engaging stakeholders throughout the lifecycle of a project. This toolkit is particularly crucial in complex projects where diverse stakeholder interests must be managed carefully to ensure project success. We consider this inclusion pertinent because we have encountered some issues related to intellectual property in the solutions implemented, which could only be resolved by including a non-disclosure agreement between various parties. A moderation of relationships was needed, which could be identified to some extent here, in change management and risk management documents.

6.5.7 Conclusions

From the start of this doctoral project, where we carried out the first action, which was just a projection of the knowledge obtained for a project that had already been carried out, to the inclusion of the third project, which represented an innovation project, we have made a remarkable evolution in the framework developed here.

We took the innovation project management model and transfigured it into a new reality, where, as a result of a constantly changing ecosystem and the Action Research methodology, we had the opportunity to modify and evolve it.

An inhospitable project environment, as a result of the change of project manager, where a lot of knowledge would have remained in places inaccessible to the whole team, thus made a fertile environment for a conciliatory and aggregating attitude of all the parties involved and would also have provided very interesting conditions for the objectives of the project but also the objectives of the researchers, i.e. an exploratory character in the management of this project.

It was clear that engaging stakeholders early in the change management process helped identify their concerns, expectations, and the potential impact of change on different groups. This proactive involvement uncovered hidden risks and resistance, providing an opportunity to address these issues before they escalate, particularly in a complex project management context, which would be dealing with the unmanaged change of its project manager.

Considering these features of the project at hand, the stopping condition in the action detailed here would be composed of two possibilities:

- Positive Stopping Condition: delivery of the objective that was the urban platform and the verticals associated with it;
- Negative stopping condition: the inability to implement the framework in the project and stakeholders' acceptance.

The stop condition must always be present on the main and secondary objectives, so comparing the results of this action with the respective objectives of this doctoral endeavour, and therefore, for the project "BUILD", and comparing with the various objectives, we have:

- (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.
    a. The objective was met since we could deliver the urban management platform under unforeseen and difficult circumstances.
- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.

    a. This is totally met since the analysis implementation in this action helped evolve the respective framework to manage stakeholders in innovation projects, further maturing already existing points. It is now prepared for a final validation.

- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
    a. The objective was partially achieved, although we believe this endeavour still needs a final validation.
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
    a. The objective was met since changes were created and implemented in the theory, thus allowing it to progress and be validated in the next action.
- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.
    a. Positive evaluation was made since the maturity offered to the model was inherited from the innovation of the Traffic Flow Prediction Project.

The model and strategy used during the following action are considered validated, and they allow additional motivation. While the final stage hasn't been met, it is clear that robust and elastic support for project management, with a clear focus on stakeholder management, has proven to be a pertinent research topic that is more current than ever.

6.6 Action 5 | Bus Rapid Transit @ Braga

The city of Braga is giving a new impetus to its urban public transport offer, taking advantage of institutional conditions, the growth in potential demand and funding opportunities, by creating a new transport system capable of meeting the mobility needs of the population that lives, works, studies or visits there, and helping to halt an observed trend towards the prevalence and dominance of self-driving cars to the detriment of other more sustainable modes.

The rapid bus system will arrive in Braga in the second half of 2026 and aims to create a high-capacity Bus Rapid Transit (BRT) system in the city of Braga (Figure 42), operating on its own canal and with decarbonized vehicles, which will reduce the prevalence of car use and connect the city centre to various

traffic-generating hubs, including the Railway Station, the Transport Coordination Centre, the University of Minho, the Hospital, the International Iberian Nanotechnology Laboratory and commercial areas.



Figure 42 – Preliminary Routes of the BRT @ Braga Project

This is the second project in this doctoral program where we have tried to implement our framework over a specific period during an ongoing project. It is essential to mention this because this project started in 2021 and will continue long after this PhD project. As they say, this would be the litmus test of the developed framework.

6.6.1 Purpose of Action

The BRT system will complement the current Braga Urban Transport network, becoming the backbone of the city's urban public transport system. It will link up with the inter-municipal transport networks of the Cávado and Ave CIMs, with rail transport and cycle mobility.

Two BRT lines will be built (Figure 43), the Yellow and the Red. The Yellow Line will be 6,2 km long and have 12 stations. It will connect the southern part of the city, where the Minho Center shopping is located, to the train station, and will attract passengers from private transport through a park & ride at the southern end of the line.

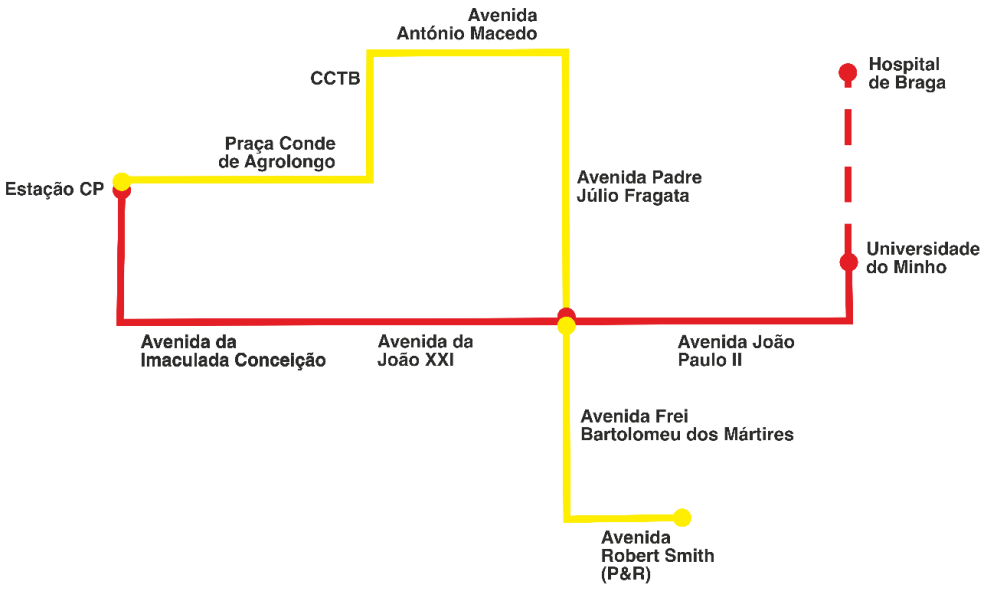


Figure 43 – BRT @ Braga Project

It will also make resolving the urban divide on the Avenida António Macedo and Avenida Padre Júlio Fragata-Avenida Frei Bartolomeu dos Mártires axes possible. The Red Line will have 6.2 km and 12 stations, an interface with rail transport, and connections to the University and the Hospital. It will contribute to resolving the urban divide along the axis of Avenida Imaculada Conceição - Avenida João XXI - Avenida João Paulo II.

Transportes Urbanos de Braga, E.M., will be the company responsible for implementing this investment, which will benefit the city's citizens and visitors.

This is the first effort of a structuring dimension for the city of Braga since Euro 2004 and could present a paradigm shift in mobility and the most significant civil engineering endeavour since then.

The opportunity to apply the framework, the final result of this doctoral project, intending to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management to this BRT project, came about purely by chance, as at no time did the researchers assume that it would be possible to apply this framework to a project of these characteristics and complexity.

The final validation of this framework can be found in the following sections of this document.

6.6.2 Practical Action

A project of 100 million euros will have a time horizon that will, in the vast majority of cases, exceed the timeframe associated with any doctoral effort, so the implementation and final validation of the framework will take place in a time window within the BRT project.

It is important to first mention the overall effort, albeit briefly, to detail then the period in which the observation and implementation of the framework took place.

The characteristics of the new BRT system will be high speed, operation mostly on its own channel, decarbonized vehicles, quality and comfort for passengers, intermodality with other public transport networks and active modes, namely cycling and walking.

This is an opportunity to introduce a public transport system that must solve mobility problems in the urban fabric and "heal" some of the city's structural wounds. It is hoped that the BRT, complemented by other fundamental measures such as constructing more cycle paths, will help achieve a significant modal shift (from the car to other more city-friendly modes).

Thus, after the completion of the Decision Support Study for a high-capacity transport system on its own site (Tabique, 2021), the aim of which would be to make a preliminary assessment of the feasibility of a large-capacity public transport system on its site in the city of Braga, to support decision-making by the City Council, as the Transport Authority, the Government of the Portuguese Republic, and the national and European funding mechanisms.



Figure 44 – Decision Support Study for a high-capacity transport system on its own site | Braga (Tabique, 2021)

The year 2022 will essentially be marked by the completion of the Demand Study for the Implementation of a BRT in Braga (VTM, 2022), which would analyse the viability of the BRT system by identifying and

prioritising the lines to be implemented and assessing their impact on attracting current users of other public transport systems and passengers who currently use individual motorised transport as their main mode of transport.

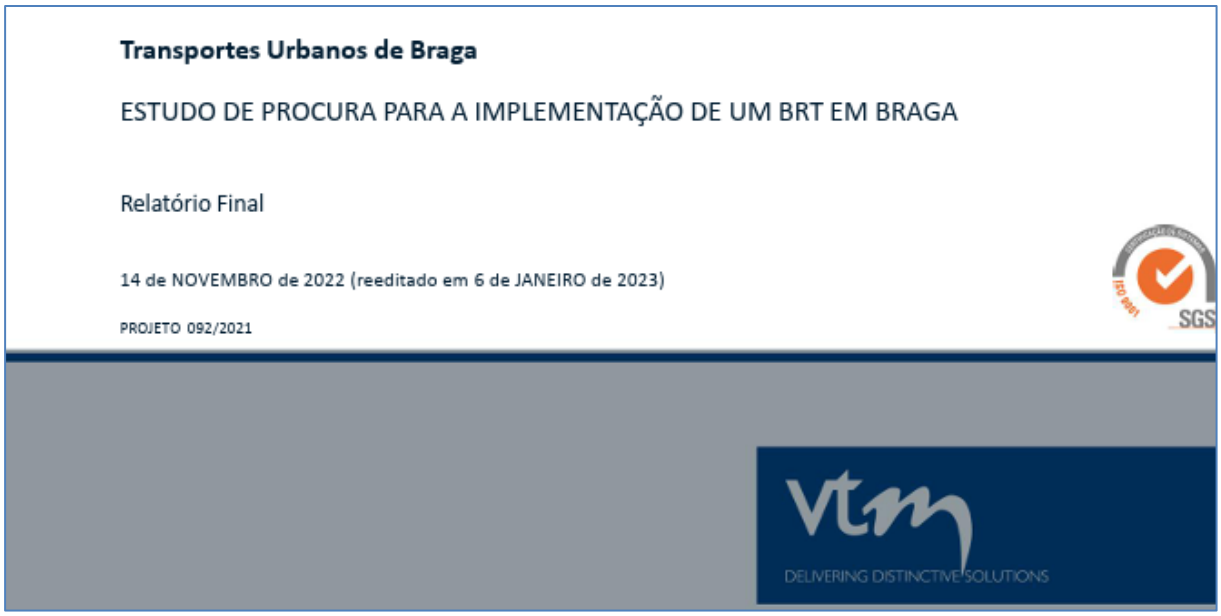


Figure 45 – Demand Study for the Implementation of a BRT in Braga ~ (VTM, 2022)

As 2022 drew to a close and the Demand Study was almost complete, new challenges were present, and the final action for this PhD project started.

The BRT @ Braga project objectives for the year 2023 would be to develop the document Braga BRT Insertion Study and Insertion Alternatives Evaluation Report (ENGIMIND, 2023) and the stopping condition for this action would be precisely this deliverable.

Thus, the composite period of this action would run from December 2022 to the end of 2023, and this is the stopping condition and the completion of all objectives defined for this time window. The period described here was long because several macro-efforts were running in parallel, which would serve as the basis for the study.

Given that one of the researchers on this PhD project was the project manager of the BRT @ Braga Project, this extended period could be reconciled with the desired objectives for the PhD to guarantee the final validation and the desired robustness.

6.6.3 Stakeholders

In contemporary project management, the identification and engagement of stakeholders are critical to the success and sustainability of initiatives, particularly those that intersect with various layers of governance and public interest and that impact complex projects.

We systematically apply our Stakeholder Classification process for the BRT @ Braga Project, trying to develop a large-scale urban development project in a central metropolitan area characterised by its diverse stakeholder spectrum, including government bodies, city council members, public enterprises, private sector participants, and civil society organisations, among others.

The project, aimed at revitalizing the use of more sustainable transport solutions, like public transport, and enhancing urban living, required nuanced understanding and meticulous management of stakeholder dynamics due to its potential impact on various interests and its susceptibility to political, social, and economic fluctuations.

The stakeholder identification process was essential in shaping the project's strategic direction, ensuring compliance with legal frameworks, securing funding, and facilitating smooth implementation through consensus-building.

The list of stakeholders, Table 49, at the point where this action occurs, has remained remarkably stable, and although the fact that it groups some stakeholders, it can be seen that it comprises all the stakeholders involved in this project, directly or indirectly.

Table 49 – BRT @ Braga Project - Stakeholder Evaluation

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Business Governing Layer and Steering Layer	Project Sponsor	Owner	Internal	9	9
Business Governing Layer	Government Officials and Policymakers	Influencer	External	9	9
Business Governing Layer	Investors and Financial Institutions	Influencer	External	8	8
Business Governing Layer	International Organisations and Partners	Influencer	External	9	9
Steering Layer and Directing Layer	Project Owner	Management	Internal	8	8
Steering Layer and Directing Layer	Technical Experts and Consultants	Technical	Internal / External	7	7
Directing Layer	Technology Providers and Vendors	Provider	External	3	4
Directing Layer and Managing Layer	Project Manager	Management	Internal / External	7	7
Managing Layer	Project Management Team	Management	Internal / External	5	5

Stakeholder Classification	Stakeholder Name	Role/Position	Organisation	Level of Influence	Impact of Change
Managing Layer	Academic and Research Institutions	Management	External	6	7
Performing Layer	Procurement and Contract Managers	Compliance and Monitoring	Internal	4	5
Performing Layer	Project Team	Operational	External	4	4
Performing Layer and Regulation Layer	Legal Team	Compliance and Monitoring	Internal	3	6
Regulation Layer	Assessment and Auditing Body	Compliance and Monitoring	Internal	6	3
External Influent Entities Layer	NGO and Civil Society	Influencer	External	7	7
External Influent Entities Layer	Utility Providers and Infrastructure Managers	Provider	External	4	5

The Equipa de Missão Recuperar Portugal (Recover Portugal Mission Team), created by the Council of Ministers Resolution no. 46-B/2021 on 4th May 2021, has the objectives of negotiating, contracting and monitoring the implementation of the Recovery and Resilience Plan. Its mission also includes, among many other responsibilities, ensuring compliance with national and EU regulations in the implementation of the PRR (Plano de Recuperação e Resiliência) Reforms and Investments and the complete and timely fulfilment of the strategic and operational objectives. For these reasons, we consider the Recover Portugal Mission Team a sponsor, together with the Government of the Portuguese Republic, having been awarded the highest rating.

The various ministries of the Government of the Portuguese Republic involved here, such as the Ministry of the Environment and Climate Action and the Ministry of Infrastructure and Housing, or even the cabinets and secretaries of state, such as the Cabinet of the Secretary of State for Urban Mobility, also receive a high rating on the points given their influence and activity. Local organisations, such as Braga City Council or the parish councils, are also considered here.

The point that assesses international organisations and partners has a rating of eight on both points, which is a high score because they are very close to funding bodies, such as JASPERS (Joint Assistance to Support Projects in European Regions), which belongs to the European Investment Bank, and therefore their influence and impact cannot be understated.

By appointment in the contract, Transportes Urbanos represent themselves as the owners and share the same rating of eight on both points. It isn't higher because it considers that the application's scope for the project in question would already be closed.

Because of their importance and the purpose of their contract, the teams of specialists and consultants, representing various individuals and companies, have high ratings, seven on both points, because they are influential in the decisions made by the project owner at various times.

Various suppliers have a low rating, although this can lead to changes in some definitions of the solutions to be implemented due to limitations imposed by what the market offers.

The project manager, who also serves as the researcher for this doctoral project, is among the most influential figures due to the responsibilities assigned. This role consistently involves acting as the decision-maker and shaping outcomes in response to varying circumstances.

The project management team has a more moderate assessment since it is broad and can only affect the technical options used. This assessment also considers the existence of external consultancy teams and specialists.

The academic institutions are presented here as stakeholders in the project despite not being part of it, i.e. they are present here because the project affects the physical space of the Campus, and for this reason, they have a higher score for the impact of the change created than for their influence within the project.

The contract and procurement managers and the legal team have a somewhat conservative assessment of the BRT @ Braga project, justified by the presence of organisations such as the Recover Portugal Mission Team and how they present the rules that must be rigidly followed.

In line with what was said about the project management team, the project team has a low rating because they are more operational elements.

The internal audit teams, also in line with what was mentioned in the contract managers and public procurement section, have very strict and clear guidelines for the effort to be made, making them more elements of control and monitoring.

A high score was awarded for both elements, considering the impact of this project on the daily lives of all members of society and the political perspective that it inevitably takes.

Given the above and the ease with which these issues can be mediatised, non-governmental organisations also inherit this assessment.

Accordingly, and in line with the table above, Figure 46 shows a graphic representation of the respective area and each stakeholder's possible influence and impact on the BRT @ Braga project.

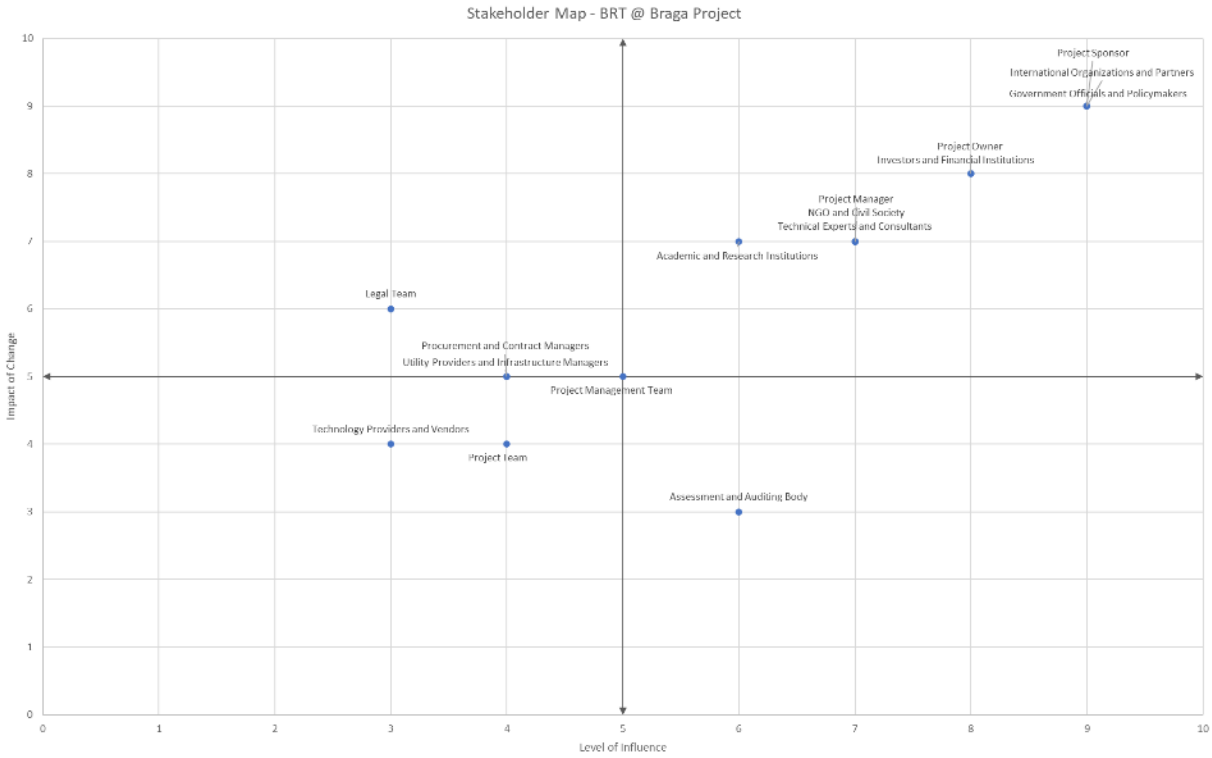


Figure 46 – BRT @ Braga Project - Stakeholder Map

We consider that the stakeholder identification process has now reached a level of maturity validated by this project. It has served as support for the various processes and documents that compose the framework, extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.

6.6.4 Project Management

All the effort made over the years of this doctoral project has led to this final effort. We have identified a complex project by considering the volume of the various contracts involved, using the public procurement process, and determining the type of procedure.

Project Management Methodology

A project of this scale, the BRT @ Braga project, requires enormous concern, a firm structure and transparent management concerning the various perspectives of project management, be they scope,

time, quality and cost, not to mention the enormous media exposure and close monitoring by all the regulatory bodies and other interested parties.

This project is considered complex from all possible perspectives. If this is not enough or there are any doubts, the project classification process can be used to determine the type of project, which can be seen in detail in the next subchapter.

We consider that this project, justified by its previous success and the conclusions it offers, will be the final proof of validation for the framework we are proposing here, so the final complex project management model will be applied and from which the final validation will be drawn, or so it is hoped.

Considering the opportunity and the elements involved, the framework was inserted to extend project management practices for this particular project, with a mindset in the concepts of Smart Cities, focusing on stakeholder management in the governance model, thus implementing it in an *ad hoc* manner and without major friction or considerations resulting from the other stakeholders.

The aim was to assess feedback that resulted from the stakeholders' lack of knowledge from this implementation and thus to be able to take that feedback from a more functional and pragmatic perspective, or even a more sincere stance. The final model, shown in Figure 47, represents the route suggested for complex projects, carefully travelled by the project team members, particularly by the project manager.

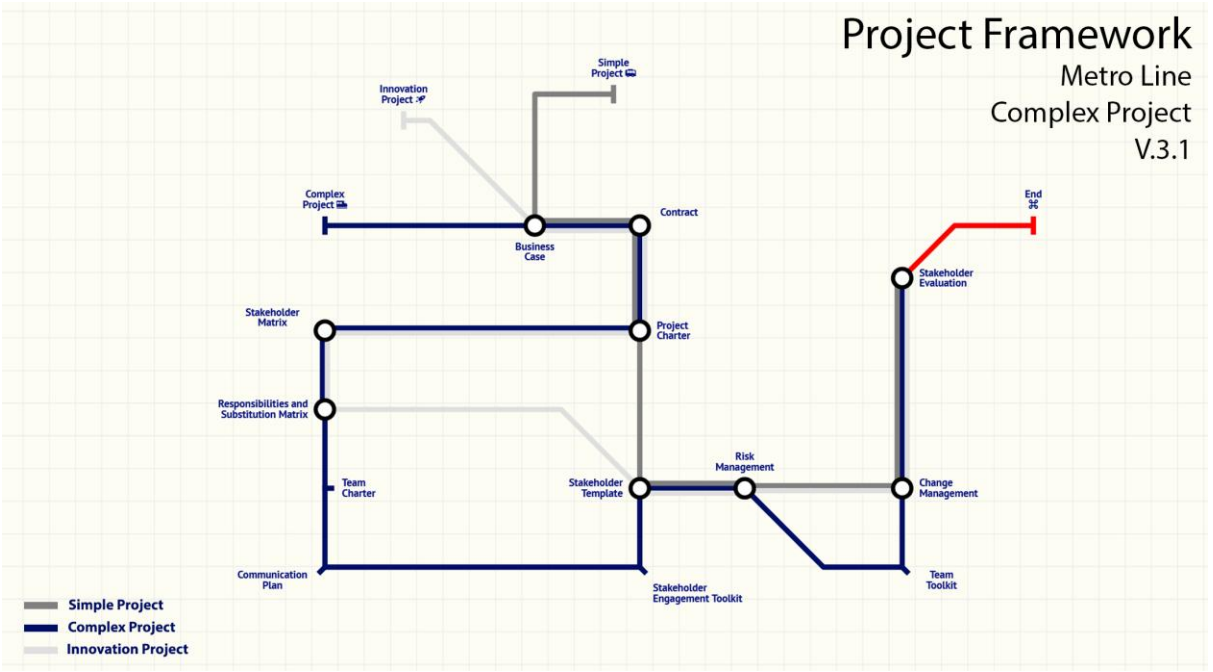


Figure 47 – Metro Line for Complex Project V.3.1

Below can be seen the classification and respective perspectives given in terms of documents and justification (Table 50):

Table 50 – BRT @ BRAGA Project Framework Documents

	BRT @ Braga Project Framework Documents
Business Case	The Business Case represents the basis of this entire project, from start to finish, providing a detailed justification for undertaking a project that will accompany all the phases and help align all perspectives and expectations. By establishing common ground through the business case, it was possible to adopt a unified approach to project execution, which is particularly important in projects that require significant capital investments and involve considerable risk.
Contract	At the stage we are at in the respective action, this project has created more than five different contracts and two addenda to existing contracts. This is a key point, particularly in projects under enormous public and government scrutiny. It outlines the terms and conditions agreed upon by the parties and even helps solve disputes arising from the ambiguity of some specifications or the terms perceived by all those involved.
Project Charter	This document was instrumental in several critical aspects that aligned closely with effective stakeholder management. It sets out the vision, purpose, and objectives of the project. For this project, which involved multiple stakeholders with potentially divergent interests and perspectives, the project charter provided a unifying vision that aligned all parties. It outlined the roles and responsibilities of all involved parties, including the project team, sponsors, and other key stakeholders. It also empowered the project manager and team by giving them the authority to request resources, make decisions, and lead the project towards its objectives.
Stakeholder Matrix	This matrix helps categorise stakeholders based on their levels of interest and power, allowing the project manager to tailor the engagement strategies effectively. This application helped to understand the application and significance of a Stakeholder Matrix in a successful complex project, illustrating its central role in ensuring effective communication, alignment, and project governance. Being more concise, it provides a structured approach to analyse, prioritize, and engage with stakeholders in a manner that aligns with their significance and impact on the project.
Responsibilities and Substitution Matrix	The Responsibilities and Substitution Matrix represents a crucial tool for clarifying roles and responsibilities in project management. This matrix is especially valuable in projects involving multiple stakeholders, like this one, with overlapping interests and responsibilities. It ensures clear communication and operational efficiency and supports effective stakeholder management by explicitly outlining who is responsible for what tasks, who needs to be consulted or informed, and who is accountable.
Team Charter	When dealing with intricate stakeholder environments, a document like a Team Charter must be a foundational tool for guiding team interactions, clarifying roles, and setting expectations. Within the context of a complex project like the BRT @ Braga project, a well-formulated team charter is seen as critical in promoting effective collaboration among diverse project stakeholders and ensuring successful project outcomes, becoming an indispensable document for managing complex projects.
Communication Plan	A project lifespan of more than five years, from its inception to its closure, presents many challenges in terms of communication. This helped systematically outline how information would be shared among stakeholders to ensure transparency, engagement, and project success. This plan is essential for managing the flow of information between various parties involved in a project, including team members, sponsors, clients, and other external stakeholders, and therefore enhancing stakeholder relationships.
Stakeholder Engagement Toolkit	The Stakeholder Engagement Toolkit document helps deliver the project team with the necessary tools and techniques to engage stakeholders proactively, manage their expectations, and integrate their contributions. It also gives confidence while managing

	various stakeholders' diverse and often conflicting interests, ensuring that their expectations are managed and their contributions are aligned with project goals.
Stakeholder Template	A stakeholder template is an invaluable tool for systematically organising and managing information about stakeholders, and although it takes the form of a spreadsheet, it helps document, analyse, and track stakeholder information throughout the project lifecycle. This document has many inputs from other documents and creates outputs for others. This document helps operational efficiency and significantly contributes to stakeholder engagement efforts' strategic alignment and adaptive capacity.
Risk Management	Any project must have risk management, whether simple, innovative, or complex. It doesn't matter the level of detail, but the effort and mental process inherent in identifying risks. This process helps managers predict and anticipate the emergence of any risk or desired opportunity. The efforts to complete and maintain this document involve tracking identified risks, reassessing their impact and likelihood over time, and evaluating the effectiveness of mitigation strategies. This project has also clarified that risks can emerge while existing ones may change, requiring constant vigilance and adaptability in risk management practices.
Team Toolkit	A solid Team Toolkit becomes an indispensable asset in managing a long-term complex project, such as one spanning over five years and still ongoing. The ongoing nature of the project adds layers of complexity due to evolving team dynamics, changing stakeholder needs or even the stakeholders or elements from them, and shifting project environments. This toolkit comprises various tools, techniques, and resources specifically tailored to support the team's effectiveness, adaptability, and sustainability over the long haul. This is a document that supports the operational aspects of project management but also addresses the human elements
Change Management	The BRT @ Braga presents all the premises necessary to apply a process that helps manage projects, following the guidelines of any project management guide, or a relatively customised one that includes a framework like the one we are developing here focused on managing stakeholders. The Change Management document is pivotal in ensuring that project changes are implemented smoothly and effectively, aligning with the stakeholders' needs and the organisational goals. This document considers the analysis made in the stakeholder identification process, as it assesses the impact caused by the change and their influence on that change. Its integration into this framework provides a generous understanding of how managing change impacts stakeholder attitudes and project success, highlighting its critical role in achieving desired project outcomes and organisational growth.
Stakeholder Evaluation	The idea we wanted to explore regarding stakeholder evaluation was that this document would be carried out at the end of the project, however, and as has also been previously demonstrated, any project methodology must be customised to adapt to the context of the project in question. We therefore opted to carry out this evaluation whenever any interaction with the respective stakeholder ended, either because the contractual object in question had been achieved or because some final objective had been reached. We have this statement because this document involves assessing the effectiveness of stakeholder engagement strategies, understanding the impact of stakeholders on the project, and determining how well stakeholders' expectations and needs have been met throughout the project lifecycle.

No further changes were introduced, and no additional templates were created. Therefore, we believe we are on the right path toward obtaining final validation.

Investment and Costs

When public funds, national or international, are utilized for project investment, the importance of that investment and its traceability become a focal point for multiple reasons. Public funds, derived from taxpayers, carry inherent transparency, accountability, and effectiveness responsibilities.

All the scrutiny present in these types of projects helps defend a perspective of classifying projects by the value of the investments, or costs, and their complexity in management. Although it is not the aim of this doctoral project, the process developed, and the subsequent grounds for opening the public procedure are pertinent, helping to document and present evidence of the need to open the project and justify the options taken for this purpose.

The cost estimates for implementing this measure are based on the studies for the BRT @ Braga Project, particularly the Red Line and the Yellow Line. According to all the benchmarking, the total investment in the BRT @ Braga project, including all the civil engineering works, vehicles (i.e. buses), technology and infrastructure, is set at 100 million euros.

This is an imperative identified in the project's assumptions, and it helped obtain the financing, which will not be exceeded or underperformed, or it could run the risk of:

- The remainder must be paid with equity if the cost exceeds this amount.
- If there is a lower cost, for example, related to changes to the project, this could lead to several situations, including the loss of the total financing.

Seriousness and precision in managing this project are central to its success and to managing all stakeholders, particularly in one of the project's most impactful dimensions: costs.

At the end of 2023, considering the existing costs in 2023 and the investments planned for 2024, it would already have a paid value of around 13 million euros, even though it has not yet been fully implemented (Table 46).



Figure 48 – Total Investments and payments to BRT project (source: https://recuperarportugal.gov.pt/monitorizacao/)

Considering the year in question, and looking critically at the 2023 period, which was characterised by numerous studies and efforts to gain maturity in the project and to manage all the change, we would be considering the following costs according to the human resources involved (totally operational and internal costs) (Table 51):

Table 51 – BRT Project - HR costs

Human Resources	% Allocated to the Project	Working Days	Days of Absence	Days Worked	Daily Hours	Hours Worked	Base Salary	Salary Total Time	Cost / Hour	Cost/Hour RDI	Total Value*	Social charges	Total Amount with Charges
Internal Project Manager	50%	260	0	260,00	3	780	2 800,00 €	12	44,44 €	22,22 €	17 333,33 €	21 493,33 €	38 826,67 €
Internal Resource #1 (int)	50%	260	0	260	7,0	1820	3 200,00 €	12,38	21,77 €	10,88 €	19 809,52 €	24 563,81 €	44 373,33 €
Internal Resource #2 (int)	30%	260	0	260	2,0	520	3 200,00 €	12,38	76,19 €	22,86 €	11 885,71 €	14 738,29 €	26 624,00 €
Internal Resource #3 (int)	15%	260	0	260	3,0	780	2 200,00 €	12,38	34,92 €	5,24 €	4 085,71 €	5 066,29 €	9 152,00 €
Internal Resource #4 (int)	15%	260	0	260	7,0	1820	2 200,00 €	12,38	14,97 €	2,24 €	4 085,71 €	5 066,29 €	9 152,00 €
Internal Resource #5 (int)	15%	260	0	260	7,0	1820	2 000,00 €	12,38	13,61 €	2,04 €	3 714,29 €	4 605,71 €	8 320,00 €
Internal Resource #6 (int)	15%	260	0	260	2,0	520	1 600,00 €	12,38	38,10 €	5,71 €	2 971,43 €	3 684,57 €	6 656,00 €
Internal Resource #7 (int)	15%	260	0	260	3,0	780	1 600,00 €	12,38	25,40 €	3,81 €	2 971,43 €	3 684,57 €	6 656,00 €
Total Value* = Hours Worked * Cost/Hour										**Total:**	66 857,14 €	82 902,86 €	149 760,00 €

Carrying out a detailed analysis, in which the total value of the project is considered, but stratifying the cost in various areas and in the total time horizon and only for the year 2023, we have the costs visible in Table 52:

Table 52 – BRT Project - total costs

Special Requirements	Total Amount
Benchmarking Travel (2023)	15 000,00 €
Training	600,00 €
Total	15 000,00 €

Public Procedure	Total Amount
Total Cost Effort	100 000 000,00 €
Studies #1 (cost 2023)	86 100,00 €
Studies #2 (cost 2023)	12 238,50 €
Studies #3 (cost 2023)	23 806,65 €
Studies #4 (cost 2023)	89 175,00 €
Total 2023	122 145,15 €
Total	100 000 000,00 €

Total Project Cost	Total Amount
Total Contract Value	100 000 000,00 €
Total	100 000 000,00 €

The various contracts signed identify all the costs inherent in this phase. These contracts set out all the expectations and results for each of the stakeholders involved, thus ensuring correct compliance with the costs and the critical path defined.

Another important factor that turned out to be relevant in this analysis and monitoring implemented is that the internal costs are very significant even in this phase. Therefore, it will be feasible to charge these costs to the main shareholder of the company Transportes Urbanos de Braga, the Braga City Council, by adding these items to the program contract for the years 2024 and onwards.

This benefit, mentioned earlier, is only possible thanks to the tools developed and implemented here, which made their feasibility possible during 2023.

With the costs inherent in the project, or even the period in question, it would be straightforward to apply the process for classifying the project and determining the rigour to manage the respective stakeholders.

Thus, considering the total cost (100 million euros), the BRT @ Braga project would be classified as a complex project after applying the Project Classification process.

Time and Schedules

The BRT project has a total estimated implementation period of 5 years, going through various phases, all of which are very different, such as studies, creating all the tender documents and opening the respective public procedures, or simply working on various artefacts relating to that same project and its framework and various funding programs.

An action, like the one present here, has a practical meaning and a stopping condition for its closure, be it the determination of objectives (intermediate), a time period, or even the achievement of a milestone.

As mentioned before, the stopping condition for this action is the combination of the time period assumed for this action and the correct completion of all the proposed objectives.

The planning and the corresponding Gantt chart (Figure 49) show only the detail necessary for the effort proposed in this doctoral project, considering that certain information, apart from being of reserved characteristics, would not add any value.

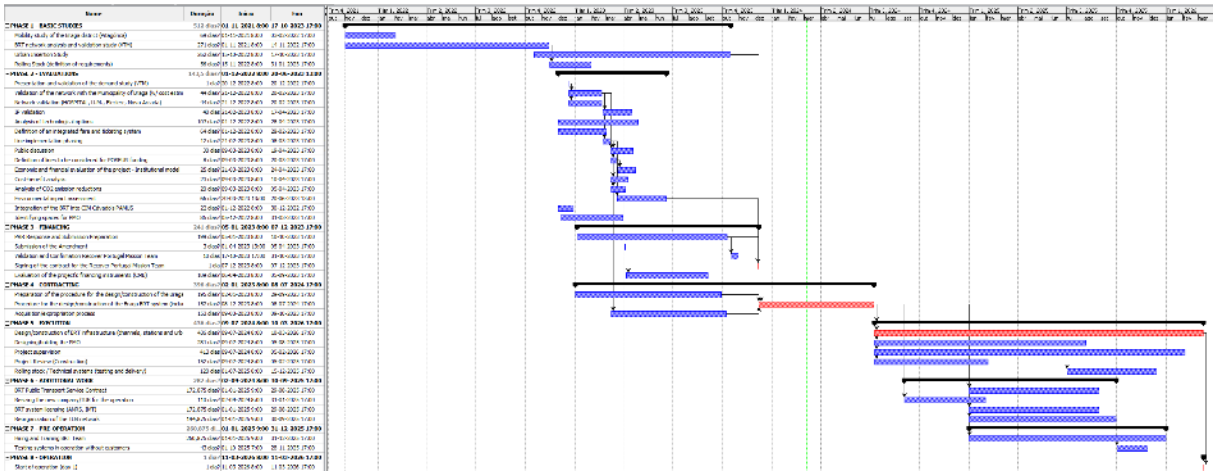


Figure 49 – Schedule and Gantt Chart for the BRT Project

We have a global focus on the entire effort and the phases that directly impact the 2023 period, and also on december 2022, the period that would be the target of the action and subsequent conclusions of the proposed framework.

This period had some slack in the way the various tasks were linked and in the phased involvement of each intervention by the various stakeholders and their respective timings.

One crucial stakeholder, whose impact on time was considerable, was the Portuguese Government itself and the various official points, such as the public presentation of the project when it was included in the Portuguese Recovery and Resilience Plan, by the Prime Minister of Portugal, António Costa (Figure 50).



Figure 50 – BRT @ Braga Project presentation by Prime Minister of Portugal

This is a stakeholder mentioned here directly just to demonstrate how a project, however, armoured it may be in terms of phases and tasks, will always have flexibility with the presence of stakeholders with a high influence and impact on change, as all timings suffer from the various control points it imposes.

The importance of determining the impact and influence of each stakeholder on the project, following the Stakeholder Classification process, made it possible to correctly identify and pursue the times associated with each task.

The process developed, in this particular case, the Project Framework Metro Line for Complex Projects, played a major role in helping to manage this project. It did not replace existing processes but filled an existing gap.

Objectives and Deliverables

The period around 2023 would be extremely important in that this would be the year in which the project would gain some inertia and consolidation in relation to its existing maturity.

The project to be implemented will lead to the construction of two lines (Figure 43):

- The Yellow Line, running between the Railway Station and Avenida Robert Smith (Minho Center Shopping Mall), is about 6.2 km long and has 12 stations. It will promote the connection of the southern part of the city to rail transport and encourage the attraction of passengers from individual transport through a park-and-ride at the southern end of the line.

- The Red Line runs between Braga Railway Station and Braga Public Hospital, passing by the University of Minho and the Institute of Nanotechnology, with around 6.2 km and 12 stations.

It should be noted that this new infrastructure will be part of the Municipality of Braga's overall public transport network, so it is not in competition with other services or infrastructures that offer similar services.

This investment aims to bring socio-economic benefits to society and does not selectively favour any company or sector.

Thus, Transportes Urbanos de Braga is entrusted with a public service mission and operates under a public service concession contract, signed on 02/04/2020 in accordance with Regulation (EC) 1370/2007, fulfilling the provisions of Law no. 52/2015, of June 9.

The year 2023 would be remarkable for several reasons, such as the fulfilment of numerous objectives:

- Public presentation of the project with the Prime Minister of Portugal, António Costa, and various members of the XXIII Government of the Portuguese Republic (03/05/2023);
- Exemption from the Environmental Impact Assessment granted by the Portuguese Environment Agency (APA) (23/10/2023);
- Signing of the Braga BRT Project Contract with the Recover Portugal Mission Team;
- Sponsors and Moderators of the Round Table "Bus Rapid Transit, a new impetus for mobility" (03/11/2023).

The studies and projects to start the public works are expected to be completed in 2024. The works will take place between 2024 and 2026, with progress milestones defined according to the various actions to be implemented.

The target audience, one of the main stakeholders in this project, is the users of the city of Braga, whose use of a solution such as the Braga BRT could become part of their mobility needs.

Assessing the risk, so that it is possible to create a matrix with measures to mitigate or transfer these risks, are mainly associated with possible litigation situations in public procurement processes.

These risks will be mitigated through careful preparation of the tendering procedure to minimise potential challenges. To this end, teams are involved in preparing the tender procedure, with internal and external Transportes Urbanos de Braga members who are highly experienced and competent in tender

procedures. These efforts occurred numerous times throughout the period, materialising in various documents to support public procurement procedures.

It should also be noted that, as Transportes Urbanos de Braga is the project owner, the conclusions presented for the BRT @ Braga investment project regarding the company's ability to present reasonable cost projections and successfully implement transport infrastructure projects in terms of mitigating the risks of project delays or cost overruns are also applicable to this project.

6.6.5 Metrics and Lessons Learned

As mentioned, the BRT @ Braga project was the true and final validation of the proposed model, which was developed over four years.

This was an intense and lengthy process, undergoing several additions and even evolutions to offer the necessary comfort to all the actors inherent in a project and its management.

The need for final validation has led to a considerable increase in the attention paid to the application of this process and to a critical stance, perhaps sometimes unfair, but with which the researchers have agreed and which they have followed up throughout this latest action.

This brings us to the evaluation of the maturity of the BRT @ Braga project, which can be seen in the following Table 53:

Table 53 – Maturity Level Matrix of the BRT @ Braga Project

Elements	Attributes to Score	Maturity Level | GDPR Project
Approach	Sound	4
	Integrated	4
Deployment	Implemented	4
	Systematic	4
Assessment and Review	Measurement	4
	Learning	4
	Improvement	4

Now, to evaluate all the components, the sound attribute was given a maturity rating of four, considering that it has created a clear rationale for project management with a focus on stakeholder management and a defined list of processes to sustain that purpose.

The approach is also integrated because it supports the entire strategy inherent in project management and its execution, allowing it to coexist with the governance model implemented for the project discussed here. For this reason, it also has a maximum maturity rating of four.

Considering its deployment and its attributes, more specifically, implemented and systematic, which also got top marks because the entire framework is implemented by default in the project management and governance model tailored for this complex project with a high impact on society.

Assessment and review, which are pertinent in a final evaluation where we are aiming for successful validation, have three attributes that end up being related to each other, e.g. measurement that represents the need to regularly and adequately measure the effectiveness of the approach and its use leads to learning moments being created to make the creation of opportunities for improvement more fertile, also very much in line with the research methodology chosen here, i.e. Action Research.

The results of measurement and learning are analysed and then translated into improvements and even conclusions, as well as possible possibilities for future work. Therefore, considering the results obtained, all these attributes justify the maximum evaluation of 4.

A final evaluation of the action is carried out using the following matrix present in Table 54:

Table 54 – Results of the action related to the BRT @ Braga Project

#	Metric Scope	Dimension of Analysis	Metric Name	BRT Project
C1	Complexity	Requirements	Requirements Complexity	4
C2		Cost	Total Predicted Investment	2
E1	Engagement	Quality	Governance	3
E2		Engagement	Communication	4
E3		Quality	Stakeholder Influence	4
E4		Requirements	Change Management	9
E5		Performance	Project Team Experience	10
M1	Monitoring	Quality	Changes to the Team Project	3
M2		Cost	Project Cost	100%
M3		Time	Time Deviation	100%
TP1	Team Perception	Requirements	Team Perception	complete

All the complex projects present not only objectives but also unique circumstances, and many of them are even divided to become more manageable, like if it is a portfolio instead of a project, being then combined with more small and manageable projects.

Looking at the matrix that evaluates the results of the action, Table 54, we have the application of the evaluation formula and the attribution of a value of four, considering that this is a project with a high external impact.

The cost resulting from applying the project classification process means that this project is classified as a complex project and, therefore, has to be evaluated with a classification of two.

The engagement metric scope has numerous certified project managers in its governance. Considering the implemented governance model, this project does not need a PMO.

Communication was interactive from the outset, which is what the communication plan called for. However, in the relationship with some stakeholders, the communication strategy was implemented with a pull aspect, which is present in the Stakeholder Engagement Toolkit and Risk Management.

This project, and its inherent risks, lead to an evaluation of four in the stakeholder influence metric, given that numerous stakeholders could stop this project. This is also evident in the process of identifying stakeholders.

Any project with the length of time as the BRT @ Braga Project can undergo countless changes. By the end of the action, we had recorded nine changes in requirements, i.e., the type of vehicles to be used, the technology used and its architecture, or even the physical implementation to be favoured in the densest part of the city of Braga. This is a feature of numerous documents, such as risk and change management.

The project management team here has an average of ten years of experience in similar roles. This value could be higher if we extended it to the project team.

In monitoring, and its three dimensions of analysis, we have the first indicator, which relates quality and the number of changes to the project team, so we have identified three changes with core elements of the project management team.

The project's cost continues to be on schedule and meets the 100 million euros target, which does not lead to any deviation from this indicator, nor does time. Cost and time are two factors that are not elastic, so if they deviate, funding will be cut, and the project will then be cancelled.

The objectives of the action were completely fulfilled, and the project team, at all the layers, fully perceives the fulfilment of the project's initial requirements and deviation from them. A critical document for this is the Communication Plan, which guarantees that all the elements of the project are aligned with the efforts underlined with this project.

This evaluation was carried out according to the constraints of the project in question and its particularities, such as its inherent challenges, like the project team and the entire ecosystem. For the above reasons, this evaluation is only suitable for this project, so it is unlikely to be represented in other projects and should not be transposed to others.

6.6.6 Theory Adjustments

Considering that the BRT @ Braga project has the application of the last action, after successful validation, we believe that no adjustments will be made to the theory in this effort supported by the Action Research methodology.

As such, the methodology will be closed, and editing the various processes and documents that make it up will be blocked.

6.6.7 Conclusions

A significant goal achieved in 2023 was the recognition by the Government of the Portuguese Republic of the project's value for the city of Braga and its inclusion in the funding of the Recovery and Resilience Programme (PRR).

One fact that the various stakeholders mentioned through this action was that the project was mature enough and had all the evidence to prove it, and this was nuclear to justify the funding necessary to continue the project.

This feedback is essential for the efforts of the doctoral project, considering that the framework developed here, with the main purpose of extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management, because it would be included in the project already at the stage mentioned above and that the results are all positive.

Nevertheless, we compared the results of this action with the primary and secondary research questions of this doctoral project:

- (MG) Extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management.
    a. The objective was met since we achieved success to all the objectives identified, with a focus on stakeholder management.
- (SG1) Creation of a framework for the engagement of the stakeholders for innovation projects in Smart Cities.
    a. This was met since the implementation of the analysis in this action helped validate the respective framework for managing stakeholders in innovation projects.
- (SG2) Improvement of the identification process for implicit and explicit stakeholders in innovation projects in Smart Cities.
    a. The objective was achieved and validated through this action.
- (SG3) Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in Smart Cities.
    a. The objective was met since small changes were created, and the process was further validated.

- (SG4) Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in Smart Cities.
    a. Partial evaluation since the maturity offered could not be fully validated due to the project's stage.

With the validation carried out and the result positive, it will be possible to move on to the next chapter with the certainty that all the objectives inherent in this endeavour have been met.

With the various actions supporting the development of the Extending Project Management Practices for Innovation Projects in Smart Cities, Focusing on Stakeholder Management, we are confident that we can propose the framework detailed in chapter 7.

7. Framework Astrolabe4SM

This chapter introduces a tailored framework, codenamed Astrolabe4SM (Astrolabe for Stakeholder Management), developed to enhance project management practices specifically for smart city innovation projects. It emphasises stakeholder management's crucial role.

The framework addresses the unique complexities of managing innovation within urban settings, where diverse stakeholder interests and dynamic project requirements pose significant challenges. By focusing on broad classification systems and a strategic management approach, this framework aims to streamline project processes and enhance stakeholder engagement.

7.1 Introduction

Regarding project management, the primary demand is how to justify the commitment of all stakeholders and the respective attention given to it.

When any project involves the right people in the right roles, efforts are enhanced by better engagement, greater relevance, and a greater likelihood of long-term success (AXELOS Limited, 2019).

Unexpected actors can provide creative solutions, enthusiastic contributions, and meaningful insights, so inclusion will always be a more favourable policy than exclusionary action.

Cooperation and collaboration, from a project perspective, is always better than working in isolation, which is often referred to as 'silo activity'. Recognising the involvement of all stakeholders in genuine collaboration is one of the initial and most central motivations in this PhD thesis effort.

Without effective collaboration, there will be no standards, frameworks, or methods to support a project and lead it, under these conditions, to success (AXELOS Limited, 2019; Project Management Institute, 2021).

We are aware that when creating documents or templates, it is always necessary to define the terminology and describe the perspective given concisely and transparently, which is also covered in Chapter 2.

Through this perspective, we will describe the process and the proposed framework in its most mature phase, which currently presents itself as the final version of the effort to which we committed ourselves.

As for the codename for the developed framework, we consider the name Astralabe4SM (Astrolabe for Stakeholder Management) to be appropriate, given that in the Age of Discoveries, the astrolabe was an essential tool for sailors, guiding them through uncharted waters with precision and reliability. Similarly, the Astrolabe4SM framework is designed to guide project managers through the complexities of stakeholder management in innovation projects.

Astrolabe4SM ensures that project managers can confidently and precisely navigate the intricate landscape of stakeholder relationships by providing structured methodologies for identifying, analysing, managing and engaging stakeholders.

Just as the astrolabe was versatile and adaptable to different navigational contexts, Astrolabe4SM is adaptable to various project types and stakeholder scenarios, making it an indispensable tool for successful project management in the modern era of smart city innovation.

In the following subchapters, the final iteration of the framework developed for Extending Project Management Practices for Innovation Projects in Smart Cities, Focusing on Stakeholder Management, with the codename Astrolabe4SM, can be seen.

7.2 Project Classification

One of the main difficulties inherent in applying any methodology is classifying the type of problem we face so that we can apply or use a practical and justifiable solution.

Embracing the intrinsic challenge in this doctoral project, it was clear that a way of qualifying the project would have to be created, which would then lead to applying a framework whose effort would depend on its typology or classification.

Using the team of researchers' experience managing or participating in public or private projects, we considered exploring a concept widely used by the public sector: the management of public procedures.

A European perspective on the management of public procedures and the legal frameworks, supported by the local implementation of the same European directives in each member state, seems to give us the necessary comfort in achieving success in this classification.

The European legal frameworks, comprising national and European Union laws, significantly influence local public procedures and help create an international standard comprising orientations and regulations (European Union, 2012).

National laws set the broad legal parameters within which local governments operate, often defining the scope of their powers and responsibilities (Gonçalo Guerra Tavares, 2022). EU legislation, particularly in member states, adds another layer of complexity, impacting local procedures in areas like environmental regulation, procurement, and human rights. Therefore, local governments must deal with these overlapping legal frameworks, ensuring compliance while addressing specific local needs and conditions.

While these orientations provide a broad framework, local governments across Europe adapt them to their specific contexts, balancing the need to comply with national and EU laws and address unique local needs and conditions. This dynamic interchange between European orientations and local specificities defines the rich local perspectives of public procedures across the continent.

7.2.1 European Orientations

The European Union (EU) has established comprehensive directives regulating public procurement processes across its member states. These directives are designed to ensure fair competition, transparency, and equal treatment in the awarding of public contracts. Fundamental principles include the prohibition of discrimination on nationality, the requirement for transparency in tendering processes, and the enforcement of specific thresholds for different types of contracts, above which EU rules apply (European Union, 2024).

The Public Contracts Code in the EU context refers to the legal framework that encompasses these directives and their implementation strategies. This code harmonizes procurement rules across the EU, ensuring public contracts, particularly those of significant value, are accessible to European businesses (European Union, 2012). This harmonisation aims to develop an integrated European market, reduce government costs, and increase public spending efficiency.

EU member states are required to transpose these directives into their national laws. This transposition process involves adapting the EU's broad regulatory framework to fit national legal systems and procurement practices. While the core principles of the directives must be maintained, countries have some flexibility in how they implement these rules. This flexibility accommodates local legal traditions and administrative structures, ensuring that the directives are correctly integrated into national contexts.

At the national level, the Public Contracts Code (PCC) influences how governments and public sector entities conduct procurement, where EU directives set out detailed procedures for tendering processes, including how contracts are advertised, how bids are evaluated, and how contracts are awarded.

These procedures ensure procurement is conducted fairly, openly, and competently, preventing corruption and developing economic efficiency.

The specifications and requisites in public contracts at the national and local levels are significantly shaped by both EU and national procurement laws. These specifications often include technical requirements, financial thresholds, and bid assessment criteria (European Union, 2012). The requisites can also involve environmental, social, and labour standards, reflecting broader EU objectives around sustainable development and social responsibility.

Local governments must align their procurement practices with national laws and EU directives (European Union, 2012). This alignment can pose challenges, especially for smaller municipalities or local entities with limited resources. They must comply with complex legal requirements while addressing local needs and priorities. Local adaptations often include setting up specialized procurement offices, training staff in EU and national procurement rules, subcontracting, and developing local guidelines that align with broader legal frameworks (European Union, 2024).

One of the critical challenges for local entities is balancing the objectives of European integration and competition with local development goals. While EU rules aim to open up public contracts to bidders across Europe, local governments are often interested in supporting local businesses and addressing specific local challenges (OECD, 2023).

Finding a balance between these sometimes-competing objectives is a central task for local authorities in managing public contracts.

The European orientation towards digitalisation has also influenced public procedures, particularly in procurement. E-procurement platforms, encouraged by EU directives, are increasingly being adopted at national and local levels. These platforms streamline the procurement process, increase transparency, and make it easier for a broader range of companies to participate in tendering processes (Prałat, 2019).

The European Public Contracts Code represents a significant aspect of the EU's efforts to standardize and regulate public procurement practices across member states (OECD, 2023). Its influence extends

from the national to the local level, shaping how public contracts are managed, the specifications and requisites involved, and the overall approach to procurement (European Union, 2024).

While the overarching goal is to create a fair, competitive, and transparent procurement environment across Europe, implementing these directives locally requires careful balancing of EU objectives with national and local priorities (European Union, 2024). The resulting relationship between these various levels of governance exemplifies the complexity and dynamism of public procedures within the European context.

It is aligned with this argument that we have defined a way of determining the complexity underlying the management of a project, i.e. relating the attention and focus given to the contracting procedure used and thus classifying how it is managed, especially in terms of stakeholder management (European Union, 2012, 2024).

A common element in the transposition of European directives into local law is the presence of three major classifications, although being very significant in terms of complexity and guidelines:

Table 55 – European Directives - three major classifications (European Union, 2024)

Type of Procedure	Description
Open Procedure	This is the most straightforward type of procurement. Any interested supplier can submit a tender. The process is open and transparent, with no prior selection, and the value threshold for supply and service contracts is typically lower than for other types of contracting authorities. Considering this definition, the effort related to the deliverable defined by an Open Procedure shall be regarded as a Simple Project in terms of its complexity.
Restricted Procedure	This procedure involves two stages. First, any interested party can request participation, but only those meeting the pre-qualification criteria are invited to submit tenders. These include entities at regional or local levels, and the value thresholds for supply and service contracts are usually higher than those defined by an Open Procedure. The restricted procedure would be classified as a Complex Project.
Innovation Partnership	This procedure is used when the need involves the development of an innovative product, service, or work that existing market solutions cannot meet. Considering the product, service, or work type, there is no need to specify the value or its thresholds, resulting in a classification as an Innovation Project.

Specific rules, and regulations, govern each of these procedures, often outlined in the EU Public Procurement Directive and the member states' national laws.

With these three types of public procedure identified, creating a general project categorisation model, that could be transposed clearly and objectively to any European national and local levels, is feasible.

Considering the desired classification of the types of projects assigned to Smart Cities, which by their nature have public entities associated with them and which, inherently to this type of organisation, always have to follow public procurement, it is possible to have European directives supporting this process for the initial phase of the framework and making it viable for local application.

Challenges and Solutions in Local Management

Managing the local implementation of European Union directives involves addressing unique challenges such as resource constraints, varying administrative capabilities, and local political dynamics (European Union, 2012).

Solutions include tailored training programs for local officials, public consultation processes to ensure community buy-in, and the development of regional compliance monitoring mechanisms that can create a local impact, such as:

- Economic Impact: While EU directives can stimulate local economic growth and innovation, they may impose additional costs on local governments and businesses.
- Social and Environmental Impact: Locally, directives can improve public services, enhance environmental quality, and increase public participation in governance.

Stakeholder Perspectives

An EU directive, bringing an outside approach to local implementation, may lead to some challenges for all the involved stakeholders and will force the accommodation of these guidelines, not only brings changes to the local procurement laws but also the behaviours and posture of all the interested or vised stakeholders, for example (European Union, 2012):

- Local Governments: They face the dual challenge of aligning with EU directives and adapting them to local contexts. This often requires balancing EU standards with local priorities and capacities.
- Local Businesses and Small and Medium-sized enterprises (SMEs): The impact on local businesses, especially SMEs, can be significant as they steer the complexities of compliance with EU and local regulations.

- Civil Society and Community Groups: At the grassroots level, civil society expects tangible benefits from these directives, such as improved environmental conditions or more transparent local governance.
- Local NGOs and Advocacy Groups: These organisations often act as watchdogs and facilitators, ensuring that the local implementation of directives reflects community needs and EU objectives.

The effective local implementation of EU directives is vital to realising their intended benefits. It requires a nuanced approach that respects the spirit of EU law and the realities of local contexts.

Recommendations for local stakeholders include favouring close collaboration between national and local authorities, engaging local communities in the implementation process, and continuously monitoring the impact of these directives at the local level. Through such concerted efforts, the objectives of EU directives can be successfully translated into meaningful local outcomes.

Case Studies of Local Implementation

European Union (EU) directives are constructed with the primary objective of harmonising practices across member states. However, the actual test of their effectiveness lies in their local implementation. This analysis explores how EU directives are integrated into local public procedures, considering the nuances of local governance structures, cultural contexts, and administrative capacities.

While uniform in their objectives, EU directives offer flexibility in their implementation to accommodate member states' diverse legal and administrative systems. This transposition process involves adapting the directives to local laws and practices.

For instance, the Public Procurement Directive requires each member state to integrate its principles into its procurement laws, which can vary significantly regarding procedural details and execution.

Some detailed examples that showcase how cities are leveraging procurement policies to drive environmental sustainability can be seen below in Table 56:

Table 56 – European Directives adapted to a local context and projects from public procurements.

Vienna, Austria - Green Public Procurement
Project Overview:
Vienna has integrated green public procurement policies to ensure all city purchases prioritise environmental sustainability.
EU Directive Connection:

This initiative aligns with the EU Directive on Public Procurement (2014/24/EU), which encourages member states to consider environmental impacts in their procurement processes.

Key Implementations

Eco-Friendly Office Supplies

Procuring recycled materials and environmentally friendly office supplies.

Sustainable Transportation

Prioritising the purchase of electric vehicles for city services.

Barcelona, Spain: Energy-efficient Infrastructure

Project Overview:

Barcelona has focused on procuring energy-efficient infrastructure to reduce the city's carbon footprint.

EU Directive Connection:

Adheres to the EU's emphasis on energy efficiency in public procurement.

Key Implementations

Intelligent Lighting Systems

Procuring energy-efficient lighting technologies for public streets and buildings.

Green Building Certifications

New public construction projects must meet green building certification standards.

Amsterdam, Netherlands: Smart City Privacy

Project Overview:

As a smart city, Amsterdam has focused on embedding GDPR compliance in its innovative city projects.

EU Directive Connection:

Data protection should be incorporated into urban data collection and use by applying the GDPR.

Key Implementations

Privacy-by-Design in IoT

Implement privacy-by-design principles in IoT (Internet of Things) deployments across the city.

Data Protection Impact Assessments

Regularly assess new technologies deployed in public spaces.

Lisbon, Portugal: Public Service Delivery aligned with GDPR

Project Overview:

Lisbon has revised its public service delivery to align with GDPR standards.

EU Directive Connection:

Adapting public service data handling to meet GDPR requirements.

Key Implementations

Training Public Employees

Training Public Employees: Comprehensive training programs for municipal employees on GDPR compliance.

Updating Public Records Management

Revising data storage and access protocols in public record management.

These examples illustrate how various European cities use procurement laws and directives to advance their local goals, which can lead to the attainment of a global agenda.

So, to explain the adaptation of this framework and its process, an effort will be made to apply it to Portugal's context and consider how it might be possible to adapt and tailor it to a national context.

7.2.2 Portuguese Context

The Public Contracts Code (Código dos Contratos Públicos, CCP) in Portugal is a mandatory legislation governing public entities' procurement of works, goods, and services (Código Dos Contratos Públicos (CCP), 2008).

This document delineates the procurement procedures that government entities must comply with and establishes the groundwork for transparency, fair competition, and equal treatment amongst all participants.

The association between the CCP and project execution is intrinsic and crucial for achieving economically and socially sustainable development.

First and foremost, the CCP aims to ensure that public funds are used efficiently and effectively. By defining a set of procurement procedures, the code seeks to maximise the cost-benefit ratio for the government and, consequently, the taxpayers (República Portuguesa, 2008). The public tender, for instance, encourages widespread competition by allowing any qualified enterprise to submit proposals, thus promoting the acquisition of the best possible offer in terms of price and quality (Jorge Andrade da Silva, 2024).

Moreover, the CCP promotes innovation and quality. Procedures such as innovation partnerships enable public entities to find innovative solutions that often go above what is available in the market. By stimulating providers to develop creative solutions, the CCP contributes to technological advancement and enhances the services or solutions provided to the population (República Portuguesa, 2008).

Transparency is another fundamental pillar of the CCP. By establishing clear rules for the publication of tenders and the disclosure of contracts, the code helps prevent corruption and ensure that all participants have equal access to information. This is crucial for public trust in procurement processes and the legitimacy of projects funded by public resources.

The equal treatment promoted by the CCP also profoundly impacts the way projects take place. The CCP allows small and medium-sized enterprises to compete with more prominent corporations by levelling the playing field. This encourages local economic growth and can lead to more tailored and attentive solutions to the specific needs of local communities or other stakeholders.

In turn, the CCP directly affects the sustainability of public projects. The code encourages sustainable and responsible practices by including environmental and social criteria in the selection processes. This means that apart from financial costs, environmental impact, energy efficiency, and social inclusion become integral to how projects are conceived and implemented (Gonçalo Guerra Tavares, 2022).

Economically speaking, the CCP plays a strategic role in promoting competition and market development. By opening doors to companies across the European Union, the CCP aligns Portugal with open market practices, encouraging foreign investment and strengthening local industries to compete in a broader market.

However, the success of the CCP's application depends on the public entities' ability to understand and effectively implement its procedures.

The proper application of the CCP can also face challenges, such as bureaucracy and the complexity of procedures, which may be seen as barriers to the agility of the procurement processes. The constant evolution of legislation, local or related to the directives of the European Union, requires ongoing updating and adaptation by the public and private agents involved.

Ultimately, the CCP is more than a set of rules for public procurement. It is a tool that guides the management of public resources responsibly, promotes economic development, stimulates innovation and interaction between all the related stakeholders and ensures that public projects are carried out with maximum benefit to society (República Portuguesa, 2008).

Its importance to how projects take place in Portugal cannot be understated, as it establishes the foundations for effective, transparent, and fair public governance and, thus, more transparent, inclusive, and traceable project management, primarily related to stakeholder management.

Considering the rules for public procurement on Portuguese grounds and the effort we are trying to achieve during this PhD project, this relationship between public procurement and stakeholder management would primarily revolve around understanding how the legal framework governs the

management of public procedures and how this interacts with the principles and practices of stakeholder management.

This effort does not focus on developing a comprehensive understanding of how Portuguese law on public procedures relates to and supports effective stakeholder management. However, a brief introduction is considered adequate if it involves several key steps.

This process integrates legal, managerial, and communication perspectives to create a cohesive approach.

Here is a structured way to develop this understanding and how it influenced the proposed framework (Table 57):

Table 57 – Relationship between public procurement and stakeholder management

Legal frameworks
• Identify the compliance requirements, such as procurement processes, bidding requirements, transparency obligations, and ethical standards.
Stakeholder Groups Identification
• Identify all potential stakeholders in public procedures, including government entities, private contractors, local communities, and interest groups. • Assess these stakeholders' interests, needs, and concerns concerning public procedures.
Analyse the Interaction Between CCP and Stakeholder Management
• Determine how the law mandates or encourages stakeholder engagement in public procedures. This could include requirements for public hearings, community consultations, or disclosure of information. • Examine how the legal framework supports or dictates communication channels and transparency with stakeholders (e.g. digital procurement platforms and official magazines).
Risk Management and Conflict Resolution
• Identify potential legal risks in public procedures, such as non-compliance, disputes, or ethical breaches. • Develop strategies to mitigate these risks, informed by legal requirements and stakeholder management best practices. • Understand legal provisions for resolving conflicts between stakeholders and the managing authority.
Ethical Considerations
• Explore how the law addresses ethical conduct in public procedures. • Align legal and ethical standards with stakeholder expectations and best practices in stakeholder management.
Continuous Learning and Adaptation
• Keep abreast of changes in the law and evolving stakeholder management techniques. • Implement a system for feedback from stakeholders and continuous improvement of processes, similar to an Action Research methodology.
Practical Application
• Study real-world examples and case studies of public procedures in Portugal to see how the law and stakeholder management practices have been applied. • Applying the learned principles in simulations or training exercises in hypothetical or controlled environments.

This comprehensive approach ensures that public procedures are legally compliant and effectively managed concerning all stakeholders involved.

This methodology validates the need to extend project management practices for innovation projects in Smart Cities. It focuses on stakeholder management and uses an actual framework for project classification. Therefore, it helps to apply a new perspective on stakeholder management.

With this intricate relationship, it is possible to develop a profound understanding of the relationship between Portuguese law on public procedures, especially the CCP, and stakeholder management.

Types of Procedures

For the elaboration of contracts, the scope of which covers services that are or are likely to be subject to market competition, project-owning entities must adopt one of the following types of procedures, or open calls, and their characteristics (República Portuguesa, 2008) (Table 58):

Table 58 – Types of Public Procedures

Types	Description	Value
Direct Adjustment		
i. General	Procedure in which the contracting authority directly invites an entity (i.e. company) of its choice to submit a tender	< 5 000 €
ii. Simplified	A straightforward procedure that dispenses with any procedural formalities and is completed when the body responsible for the contracting decision approves the invoice or equivalent document submitted by the entity invited to make the purchase.	< 20 000 €
Prior Consultation	Procedure in which the contracting authority directly invites at least three entities of its choice to submit a tender and may negotiate with them on aspects of the performance of the contract to be awarded, provided that this possibility is expressly stated in the invitation	< 75 000 €
Public Tender		
i. Normal (National and International)	Competitive procedure in which the contracting authority publicises its existence utilizing a notice published in the official national media (Diário da República) and also international media (Official Journal of the European Union) when the value of the contract to be awarded exceeds the Community thresholds, and any interested party, may submit a tender.	National: ≥ 75 000 € and ≤ 221 000 € International: no limits
ii. Urgent	The competitive procedure is publicised by a notice published in the Diário da República, and the deadline for submitting tenders is considerably reduced as it is counted in hours.	≥ 7 5000 € and ≤ 221 000 €
Restricted Tender with Prior Qualification	Competitive procedure in which the contracting authority publicises its existence through a notice published in the official national media (Diário da República) and international media (Official Journal of the European Union), with any interested party able to submit a tender. It can be adopted whenever the contracting authority deems assessing economic operators' technical or financial capacity is necessary. It should be emphasised that, as a rule, the minimum financial capacity requirements may not exceed twice the value of the contract.	≤ 221 000 €

Types	Description	Value
Negotiated Procedure	A competitive procedure in which the contracting authority publicises its existence employing a notice published in the official national media (Diário da República) and international media (Official Journal of the European Union), with any interested party able to submit a tender. Like the restricted tender by prior qualification, the negotiated procedure is characterised by a qualification phase. However, it has the specificity that competitors (who have been previously qualified) can improve the attributes of their proposals in a negotiation phase.	≤ 221 000 €
Competitive Dialogue	A competitive procedure in which the contracting authority publicises its existence employing a notice published in the official national media (Diário da República) and international media (Official Journal of the European Union), with any interested party able to submit a tender. The competitive dialogue is used when the contracting authority does not know how to meet it despite identifying the need. Like the restricted tender procedure, it is characterised by a qualification phase. However, it has the specificity that, before the tender submission phase, there is a phase of presentation of solutions and dialogue with qualified candidates invited to submit a tender. In this procedure, the specifications are only drawn up after the solutions dialogue phase is over,	≤ 221 000 €
Innovation Partnership	The innovation partnership procedure aims to conduct research and development activities for innovative goods, services or works with a view to the subsequent purchase of these goods, services or works, provided that the previously agreed maximum price performance levels are met. The innovation partnership is a public procurement procedure covering research and development contracts and final products. The proposal must be guaranteed to be innovative and will solve the contracting authority's question, creating a plan that demonstrates the project's phases until the innovation is presented (Cláudia Margarida Ramos Teixeira, 2019). Thus, this endeavour is distinguished by being dedicated to research and developing the final product.	≤ 221 000 €
Design Contest	The design contest aims to select one or more design works at a basic programme or similar level, specifically in art, land use planning, urban planning, architecture, engineering, or data processing.	≤ 221 000 €
Ideas Competition	The design contest aims to select one or more design works at a basic programme or similar level, specifically in art, land use planning, urban planning, architecture, engineering, or data processing.	≤ 221 000 €
Dynamic Acquisition Systems	To conclude, contracts for the lease or purchase of movable property or the purchase of services in everyday use, as well as public works contracts of reduced technical complexity, the characteristics, and methods of execution, are generally available on the market to meet their needs.	≤ 221 000 €
Framework Agreements	A framework agreement is a contract between one or more contracting entities and one or more other entities to regulate future contractual relations established over a given period by fixing their terms in advance.	≤ 221 000 €

Something that helps to substantiate the objectivity of the proposed model is the argument that the choice of direct adjustment, prior consultation, public tender or restricted tender procedure should be made based on the value of the contract to be concluded.

However, considering the type of project and contract, we have chosen to consider only the possibility of concluding contracts whose scope refers to the formation of contracts for the lease or acquisition of movable goods and the acquisition of services.

Considering the global nature and scope of technological projects and the notion of financial value, which is ultimately determined and thus uncontested, it is possible to design a project qualification model to start using the proposed framework.

7.2.3 Suggested Model

The quality of public contracts is, in fact, decisive for the quality of the object of the contract and its innovative character. The multiplexing of all types of procedures in any context and their respective classification depends on defining rules and guidelines for correctly selecting and implementing the proposed model.

By analysing the Public Procurement Code (CCP) in detail and using European guidelines to classify the respective procedures, we can identify three types of procedures that perfectly fit the desired effort, considering the desired result (European Union, 2012, 2024; República Portuguesa, 2008).

The before mentioned procedures are:

- Direct Adjustment
- Public Tender
- Innovation Partnership

This choice takes into account the data in the Relatório Anual 2022 - Contratação Pública Em Portugal (2023), where the indicators in Figure 51 validate the selection of the various procedures.

Figure 51 also shows that two of the procedures selected, direct adjustment and public tender, in their variants, are 65.15% representative of the total number of national procedures that occurred during 2022, demonstrating the validity and relevance of the chosen procedures.

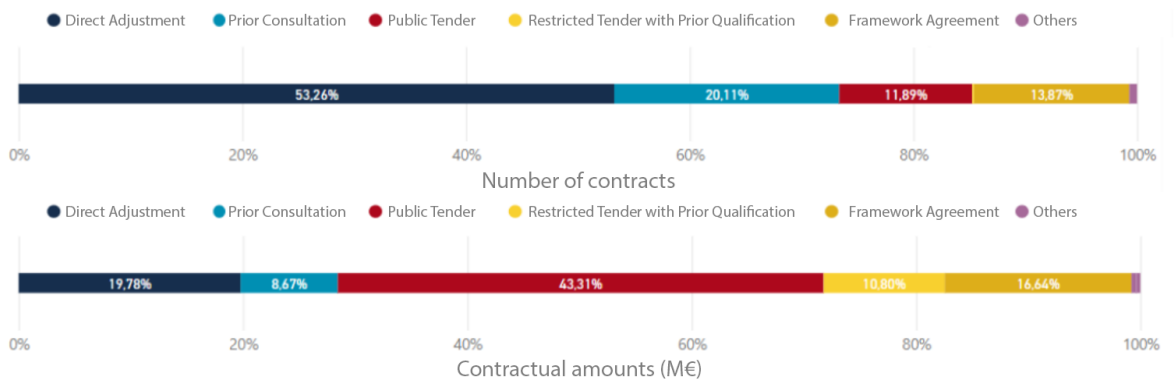


Figure 51 – Public procurement by type of procedure
(República Portuguesa - Infraestruturas e Educação, 2023)

Although the Innovation Partnership is not very significant in numbers expression, included in the Others category, it still proves relevant and valid due to its scope and endeavour for this doctorate effort.

Therefore, bearing in mind that this point represents the first step in choosing the methodology to be applied, we suggest a simple application according to the type of procedure, which is thus characterised in terms of costs or even according to whether or not there are solutions on the market.

In this way, we can use the following activity diagram (Figure 52), which represents a process, to visualise the high-level activities, which we illustrate below.

In the following diagram, Figure 52, we have used two colours: blue to represent the initial logical process and purple for the sub-processes that are extensions of the previous one and, therefore, deserve more detail (for better reading, please refer to the image provided in the appendix of this document).

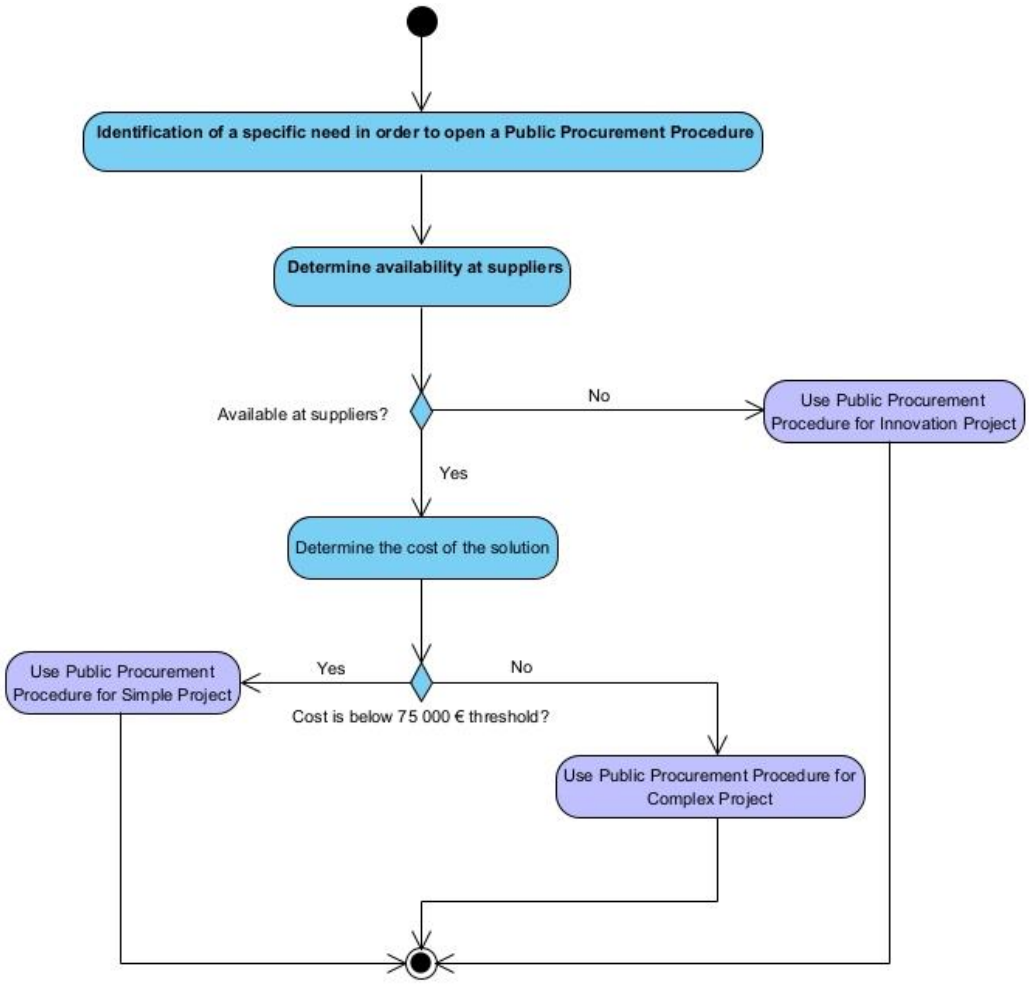


Figure 52 – Selection of type of Public Procedure

The first stage is to identify a need that will motivate the opening of a public procedure to acquire a service or product supported by a business case and which will provide all the necessary information to the respective legal team to start the lifecycle of what will not even be a project yet, but which will already be substantial.

To make the first selection, it should be asked if a suitable solution exists with a partner or supplier. If not, using a partnership for innovation may be necessary and justified (Figure 53).

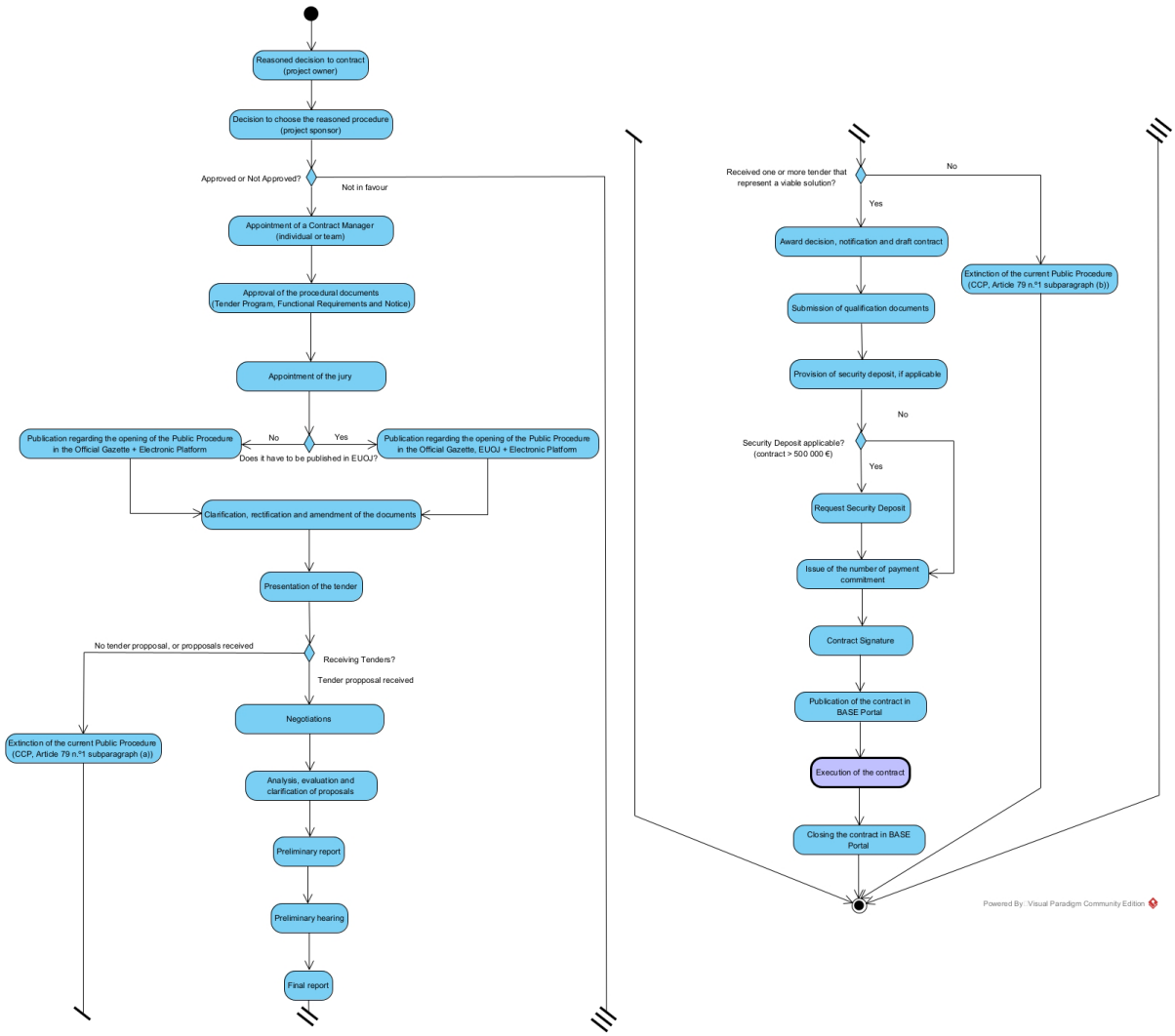


Figure 53 – Innovation Partnership

However, the first response to this phase should largely favour existing solutions, i.e., a solution on the market can meet the need and purpose initially identified.

Once this solution has been identified, a market enquiry should then be conducted to determine the cost of the solution, so we suggest two levels at this stage:

- Below the 75 000 € threshold
- Equal or higher than the 75 000 € threshold

This phase makes it possible to differentiate the projects into two categories, making this categorisation feasible for the objectives set for this doctoral project.

Therefore, if a solution costs less than €75 000, it will be classified as a Simple Project and follow the activity diagram drawn up for this, representing the Direct Adjustment Procedure (Figure 54).

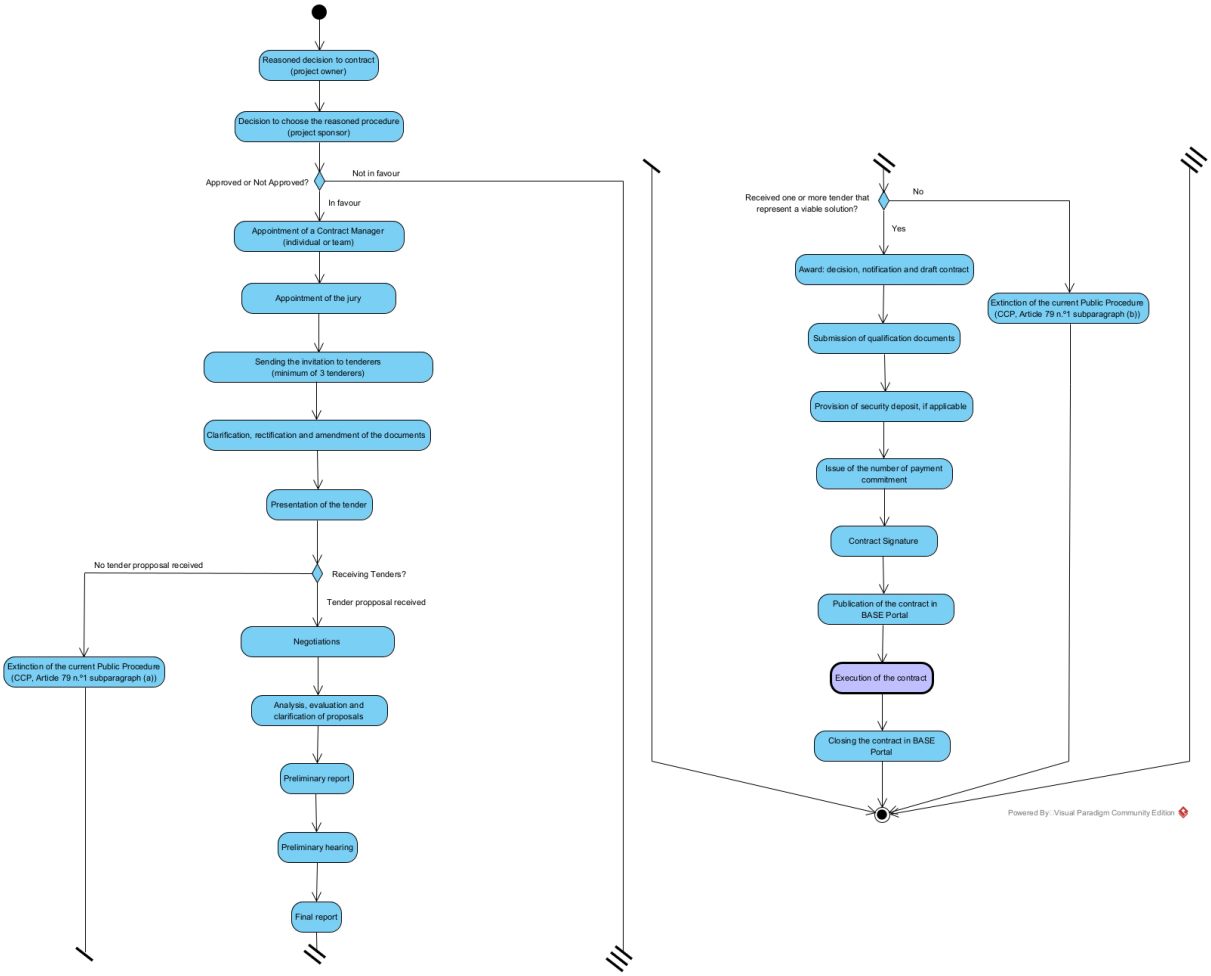


Figure 54 – Direct Adjustment Procedure

On the other hand, if the solution exists but costs €75 000 or more, the remaining process will follow as a Complex Project sustained by the Public Tender Procedure (Figure 55).

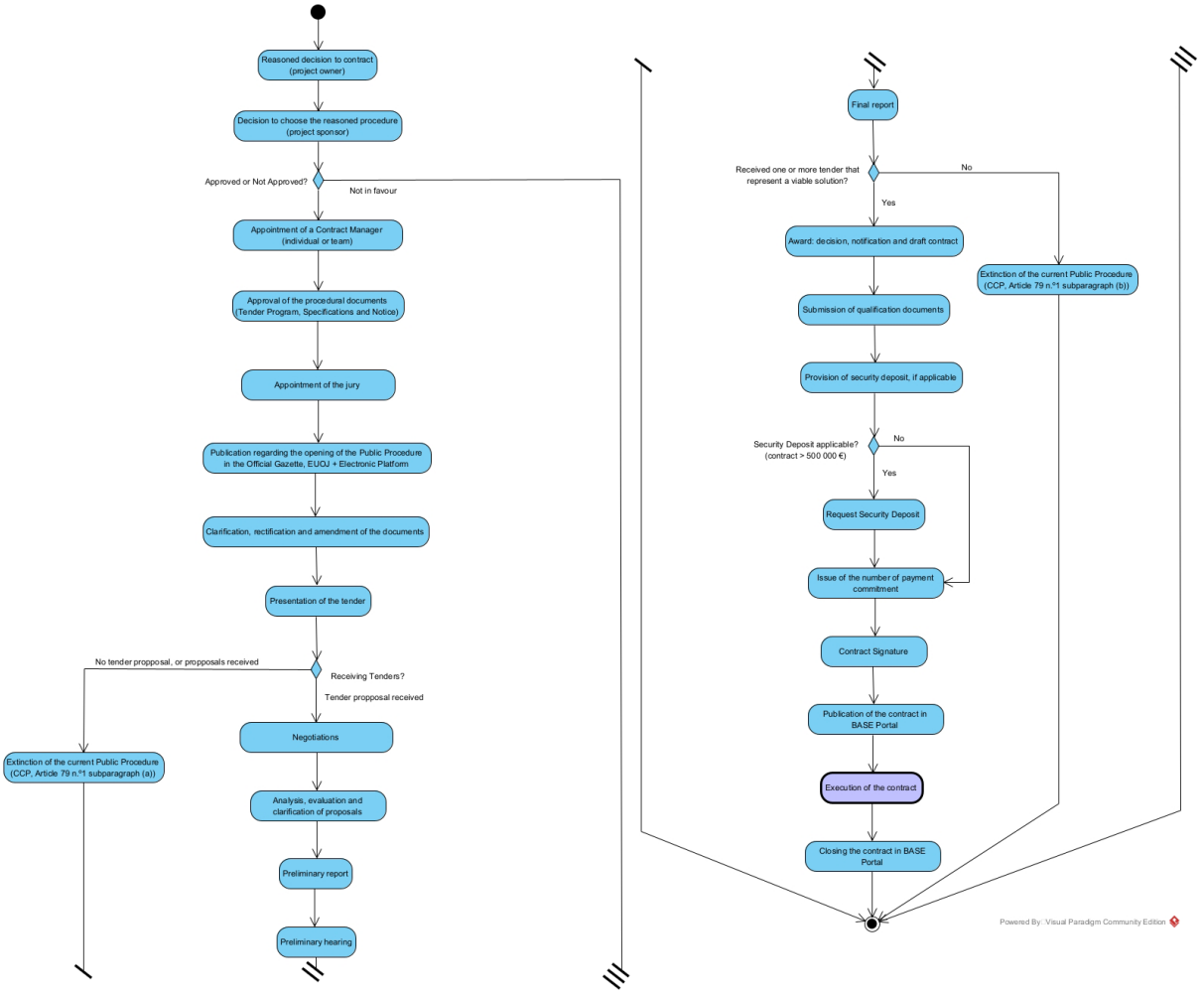


Figure 55 – Public Tender Procedure

After this classification, and during the project's preparation and initiation phase, it will be possible to identify the various stakeholders and how all these groups and individuals can be managed.

Throughout the diagrams for the associated procedures, we have also used two colours: light blue represents the necessary process that can run in parallel, and purple represents the moment when the process is resumed with the proposed project management methodology, following the Astrolabe4SM.

7.2.4 Conclusion

The classification of a project is the base of the pyramid of the problem we set out to solve in our current doctoral project.

Finding a method that represented an unmistakable way of classifying projects in a local context, using an international reference (European Union, 2024) and easily adaptable to any reality, was one of the

elements that most caught the researchers' attention and required the most benchmarking, especially considering the components related to public procurement that are in a different perspective to what a more technical area usually has.

Using the European directives (European Union, 2024), which guides local public procurement models in all member states, it was possible to define and identify the procedures that have the most potential to be used to promote innovative projects and projects related to Smart Cities.

Further increasing the granularity of an interpretation of this type of directive and validating this model with a possible application from a local perspective, we used Portugal's Public Procurement Code (República Portuguesa, 2008), to validate this model, we quickly identified three types of procurement procedures and the final design of the processes for classifying them, then applied the respective stakeholder-focused management to them.

Thus, looking at the following diagram (Figure 56), it is possible to determine the constraints and how the system will evolve throughout this chapter.



Figure 56 – Project Classification

Once this point has been successfully reached, the remaining pyramid levels will be reached with greater clarity and logical thinking reinforced by the various inputs from the main project management frameworks and knowledge guides.

7.3 Stakeholder Identification

When considering a project focused on smart city development that emphasises managing stakeholder perspectives, several key user groups are typically involved and should be considered.

Stakeholders can be individuals, groups, or organisations, and that can affect, be affected by someone or something, or have the perception that they are affected by a decision, activity or result of a project, program, or portfolio (Project Management Institute, 2017)

The opposite is also true, so the stakeholders influence a project directly or indirectly, its performance, or its result, either positively or negatively (Table 59).

Table 59 – Effectively Engage with Stakeholders
(Project Management Institute, 2021)

Stakeholders	
Engage stakeholders proactively and to the degree needed to contribute to project success and customer satisfaction.	▶ Stakeholders influence projects, performance and outcomes. ▶ Project teams serve other stakeholders by engaging with them. ▶ Stakeholder engagement proactively advances value delivery.

Several times, we made a brief description of what the stakeholder is and its importance; however, the involvement of stakeholders and how they interact also turns out to be of relevant importance.

A project is made by people for people, which shows that the interaction of the respective stakeholders must maintain the alignment between all efforts, expectations, and involvement to enhance and ensure a positive relationship and greater satisfaction in the effort to be carried out.

According to the PMI (2017), efficient engagement by each stakeholder should follow a 6-step process that can be seen in the following Figure 57:

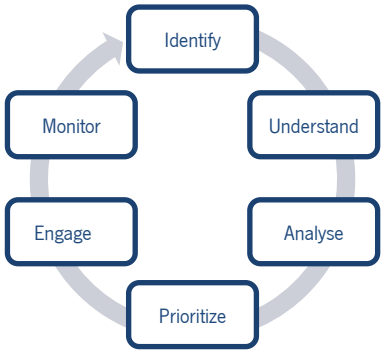


Figure 57 – Navigating Effective Stakeholder Engagement
(Project Management Institute, 2017)

According to Prince2 (Bentley, 2015; Great Britain, 2017), to involve stakeholders in the best way, facilitating their management and making it successful, they should know beforehand:

- why the project is needed;
- what the objective of the project is;
- how the outcome will be achieved;
- what their responsibilities are.

Involving stakeholders effectively in a project or initiative requires careful planning and communication. As said before, stakeholders can include anyone affected by the project, such as employees, customers, suppliers, investors, and community members. To ensure successful stakeholder management, consider the following.

Stakeholder identification in PM² (Project Management Methodology) (European Commission, 2018) is a critical process to recognise all individuals, groups, or organisations that may affect or be affected by a project's outcome (European Commission, 2018). This process is vital for the successful delivery of a project as it ensures that the needs and expectations of the most influential stakeholders are understood and managed.

PM² acknowledges that stakeholders can have a deep impact on the project lifecycle. Their needs, expectations, and information requirements must be considered to ensure effective communication and engagement strategies. Stakeholders can be internal, like team members and managers, or external, such as clients, suppliers, and regulatory bodies.

The first step in the PM² stakeholder identification process is to establish who these stakeholders are. This involves brainstorming sessions with the project team and consulting organisational documents that may reveal interested parties.

Project managers can also look at previous projects for clues about potential stakeholders, perhaps it can even be a deliverable of the lessons learned effort.

These user groups, or individuals, play vital roles throughout the project lifecycle, from initiation and planning to execution, monitoring, and closure.

As seen in Table 60, potential stakeholder groups, or user groups, and their roles are suggested within a project where an effort was made to expand further on the project team and direct stakeholders to identify additional specific roles and user groups that are crucial for the project's success.

These actors play vital roles in the day-to-day operations, decision-making processes, and overall progression of the project.

Table 60 – Potential user group of stakeholders

1	**Government Officials and Policymakers**	
	Role	Oversee the project's alignment with public policies and regulations, provide funding and resources, and ensure the project serves the public interest.

	Involvement	High-level decision-making, providing regulatory approvals, and ensuring compliance.
2	**Project Management Team**	
	Role	Plan, execute, and oversee the project, ensuring it meets its objectives within the given constraints.
	Involvement	Daily management, coordination of activities, resource allocation, and risk management.
3	**Technical Experts and Consultants**	
	Role	Provide specialized knowledge and expertise in IT, urban planning, and sustainability.
	Involvement	Designing solutions, offering technical guidance, and assisting in problem-solving.
4	**Local Communities and Citizens**	
	Role	End-users of the smart city solutions, providing feedback, and participating in community engagement initiatives.
	Involvement	Providing input during planning and implementation, testing solutions, and participating in community outreach programs.
5	**Business Owners and Commercial Entities**	
	Role	Collaborate in project implementation, provide private investment, and adopt smart city solutions for their operations.
	Involvement	Investment, providing feedback, and participating in public-private partnerships.
6	**Academic and Research Institutions**	
	Role	Conduct research, provide data and analytical support, and contribute to innovation within the project.
	Involvement	Research, data analysis, and innovation support.
7	**Non-Governmental Organisations and Civil Society**	
	Role	Advocate for community needs, ensure inclusivity, and monitor the social and environmental impacts of the project.
	Involvement	Advocacy, monitoring and evaluation, and community engagement.
8	**Utility Providers and Infrastructure Managers**	
	Role	Manage and upgrade infrastructure such as energy grids, water supply, and transportation systems to support smart city solutions.
	Involvement	Infrastructure management, project team coordination, and smart solutions implementation.
9	**Technology Providers and Vendors**	
	Role	Supply the necessary hardware and software solutions and provide technical support.
	Involvement	Providing products and services, technical support, and maintenance.
10	**Investors and Financial Institutions**	
	Role	Provide funding and financial support for the project.
	Involvement	Investment, risk assessment, and financial management.
11	**International Organisations and Partners**	

	Role	Offer global expertise, potential funding, and support in aligning the project with international standards and best practices.
	Involvement	Providing expertise, potential funding, and international coordination.
12	**Project Sponsor**	
	Role	Provides overall direction, resources, and support for the project. Makes high-level decisions and ensures alignment with organisational strategies.
	Involvement	Securing funding, providing resources, and making major decisions.
13	**Project Manager**	
	Role	Oversees the entire project, ensuring it meets its objectives within the given constraints and timelines.
	Involvement	Planning, execution, monitoring, and closing of the project.
14	**Project Coordinators and Assistants**	
	Role	Assist the project manager in administrative tasks, coordination, and follow-ups.
	Involvement	Scheduling, documentation, and supporting communication within the team.
15	**Business Analysts**	
	Role	Analyse business needs and requirements, ensuring that the project delivers value and aligns with organisational goals
	Involvement	Requirement gathering, data analysis, and solution recommendation.
16	**Technical Leads and Architects**	
	Role	Design the technical aspects of the project, ensuring reliability, scalability, and alignment with smart city objectives.
	Involvement	System design, technical guidance, and oversight of development activities.
17	**Developers and Engineers**	
	Role	Develop and implement the technical solutions required for the project.
	Involvement	Coding, testing, and deploying solutions.
18	**Quality Assurance Specialists**	
	Role	Ensure that the project's outputs meet the required standards and specifications.
	Involvement	Testing, quality checks, and validation.
19	**User Experience (UX) Designers**	
	Role	Design the interfaces and experiences for any digital solutions, ensuring they are user-friendly and meet the needs of the end-users.
	Involvement	Design, user research, and usability testing.
20	**Operations and Maintenance Team**	
	Role	Ensure the implemented solutions are running efficiently, and provide maintenance as needed.
	Involvement	Monitoring, maintenance, and support.
21	**Training and Development Specialists**	
	Role	Develop and deliver training programs for end-users and other stakeholders.
	Involvement	Training program development, delivery, and evaluation.
22	**Communication Specialists**	
	Role	Manage internal and external communications, ensuring clear, consistent, and effective messaging.

	Involvement	Communication planning, content creation, and media relations.
23	**Stakeholder Liaison**	
	Role	Act as a bridge between the project team and external stakeholders, ensuring effective communication and relationship management.
	Involvement	Communication, relationship management, and conflict resolution.
24	**Change Management Specialists**	
	Role	Plan and implement strategies to manage organisational change associated with the project, ensuring the smooth adoption of new solutions.
	Involvement	Change planning, stakeholder engagement, and training.
25	**Procurement and Contract Managers**	
	Role	Manage procurement processes, contracts, and relationships with suppliers and vendors.
	Involvement	Procurement, contract management, and vendor relations.
26	**Legal Team**	
	Role	Ensure that all aspects of the project adhere to relevant laws, regulations, and contractual agreements.
	Involvement	Contract negotiation, management, regulatory compliance, intellectual property, and dispute resolution.
27	**Funding Applications Consultant**	
	Role	Identifying potential funding sources, preparing grant applications, and ensuring compliance with funding requirements.
	Involvement	Research, identification and preparation of funding opportunities, liaison with Funding Bodies, strategic advice, and knowledge of industry Trends.

Understanding these actors' distinct roles and responsibilities within the project team and among direct stakeholders is crucial for effective project management and stakeholder engagement. Ensuring clear communication, proper resource allocation, and efficient coordination among these actors can significantly contribute to the project's success.

Throughout the five actions, it was possible to enrich the previous table and define each of the roles and their involvement. An exploratory character was carried out here, and the respective research into the various methodologies also allowed the expansion of the table.

With an inventory of all the possible user profiles, segmentation and profiling are possible so that groups and rules can be created based on the impact and importance of each project element.

7.4 Stakeholder Classification

One of the prerogatives of the effort proposed here is to identify the stakeholders associated with a project and, as such, to create a process that makes this process logical and capable of being evaluated and eventually scrutinized.

The choice of project management methodology is crucial for the success of any project. Among the various methodologies, PM² (European Commission, 2018), PMBOK (Project Management Institute, 2017), and PRINCE2 (Axelos, 2017) are widely recognised, as mentioned before, in this PhD thesis document.

It is our opinion that PM² offers a superior approach to stakeholder identification compared to PMBOK and PRINCE2, primarily due to its comprehensive, flexible, and tailored approach. Stakeholder identification is critical in project management, influencing project planning, execution, and success.

PM² stands out in its approach to stakeholder identification by providing a more comprehensive framework. Unlike PMBOK and PRINCE2, which offer a more generalized view, PM² has a higher granularity about the specificities of each stakeholder's interest, influence, and potential impact on the project. This detailed analysis ensures that no significant stakeholder is overlooked.

Furthermore, PM² encourages continuous stakeholder analysis throughout the project lifecycle, adapting to changes and new stakeholder dynamics. This ongoing engagement contrasts with the relatively static stakeholder analysis in PMBOK and PRINCE2, which typically occurs at set stages of the project.

PM²'s flexibility in stakeholder identification is another advantage. While PMBOK and PRINCE2 offer structured frameworks, they can be rigid, making adapting to unique project contexts challenging. PM², on the other hand, provides guidelines adaptable to different organisational cultures and project scopes. This flexibility ensures that stakeholder identification is not a one-size-fits-all process but tailored to each project's needs and dynamics. Such adaptability is crucial in today's rapidly changing business environments, where stakeholders' roles and interests can develop quickly.

Still, PM²'s tailored approach to stakeholder identification is particularly beneficial for projects in diverse environments. It accommodates different types and sizes of projects, ranging from small internal initiatives to large, complex, cross-organisational projects. This contrasts with the one-dimensional approach of PMBOK and the strict, process-heavy orientation of PRINCE2. PM²'s methodology is inclusive, considering internal and external stakeholders, and pointing out the importance of

understanding their unique perspectives and contributions to the project. This comprehensive inclusivity ensures a holistic understanding of the project environment.

Another significant aspect of PM² is its emphasis on stakeholder engagement and communication, which was an objective during our research and the development of the proposed framework.

Unlike PMBOK and PRINCE2, which focus more on processes and outputs, PM² places a higher importance on continuous stakeholder communication and engagement. This approach helps build trust, ensure stakeholder buy-in, and facilitate smoother project execution. Effective communication strategies in PM² aid in clarifying stakeholder expectations, aligning their interests with project goals, and mitigating potential conflicts. This proactive engagement leads to better project outcomes.

It is our opinion that PM²'s comprehensive, flexible, and tailored approach to stakeholder identification makes it a superior choice compared to PMBOK and PRINCE2. Its emphasis on detailed analysis, adaptability, inclusive stakeholder consideration, and continuous engagement positions it as a more effective methodology for managing complex, diverse, and evolving project environments.

To allow this classification of the identified stakeholders, we have conducted the following guidelines and processes using the PM² methodology.

7.4.1 Categorisation of Stakeholders

Once identified, stakeholders are categorised by their interest, influence, and impact on the project. The PM² (European Commission, 2018) methodology suggests a categorisation model where stakeholders are divided into groups such as:

- Business Layer: This includes high-level stakeholders who define the project's business objectives and ensure that it delivers value.
- Operational Layer: Individuals or groups involved in the project's daily operation, including the project team and operational management.
- Regulation Layer: Entities that enforce compliance with relevant laws, regulations, and standards.
- External Influencers: These are parties outside the project's direct control that can nonetheless impact its progress, such as community groups or the media.

7.4.2 Stakeholder Analysis

After categorisation, a deeper analysis is conducted to understand the stakeholders' characteristics:

- Power: The influence they have over the project or its outcomes.
- Interest: The degree of concern about the project's performance or outcomes.
- Impact: The extent to which project outcomes can affect stakeholders.

7.4.3 Stakeholder Mapping

To help understand the relationships between different stakeholders and the project, and determine the communication needs, the PM² (European Commission, 2018) methodology recommends creating a visual representation of stakeholders through mapping.

This simple tool helps define stakeholders, plotted based on their interests, power or impact, and influence (Figure 58).

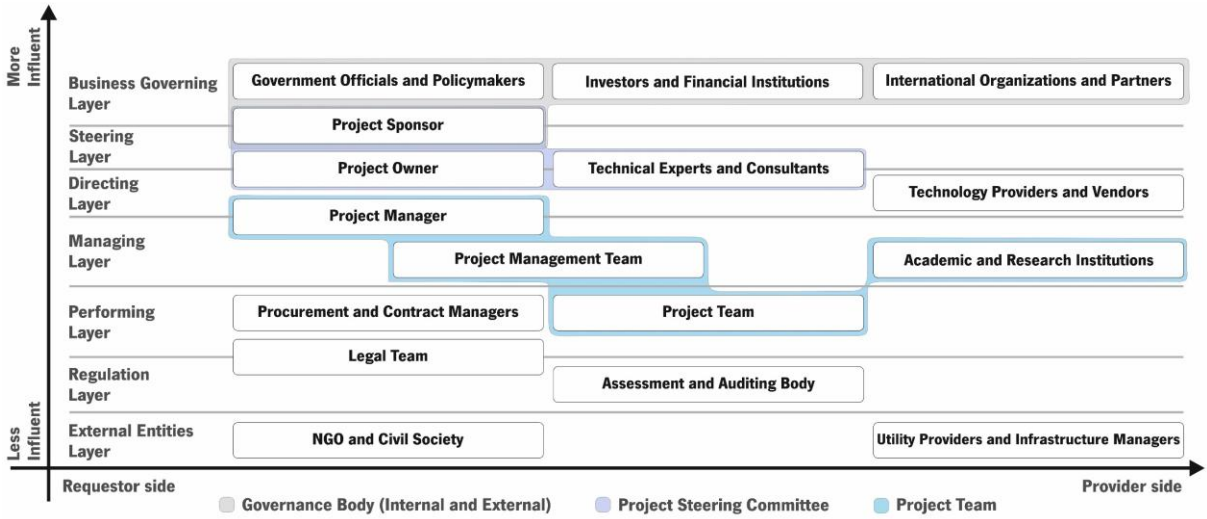


Figure 58 – Stakeholder Mapping (Influence and Requestor or Provider Side)

This mapping was accomplished after the five actions had been carried out, whereby analyzing all the stakeholders, their power, and their perspective from their side (internal or external) made it possible to relate their relationship and impact on the project.

Note that some stakeholders may fit into multiple layers depending on the phase of the project and their involvement. It is also essential to consider that the PM² model is flexible and should be adapted to the specifics of the project context (Table 61).

Adding the External Influent Entities Layer is a creative step that reflects smart city projects' dynamic and complex environment.

Table 61 – Stakeholder Mapping and Definition

Layer	Description	Stakeholders
Business Governing Layer	This layer involves high-level oversight and strategic direction, and the stakeholder may be internal or external.	Project Sponsor Government Officials and Policymakers Investors and Financial Institutions International Organisations and Partners
Steering Layer	Stakeholders who provide guidance, resources, and decision-making support.	Project Sponsor Project Owner Technical Experts and Consultants
Directing Layer	Those who directly impact the project's direction and management.	Project Owner Project Manager Technical Experts and Consultants Technology Providers and Vendors
Managing Layer	Stakeholders are involved in the project's day-to-day management.	Project Manager Project Management Team Academic and Research Institutions
Performing Layer	The individuals and teams who are actively involved in executing project tasks.	Project Team Procurement and Contract Managers Legal Team
Regulation Layer	This includes entities that provide regulatory oversight or standards the project must comply with.	Legal Team Assessment and Auditing Body
External Influent Entities Layer	This layer might include external stakeholders who influence the project but are not part of the internal structure.	NGO and Civil Society Utility Providers and Infrastructure Managers

This mapping allows the creation of groups of stakeholders and, therefore, permits a more correct management of the framework itself.

Various concerns are also inherent in the classification of stakeholders and whose respective involvement PM² promotes, which can be found in Table 62 as guidelines to be considered.

Table 62 – Stakeholder Classification Guidelines (adapted from European Commission (2018))

Stakeholder Engagement Planning
PM² suggests developing a stakeholder engagement plan based on the analysis and mapping. This plan should outline: • Communication Strategy: How and when stakeholders will be informed and consulted. • Engagement Activities: Specific actions to engage stakeholders, including meetings, workshops, or updates. • Information Distribution: Ensuring stakeholders receive the right information at the right time.
Engagement and Management
Effective stakeholder management is an ongoing process. PM² emphasises the need for regular reviews of stakeholder strategies to adapt to any changes. The project manager is responsible for maintaining relationships, managing expectations, and adjusting strategy.
Feedback Loops

PM² also underlines the importance of feedback loops. Stakeholder engagement involves distributing information and receiving feedback and insights from stakeholders, which can be invaluable in guiding project decisions.
Documentation
All stakeholder information and plans should be documented in a Stakeholder Framework, such as the one we propose. This framework should include details such as the stakeholders' contact information, interests, influence, expectations, and the strategy for engagement.
Challenges in Stakeholder Identification
The PM² methodology is aware of the challenges in stakeholder identification, such as hidden stakeholders who may emerge later in the project and conflicting stakeholder interests that can lead to project risks. It suggests regular updates to the stakeholder analysis to mitigate these challenges.
Ethical Considerations
PM² guides project managers to consider ethical implications when dealing with stakeholders. This includes respecting privacy, being transparent in communication, and ensuring that engagement activities are inclusive and fair.

7.4.4 Conclusion

In PM², the stakeholder identification process is a comprehensive activity beyond listing potential stakeholders.

It involves a systematic understanding of their needs, interests, and influence. Effective stakeholder identification and management are vital to achieving project objectives and delivering value as defined by the PM² methodology. It is a dynamic and iterative process that adapts as the project progresses, ensuring that all relevant parties are appropriately engaged and managed throughout the project lifecycle.

The level of maturity obtained here is in line with the implementation of this process throughout the five actions, where through the Action Research method, it was possible to provide the necessary conditions for its improvement.

7.5 Proposed Framework

When considering a project management solution (e.g., book, process, framework), it should be considered that when we start using it, it will reveal limitations that date back to the factory floors of the 1900s, representing an organisational utopia.

This subchapter introduces a comprehensive list of documents composing a framework for managing smart city projects. It emphasises the stakeholder perspective and recognises that the success of such projects is intricately tied to the effective management of their diverse and often conflicting stakeholder interests.

The stakeholder perspective in project management is paramount because it encompasses a broad spectrum, from government bodies, local communities, and businesses to individual citizens and international organisations.

Each entity has its unique set of interests, expectations, and influence, rendering stakeholder management a complex yet crucial component of project management.

This subchapter aims to elucidate the intricacies of this process, providing a nuanced understanding of how stakeholder perspectives can be effectively integrated into the project management lifecycle.

In addition to answering the research questions, the work and effort carried out over the various years of this doctoral project aim to make a set of recommendations.

7.5.1 Business Case

A business case justifies a proposed business change or project based on its expected commercial benefits. Essentially, it quantifies the value of a project and provides the necessary information for stakeholders and decision-makers to determine whether the project should proceed.

While the importance of a business case is universally recognised in project management, its composition and details vary across different project management frameworks.

Definition and Purpose

The PMBOK Guide (Project Management Institute, 2017), a Project Management Institute (PMI) standard, does not provide a detailed process for creating a business case but acknowledges its importance as input for the project charter.

In the PMBOK framework, the business case usually outlines the reasons for initiating a project or phase, presenting information from a business standpoint about the project's benefits and the business value it is supposed to deliver. The benefits can include details about market demand, organisational needs, customer requests, technological advancement, legal requirements, and more.

While PMBOK does not provide an exhaustive structure, it is implied that the business case should contain:

- Background: Details of the market or business conditions prompting the project.

- Business Objective: The business outcomes the project aims to achieve.
- Cost-Benefit Analysis: An examination of the project's expected costs versus its anticipated benefits (both tangible and intangible).

PRINCE2 (Axelos, 2017), developed by the UK government, places significant emphasis on the business case and sees it as one of its seven core principles. The business case drives all project activities and decisions, and its relevance is revisited throughout the project lifecycle.

In PRINCE2, the business case includes:

- Reasons: Why the project is necessary.
- Options: Various ways the project outcomes can be achieved (typically including "do nothing").
- Benefits: Expected advantages and measurable improvements.
- Risks: Potential challenges or events that could affect the project outcome.
- Costs: An estimate of the project expenditure.
- Timescale: Expected project duration and when benefits will be realised.

One standout aspect of PRINCE2 is its focus on continual business justification. A project should continue only if its business case remains valid. If the business case is deemed no longer viable at any stage, PRINCE2 recommends stopping the project.

PM² (European Commission, 2018) is a project management methodology developed by the European Commission. Like PRINCE2 and PMBOK, it recognises the importance of the business case in justifying the project.

In PM², the business case contains the following:

- Describe the Business Problem or Opportunity: Why is this project being considered?
- Outlines the Objectives: What does the project intend to achieve in business terms?
- Provides Options: Alternative ways to address the problem or opportunity.
- Analyses Costs and Benefits: An examination of the potential costs of the project against the expected benefits.
- Assesses Risks and Constraints: Identifying potential challenges.

- Gives Recommendations: Preferred options based on the provided analysis.

One notable feature of PM² is its emphasis on aligning the project with broader organisational strategies and objectives, ensuring it supports overarching business goals.

Regardless of the framework used, the business case remains a project management basis. While its composition and depth may vary, its essence remains consistent: to provide a business justification for initiating a project. It allows stakeholders to understand the expected benefits, costs, and risks associated with a project and is instrumental in making informed decisions.

As projects are investments, the business case is the rationale behind that investment.

Template

In an era of rapid change and tight resources, a well-structured business case ensures that projects align with strategic goals, provide clear value, and are rooted in thorough analysis.

It is designed to provide a comprehensive view of the proposed project by emphasising its rationale, expected benefits, alignment with organisational objectives, and a clear analysis of costs, risks, and alternatives (Table 63).

By employing this integrated approach, stakeholders, project managers, and decision-makers are equipped with a holistic perspective, ensuring that projects not only meet immediate needs but also fit into the broader vision and strategy of the organisation.

Table 63 – Business Case Template Fields

ID	Field	Description	Input
1	Executive Summary		
1.1	Brief Description	Provide context for the business case: Background of the business or market situation; Preliminary identification of the business problem or opportunity; Initial idea of the proposed project's scope.	
1.2	Alignment with Strategic Goals	Demonstrate how the project aligns with organisational strategy	PMBOK
2	Project Description		
2.1	Background Information	Detail the context and background of the project.	
2.2	Scope and Objectives	Define the project scope, objectives, and deliverables.	PM²
2.3	Expected Benefits	List the expected benefits, linking them to stakeholder needs and strategic objectives.	PRINCE2
3	Stakeholder Analysis		

ID	Field	Description	Input
3.1	Stakeholder Identification	List key stakeholders and their roles and responsibilities.	PMBOK
3.2	Interest and Influence	Assess stakeholder interest and influence using tools like power/interest grids.	PMBOK
3.3	Engagement Strategy	Develop strategies for engaging different stakeholders	PM² and PRINCE2
4	Market Analysis and Feasibility Study		
4.1	Market Assessment	Analyse current market conditions relevant to the project.	
4.2	Feasibility Study	Include technical, financial, and operational feasibility assessments.	
5	Risk Assessment		
5.1	Risk Identification	Identify potential risks and their sources.	PMBOK
5.2	Risk Analysis	Assess the impact and probability of identified risks.	PRINCE2
5.3	Mitigation Strategies	Propose strategies to mitigate or manage risks.	PM²
6	Cost-Benefit Analysis		
6.1	Cost Estimation	Provide a detailed estimate of the project costs.	PMBOK
6.2	Benefit Analysis	Outline the quantifiable and non-quantifiable benefits.	PRINCE2
6.3	ROI Calculation	Calculate the Return on Investment and other financial metrics.	
7	Project Approach and Methodology		
7.1	Methodology	Define the project management methodology to be used.	
7.2	Project Lifecycle	Describe the lifecycle stages, from initiation to closure.	PM²
8	Project Organisation and Governance		
8.1	Project Team Structure	Define the project team structure and roles.	PRINCE2
8.2	Governance Framework	Establish a governance framework outlining decision-making processes and escalation paths.	PM²
9	Quality Management Plan		
9.1	Quality Objectives	Set quality objectives and standards.	PMBOK
9.2	Quality Control and Assurance:	Detail quality control and assurance processes.	PRINCE2
10	Communication Plan		
10.1	Communication Strategy	Develop a strategy for internal and external communications, detailing frequency, methods, and responsibilities.	PM² & PRINCE2
11	Implementation Plan		
11.1	Milestones and Timeline	Outline key milestones, timelines, and deadlines.	PMBOK
11.2	Resource Allocation:	Detail resource allocation, including human, financial, and material resources.	
12	Monitoring and Evaluation		
12.1	Performance Metrics:	Define key performance indicators (KPIs) and metrics for success.	PMBOK
12.2	Evaluation Plan	Describe how the project's progress and success will be evaluated.	PRINCE2
13	Approval and Sign-off		
13.1	Approval	Signoffs from key stakeholders and decision-makers.	

By integrating elements from PMBOK, PRINCE2, and PM², this business case template offers a holistic approach to project justification. It ensures that projects are feasible regarding costs and benefits, align with broader organisational objectives, and are backed by a thorough analysis of options and risks.

This template combines the structured approach of PRINCE2, the detailed process orientation of PMBOK, and the flexibility and outcome focus of PM², offering a comprehensive guide for developing a business case in various project environments.

7.5.2 Contract

The successful management of public projects relies heavily on the integrity and clarity of the contracts that underpin them (República Portuguesa, 2008). In the context of Portugal, where specific laws govern public procurement, it helped create a process for categorising projects as simple, complex, or innovative. Therefore, understanding these contracts becomes pivotal.

This chapter aims to elucidate the role of contracts in aligning project objectives with stakeholder expectations, thereby ensuring project success. It provides an overview of the public procurement framework in Portugal, emphasising how contracts are tailored to project complexities and stakeholder structures.

Definition and Purpose

A contract in the dominion of public procurement is a legally binding agreement between stakeholders directly involved in the project, typically involving a public sector organisation and one or more private sector entities.

These contracts are essential for delineating responsibilities, specifying service delivery parameters, and establishing the criteria for performance evaluation. They serve as a safeguard against potential disputes and a roadmap for project execution, ensuring all parties are aligned with the project's goals and outcomes.

Template

Understanding the key components that constitute a contract can aid in ensuring that these agreements are comprehensive and effective. Essential elements of a typical public procurement contract include:

- Scope of Work: This section clearly defines the work to be performed, the expected outcomes, and the standards it must follow. It is crucial to prevent scope creep and ensure all parties understand the project's requirements.
- Duration of Contract: It specifies the timeline for the project, including start and end dates, and critical milestones, ensuring timely delivery and project progression.
- Payment Terms: This clause outlines the financial arrangements, such as payment schedules, invoicing procedures, and conditions for final payments, which are critical for maintaining financial discipline and cash flow.
- Obligations of Parties: Each party's detailed responsibilities are enumerated here to ensure clarity and accountability. This includes provisions for managing changes in project scope, which can be particularly complex in public projects and the governance model. This is where the use of the developed framework should be stated.
- Penalties for Non-Compliance: Contracts typically include penalties for delays, substandard work, or other contractual breaches to enforce compliance and effectiveness.
- Termination Conditions: These terms define the circumstances under which the contract can be prematurely terminated, providing a clear exit strategy for all parties involved in cases of substantial non-performance or external factors impacting the project.

A different approach was followed here, where we identified only the fields that must comprise the document, following the normal template associated with the standard used by any legal team and that are as well defined by the Portuguese CCP guidelines (Jorge Andrade da Silva, 2024).

Typically, a contract has a first version as a draft that must be validated by all parties to ensure its validity. Once the draft contract has been validated, it will be signed by all the parties, by those empowered to do so, thus making the document legal and binding in terms of effort.

The contract is part of all the processes designed for any project, whether simple, complex or innovative (Figure 59):

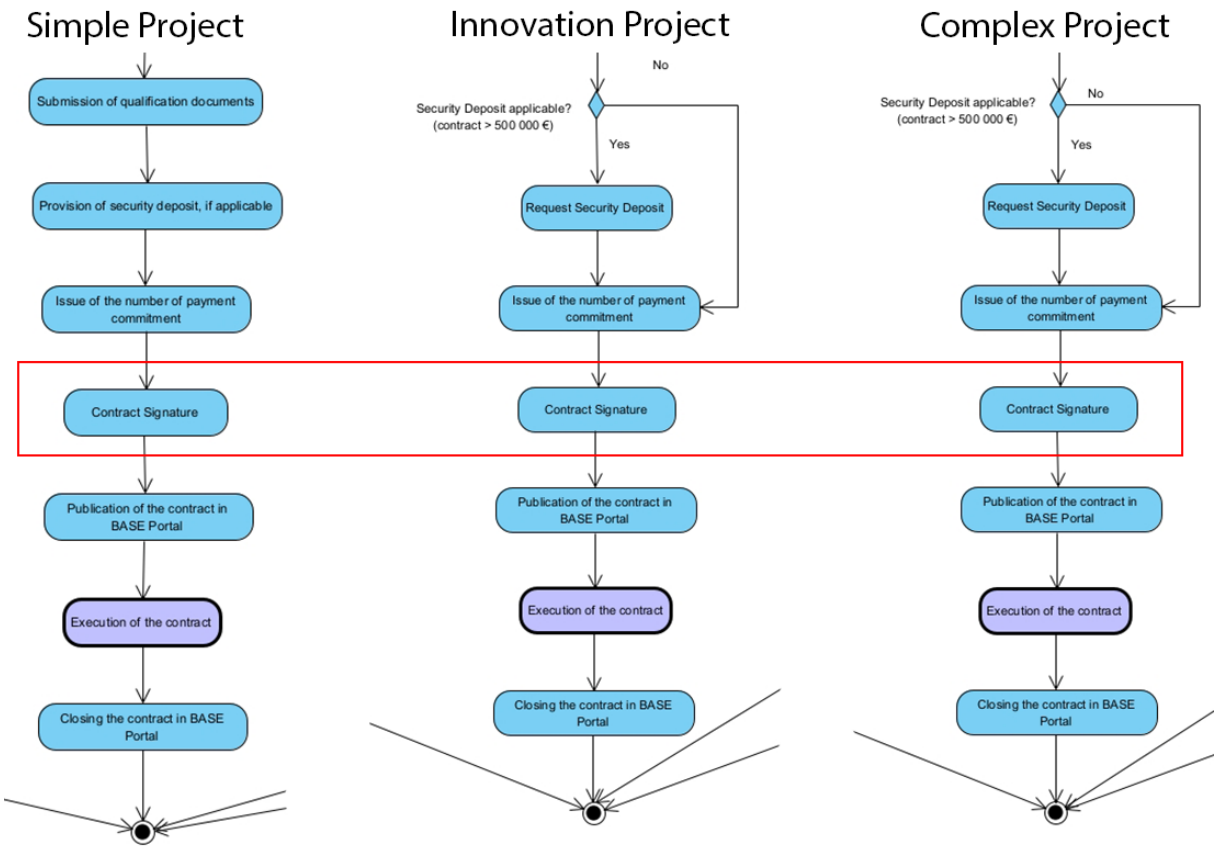


Figure 59 – Contract requirement on all types of projects

This document aims to be formal and comprehensive, setting the stage for all future work and the specific nuances of managing stakeholder relationships through contractual agreements.

7.5.3 Project Charter

The project charter is a crucial document in project management that acts as the cornerstone for project initiation and sets the stage for successful project execution.

It is a formal contract between the project sponsor or initiating entity and the project manager, defining the project's purpose, objectives, scope, and key stakeholders. The project charter is crucial in aligning the project's goals with the organisation's strategic objectives and ensuring clarity and understanding among all project participants.

Drawing on key principles from the PMBOK (Project Management Body of Knowledge) (Project Management Institute, 2017), PRINCE2 (Projects IN Controlled Environments) (Axelos, 2017), and PM² (Project Management Methodology) (European Commission, 2018), the project charter plays a crucial role in aligning stakeholders, establishing project objectives, and defining the project's scope.

In PMBOK (Project Management Institute, 2017), the project charter is a part of the initiating process group, which involves the activities necessary to define a new project or a new phase of an existing project. During this phase, the project charter is developed and authorized, signifying the project's official start. The charter is typically issued by the project sponsor or the person or group external to the project that provides the necessary resources and support for the project.

The content of the project charter, as outlined in PMBOK, includes the project's high-level objectives, requirements, and deliverables. It establishes the initial authority of the project manager and their assigned level of responsibility and accountability. The charter also identifies key stakeholders and their roles in the project, ensuring that their interests and expectations are acknowledged and addressed.

Similarly, in PRINCE2 (Axelos, 2017), the project charter aligns with the concept of the "Project Mandate": “Do we have a worthwhile and viable project?”. The Project Mandate is a key input to the pre-project process and provides essential information about the project's background, purpose, and objectives. It is usually issued by senior management or a corporate or program management entity and is the basis for initiating a project.

In PRINCE2, the project charter or Project Mandate sets out the justification for the project, including the business case, expected benefits, and the estimated resources required. It outlines the high-level scope and constraints of the project, offering a clear picture of what the project aims to achieve. The project charter also defines the project management approach, using PRINCE2 principles, themes, and processes to ensure consistent and effective project governance.

Besides, PRINCE2 underlines the importance of continued business justification throughout the project's life. This means the project charter or Project Mandate should be regularly reviewed and validated to ensure that the objectives and expected benefits remain viable and aligned with the organisation's strategic goals.

In PM² (European Commission, 2018), the project charter represents the Project Initiation phase, which sets the strategic context for the project. PM² highlights the need for a clear and well-documented business case in the project charter. The business case outlines the rationale for the project, including the problem to be solved, the benefits to be realised, the risks involved, and the estimated costs and resources required.

The project charter in PM² also defines the project's objectives, scope, and expected deliverables. It identifies the key stakeholders and their interests, ensuring their needs are considered throughout the project's lifecycle. Moreover, PM² highlights the importance of project governance and the need for clear roles and responsibilities, typically outlined in the project charter.

While terminology and specific elements may differ between PMBOK, PRINCE2, and PM², the core purpose and content of the project charter remain consistent. It acts as a contract between the project sponsor and the project manager, providing a shared understanding of the project's goals, scope, and key stakeholders. The project charter's significance lies in its ability to set the direction for the project, align it with strategic objectives, and serve as a reference point for effective decision-making and governance throughout the project's lifecycle.

In conclusion, the project charter is a vital document that combines fundamental principles from PMBOK, PRINCE2, and PM², providing a cohesive foundation for project initiation and execution. By defining the project's purpose, objectives, scope, and key stakeholders, the project charter sets the stage for successful project management, and ensures that all project participants are aligned in their efforts to achieve project success.

Definition and Purpose

The concept of a Project Charter is defined and recognised in both PMBOK, PRINCE2, and PM² methodologies.

In PMBOK (Project Management Institute, 2017), a Project Charter is a document that formally authorises the existence of a project, giving the project manager the authority to apply organizational resources to project activities. The Project Charter serves as the project's foundation and establishes the project's objectives, scope, stakeholders, high-level risks, and initial requirements.

According to the PMBOK Guide, the charter should articulate:

- Business Justification: This entails understanding why the project was initiated, whether it was due to market demand, legal requirement, or organisational need;
- Product Description: An overview of the product, service, or result the project is expected to deliver;

- Project Objectives: Clearly defined targets the project aims to achieve, often articulated in terms of scope, schedule, and cost;
- Project Boundaries: What is included in the project and, crucially, what is not;
- High-level Risks: Identifying potential challenges or threats that could impede the project's success.

The Project Charter is developed during the Initiating Process Group and guides the project throughout its lifecycle.

PRINCE2 (Axelos, 2017), while not referencing a project charter per se, has an analogous document called the Project Brief. It sets the stage for a more detailed Project Initiation Document (PID) encompassing the project's vision.

It is a statement of the project's objectives and high-level requirements provided by a higher authority, such as the project board or a customer, to initiate the project.

The Project Mandate gives the project manager the authority to start the project and serves as the basis for creating the PID. It outlines the context and reasons for undertaking the project.

The Project Brief, resonating with the essence of a charter, includes:

- Background: the setting against which the project was conceived;
- Project Objectives: the expected outcomes are in line with business benefits;
- Project Definition: a high-level description of what the project aims to achieve;
- Constraints and Assumptions: recognising the limitations within which the project must operate;
- Outline Business Case: a precursor to a more detailed business case, ensuring the project is economically viable.

In PRINCE2, the Project Brief is instrumental in defining the project and ensuring it aligns with the organisation's objectives before it receives the go-ahead.

PM² (European Commission, 2018) also recognises the importance of a Project Charter. It defines the Project Charter as a document that formally authorises the project, establishes its objectives, and provides the project manager with the authority to execute the project, however, it does not employ this terminology.

Within PM², the initial phase of a project revolves around the "Initiation Request," which resembles a project charter.

The Project Charter / Initiation Request in PM² typically includes information such as:

- Project Rationale: a comprehension of why the project is being proposed.
- Objectives: what the project intends to accomplish.
- Scope: clear boundaries regarding what is in and out of the project's purview.
- Stakeholders: identify those with vested interests in the project.
- Constraints and Assumptions: recognising boundaries and foundational beliefs underpinning the project.

PM² underlines the project's alignment with more comprehensive organisational strategies, ensuring that it is not siloed but supports overarching objectives.

Overall, the Project Charter or Project Mandate (PRINCE2) or Initiation Request (PM²) is a foundational document in project management. It clearly explains the project's purpose, objectives, scope, and initial parameters. It is a reference for project initiation, authorisation, and subsequent decision-making.

The essence of a project charter remains consistent across the PMBOK, PRINCE2, and PM² methodologies, though the terminology and specific components may vary. This document is the bedrock upon which projects are built, serving as an anchor throughout their lifecycle. It ensures clarity, provides approval, and lays the groundwork for subsequent project phases.

Whether exploring PMBOK's structured processes, navigating PRINCE2's principle-driven approach, or embracing PM²'s emphasis on alignment with organizational strategies, the project charter (or its equivalent) remains indispensable.

The compass points the way, ensuring that every stakeholder, from team members to top management, understands the project's direction and purpose.

Template

The project charter serves as a foundational document in project management. It grants authorisation to commence the project and gives the project manager the authority to allocate resources.

This template, a fusion of insights from the PMBOK, PRINCE2, and PM² methodologies, ensures a holistic approach to project initiation, encompassing critical elements from each framework (Table 64).

Adopting this integrated perspective, the charter comprehensively encapsulates the project's scope, stakeholders, objectives, and initial risks.

Table 64 – Project Charter Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Brief Description	A brief statement detailing what the project is about.	PMBOK
2	Project Purpose or Justification		
2.1	Purpose or Justification	Derived from the business case, elucidate why the project is being undertaken, considering the business need, opportunity, or problem it addresses	
3	Project Objectives		
3.1	Objectives	Clearly outline the specific goals the project seeks to achieve by its completion. These can include performance outcomes, deliverables, or milestones.	
4	High-Level Project Requirements		
4.1	Project Requirements	Enumerate the key requirements that the project must satisfy. This can include technical specifications, regulatory requirements, or stakeholder expectations.	
5	Project Scope		
5.1	In Scope	Define what is included within the boundaries of the project.	PMBOK and PRINCE2
5.2	Out of Scope	Specify what is excluded, ensuring clarity, and avoiding scope creep.	PMBOK and PRINCE2
6	Key Stakeholders		
6.1	Stakeholders	List and describe the main individuals or groups with a vested interest in the project, detailing their roles and responsibilities.	PMBOK and PM²
7	Project Deliverables		
7.1	Deliverables	Detail the main products, results, or capabilities that the project will produce and that are required to achieve the project objectives.	
8	High-Level Milestones		
8.1	Milestones	Provide a list of significant events or stages in the project. These can include reviews, decision points, or phase completions.	
9	High-Level Risks		
9.1	Risks	Identify potential challenges or threats that could adversely affect the project outcome and provide preliminary risk mitigation strategies.	PMBOK and PRINCE2
10	Project Constraints and Assumptions		
10.1	Constraints	Limitations or restrictions, such as budget, timeline, or resources.	

ID	Field	Description	Input
10.2	Assumptions	Things believed to be true or certain to happen upon which the project is based.	
11	Project Authority and Governance		
11.1	Authority and Governance	Outline the governance structure for the project. This includes: - Project roles and responsibilities; - Decision-making processes; - Escalation paths.	PM²
12	Project Budget Estimate		
12.1	Budget Estimate	Provide a high-level estimate of the project's financial requirements. This can be broken down into phases or key components.	PRINCE2 and PM²

7.5.4 Responsibilities and Substitution Matrix

Responsibilities and a Substitution Matrix are essential aspects of stakeholder management. An effort was made to examine their significance in project management from a stakeholder perspective.

Clearly defining stakeholder responsibilities is crucial for effective stakeholder management. It involves identifying the roles and duties of each stakeholder concerning the project, ensures stakeholders understand their obligations, deliverables, and contributions to the project's success. This clarity helps manage stakeholder expectations and avoid misunderstandings or conflicts.

Responsibilities can include tasks such as providing resources, offering subject matter expertise, making critical decisions, reviewing deliverables, or participating in project meetings. Assigning and communicating responsibilities to stakeholders enables smooth collaboration, accountability, and the achievement of project objectives.

Definition and Purpose

Mapping out responsibilities in project management is integral to ensuring clarity of roles, efficient communication, and effective project execution.

While the term Responsibilities and Substitution Matrix is not standard in all project management frameworks, the underlying principle of assigning and delineating roles and responsibilities is prevalent across methodologies.

This concept can be more deeply detailed using PMBOK, PRINCE2, and PM² as benchmarking.

In the PMBOK framework (Project Management Institute, 2017), the Responsibility Assignment Matrix (RAM), often known as the RACI matrix, is the concept closest to a Responsibilities and Substitution Matrix.

This matrix is a tool used to illustrate the connection between work packages or activities and team members. As said before, the acronym RACI stands for:

Responsible: The person(s) who do the work.

Accountable: The person who is accountable for the work.

Consulted: Those whose opinions are sought, two-way communication.

Informed: Those who are kept up to date on progress; one-way communication.

By employing the RACI matrix, project managers can effectively allocate tasks and ensure everyone knows their specific roles and responsibilities.

PRINCE2 (Axelos, 2017) The PRINCE2 methodology strongly emphasises clarity of roles and responsibilities. Although it does not explicitly use the term Responsibilities and Substitution Matrix, it provides detailed descriptions of various roles, such as the Project Manager, Project Board, and Team Manager.

One of the foundational documents in PRINCE2, the Project Initiation Document (PID), contains a section detailing the project's roles and responsibilities. While not in matrix form, this document ensures that all stakeholders are aware of their duties and the duties of others.

To create a substitution strategy within PRINCE2, the project manager would typically refer to the project's risk management strategy. If a key member is unavailable (a potential risk), there would be a pre-determined plan, or substitution, to handle their responsibilities.

PM² (European Commission, 2018) methodology highlights simplicity and clarity, which includes clearly outlined roles and responsibilities. Within the PM² framework, roles are categorised into four layers: Governance roles, Core Team roles, Key Supporting roles, and Stakeholders.

While PM² does not explicitly offer a Responsibilities and Substitution Matrix, the detailed definitions of roles within the methodology ensure clarity of responsibility. Every role, from the Project Steering Committee to the Project Manager and even the Change Manager, has a clear list of responsibilities.

Substitution in PM² would be related to risk management and ensuring continuity. Effective delegation, transparent communication, and comprehensive documentation would ensure that their responsibilities can be managed without a critical stakeholder.

The concept of a "Responsibilities and Substitution Matrix" can be inferred from established tools, methodologies, and documents from the PMBOK, PRINCE2, and PM² frameworks.

While terminologies may differ, the core principle remains to ensure that every project activity or task has a responsible individual or group and a clear plan for substitutions in case of unavailability.

Effectively, it is about leaving no task unowned and no responsibility ambiguous. A matrix or documented strategy brings clarity and streamlines the execution process. It eliminates the confusion around "who does what" and ensures that the project continues running smoothly despite unforeseen circumstances. A well-drafted matrix, backed by comprehensive risk management and delegation strategies, is instrumental in steering a project towards success.

Template

In the complex project management domain, clarifying roles and their corresponding responsibilities is paramount.

The "Responsibilities and Substitution Matrix" ensures that every task has a designated owner and a backup plan should the primary responsible individual be unavailable.

This matrix combines concepts from leading project management frameworks: the clarity of roles from PRINCE2, the structured assignment from PMBOK's RACI, and the defined roles within PM².

This tool serves as both a guide and a safety net, ensuring project tasks remain on track despite unforeseen challenges.

The template for the Responsibilities and Substitution Matrix considers the key concepts and best practices from the PMBOK, PRINCE2, and PM² methodologies to ensure a comprehensive and cohesive approach. This ensures the matrix aligns with industry standards while catering to the project's unique needs (Table 65).

Table 65 – Responsibilities and Substitution Matrix Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	

ID	Field	Description	Input
1.2	Purpose	Briefly state the purpose of the matrix, emphasising its role in ensuring clarity of responsibilities and continuity in case of absence.	
1.3	Scope	Define the scope of the matrix, detailing the roles and phases of the project it covers.	
2	Role Definitions		
2.1	Role Identification	List all project roles (inspired by PRINCE2's defined roles and PMBOK's role delineation).	PRINCE2 and PMBOK
2.2	Description	Provide a brief description of each role, clarifying expectations and scope of work.	
3	Responsibility Matrix (RACI Model)		
3.1	Tasks/Activities	Enumerate key project tasks and activities (aligned with PMBOK's task identification): • Responsible: Identify who is responsible for each task (the 'doer'); • Accountable: Specify who is responsible for decision-making and oversight (only one per task); • Consulted: List of those whose input is sought; two-way communication; • Informed: Mention who needs to be kept informed; one-way communication.	PMBOK
4	Substitution Plan		
4.1	Primary Role Holder	Name the primary individual responsible for each role.	
4.2	Substitute(s)	Identify the designated substitute(s) for each role.	
4.3	Availability	Note the availability and contact information of the substitutes.	
4.4	Transition Plan	Briefly outline the plan for transitioning responsibilities to the substitute, including any necessary training or briefing sessions (reflecting PM²'s focus on effective handover).	PM²
5	Skills and Competencies		
5.1	Required Skills	List the skills and competencies required for each role (aligning with PMBOK's emphasis on skill requirements).	
5.2	Current Competencies	Assess and record the current competencies of each role holder and substitute. Development Plan: Suggest a plan for skill development where gaps exist.	
6	Communication Plan for Substitution		
6.1	Notification Process	Define the process for notifying team members and stakeholders about role substitutions.	PM²
6.2	Key Contacts	Include a list of key contacts for each role.	PM²
7	Review and Update Mechanism		
7.1	Review Frequency	Set the frequency for reviewing and updating the matrix.	PRINCE2
7.2	Update Process	Outline the process for making changes to the matrix.	
8	Approval and Acknowledgment		

ID	Field	Description	Input
8.1	Sign-off	Space for sign-off by the project manager and other key stakeholders.	
8.2	Acknowledgement by Role Holders	Space for role holders and substitutes to acknowledge their understanding and acceptance of the responsibilities and plans outlined.	

The Responsibilities and Substitution Matrix template presented here incorporates essential elements from PMBOK, PRINCE2, and PM², providing a comprehensive approach to defining roles and responsibilities in a project.

Using this template, project managers can promote effective collaboration, decision-making, and project success by ensuring that each team member understands their responsibilities and authority within the project's context.

Although, for this instance, it must be considered some usage guidelines, such as:

- This matrix should be regularly updated to reflect any changes in project roles or task assignments.
- The matrix is a living document throughout the project's lifecycle, ensuring clarity and consistency.
- When creating this matrix, continuous engagement with all team members ensures everyone understands and agrees on their roles.
- When considering substitutions, it is essential to ensure that the backup individual (human resource) is adequately trained, informed and prepared to take over the task at any point.

Integrating principles from PMBOK, PRINCE2, and PM², the Responsibilities and Substitution Matrix is a comprehensive tool for ensuring project tasks are well-defined and owned and have a clear continuity plan.

In a domain where uncertainty is a given, such clarity and preparation can be instrumental in navigating challenges and ensuring project success. This was more than justified on the second and third actions since changes to the project were made without any kind of plan for managing these absences.

7.5.5 Communication Plan

The Communication Plan is a vital project management document that outlines a structured approach to effective communication within a project. It is designed to facilitate a clear and timely exchange of information among stakeholders, ensuring that the right messages are delivered to the right people at the right time.

When considering the frameworks of PMBOK, PRINCE2, and PM², the Communications Plan plays a central role in project success and alignment with organisational objectives.

The Communication Plan is a strategic tool integral to project planning and execution. Its significance lies in the fact that effective communication is the backbone of successful project management.

The Communication Plan ensures stakeholders are well-informed, engaged, and aligned with project goals and progress. By integrating principles from PMBOK, PRINCE2, and PM², the Communications Plan provides a comprehensive approach to managing the flow of information within a project, considering the stakeholders' needs and expectations regarding the flow of information.

Definition and Purpose

In PMBOK (Project Management Institute, 2017), the communications plan is included in the project management plan, developed during the project planning phase. According to the PMBOK Guide, the Communications Plan outlines the following key elements:

- Stakeholder Communication Requirements: identify the communication needs of all stakeholders involved in the project. This includes understanding their preferences, expectations, and the level of detail required in communication;
- Information to be Communicated: determine the specific information that needs to be communicated, such as project status updates, risks, issues, milestones, and changes;
- Communication Methods: define the channels and mediums to deliver information. This may include meetings, emails, status reports, presentations, and project management tools;
- Communication Frequency: establish the frequency of communication for each stakeholder group or individual, ensuring that it aligns with their needs and preferences;

- Communication Responsibility and Distribution: identify who is responsible for preparing and delivering the communication and specify the recipients for each type of communication;
- Escalation Procedures: define the escalation path for communication issues or concerns that cannot be resolved at the project level.

In PRINCE2 (Axelos, 2017), the Communications Plan is a part of the Plans theme. It is integrated into the overall Project Initiation Documentation (PID). The PRINCE2 approach highlights the importance of tailoring the Communications Plan to suit the specific needs and characteristics of the project. Critical aspects of the Communications Plan in PRINCE2 include:

- Audience Analysis: Identify the primary stakeholders and their communication preferences. Tailor the content and format of communication to suit the different stakeholder groups.
- Key Messages: Determine the key messages that stakeholders must communicate to maintain their engagement and support.
- Timing and Frequency: Establish a schedule for regular communication updates to inform stakeholders about the project's progress and any changes.
- Communication Channels: Specify the communication channels to be used for different types of information and consider the most appropriate means of effectively reaching stakeholders.
- Roles and Responsibilities: Clearly define the roles and responsibilities of team members in managing communication, including who is responsible for authoring, approving, and distributing communications.

In the PM² methodology (European Commission, 2018), the Communications Plan is developed as part of the Governance domain. It is closely linked to the Stakeholder Management aspect, as effective communication is crucial for stakeholder engagement. In PM², the Communications Plan covers the following aspects:

- Stakeholder Mapping: identify and analyse stakeholders to understand their communication needs, preferences, and influence on the project;
- Communication Objectives: define the specific communication objectives, such as creating awareness, gaining support, and managing expectations;

- Communication Messages: craft clear and concise messages to express project progress, risks, and achievements to stakeholders;
- Communication Methods: determine the most effective communication methods, considering stakeholders' cultural and organisational context;
- Feedback Mechanisms: establish mechanisms for receiving feedback from stakeholders, ensuring their concerns and suggestions are addressed;
- Communication Plan Review: review and update the Communications Plan regularly to adapt to changing stakeholder needs and project requirements.

Drawing on PMBOK, PRINCE2, and PM² principles, the Communications Plan serves as a roadmap for effective project communication. By defining the stakeholders, key messages, communication channels, and responsibilities, the Communications Plan ensures that all stakeholders are engaged, informed, and supported throughout the project lifecycle. It promotes transparency, risk mitigation, enhanced collaboration, project success, and alignment with organisational objectives.

Template

Developing a comprehensive communications plan for stakeholders is crucial for effective project management. A well-structured communications plan ensures the correct information reaches stakeholders at the right time.

Here are some key components to consider when creating a communications plan:

- Stakeholder Segmentation: identify and categorise stakeholders based on their roles, interests, influence, and communication preferences. This segmentation will help tailor the communication approach for different stakeholder groups;
- Communication Objectives: determine the primary objectives of the communication plan. These objectives include keeping stakeholders informed, obtaining feedback, managing expectations, and promoting engagement and collaboration;
- Key Messages: define the key messages to communicate to the project stakeholders. These messages should be clear, concise, and aligned with the project's objectives and value proposition. Ensure that messages address stakeholders' interests, concerns, and expectations;

- Communication Channels: select the most appropriate communication channels for each stakeholder group. This could include face-to-face meetings, email, project management software, video conferences, newsletters, project portals, or social media platforms. The preferences and accessibility of stakeholders should be considered when choosing the channels;
- Frequency and Timing: the frequency and timing of your communications should be determined, as well as regular updates, progress reports, milestone announcements, and other communication touchpoints based on the needs and expectations of the stakeholders. Critical information is shared promptly, and that communication is consistent and should be ensured;
- Stakeholder Engagement Activities: specific stakeholder engagement activities must be incorporated into the plan. These can include workshops, focus groups, one-on-one meetings, or surveys to gather feedback, address concerns, and involve stakeholders in decision-making;
- Escalation Procedures: define escalation procedures for handling urgent or critical communication needs. Establish clear lines of communication and decision-making authority to ensure issues are addressed promptly;
- Roles and Responsibilities: clearly define the roles and responsibilities of team members involved in stakeholder communications. Designate individuals responsible for drafting, reviewing, and delivering communications. Ensure accountability and clear lines of communication within the project team;
- Communication Evaluation: establish mechanisms to monitor and evaluate the effectiveness of the communication plan. Regularly assess stakeholders' feedback, engagement levels, and the impact of communications on project outcomes. This feedback can be used to make necessary adjustments and improvements.

The components mentioned for developing a communications plan for stakeholders are not specific to any single project management framework. Instead, they are general best practices that can be applied within various project management methodologies and frameworks.

These practices align with popular project management frameworks' effective communication and stakeholder engagement principles (European Commission, 2018; Great Britain, 2017; Project Management Institute, 2017).

While specific methodologies may provide additional guidance or processes for stakeholder communication and engagement, the key elements of a communications plan, such as stakeholder segmentation, defining key messages, selecting appropriate communication channels, and establishing a feedback mechanism, are universally applicable.

The components mentioned in the communications plan are considered good practices in project management. Regardless of the framework used, the communication plan can be tailored and adapted to suit any project's specific needs and requirements.

A Stakeholder Communication Plan is a crucial component of project management that focuses on effectively engaging and informing stakeholders throughout the project lifecycle. It ensures that the correct information is delivered to the right stakeholders in a timely and relevant manner. Integrating principles from PMBOK, PRINCE2, and PM², the Stakeholder Communication Plan template provides a comprehensive approach to managing stakeholder communication.

The template (Table 66) considers the PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) project management frameworks to ensure a comprehensive and adaptable approach to stakeholder communication.

Table 66 – Communication Plan Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the purpose of the communication plan, emphasising its role in ensuring clear, consistent, and effective communication throughout the project.	
1.3	Scope	Outline the scope, detailing the communication requirements for various project stages and stakeholders.	
2	Communication Objectives		
2.1	Goals	Clearly state the project's communication objectives, which are aligned with the overall project goals (reflecting PMBOK's emphasis on aligning communication with project objectives).	PMBOK
3	Stakeholder Analysis		
3.1	Identification	List all stakeholders.	PMBOK
3.2	Needs and Preferences	Assess and document each stakeholder or stakeholder group's communication needs, preferences, and requirements (inspired by PRINCE2's focus on stakeholder engagement).	PRINCE2
4	Communication Matrix		

ID	Field	Description	Input
4.1	Information to be Communicated	Detail the types of information to be communicated (e.g., project updates, risks, changes).	
4.2	Audience	Specify the audience for each type of information.	
4.3	Frequency	Define how often each type of communication should occur.	
4.4	Method/Channel	Identify the most suitable method or channel for each type of communication (drawing from PM²'s emphasis on effective communication channels).	PM²
4.5	Responsible Party	Assign who is responsible for initiating and managing each type of communication.	
5	Escalation Process		
5.1	Escalation Pathways	Define clear escalation pathways for addressing and escalating issues.	PMBOK and PRINCE2
5.2	Thresholds for Escalation	Set thresholds or criteria for when an issue should be escalated.	
6	Communication Tools and Resources		
6.1	Tools	Specify the tools and resources (like project management software, email, and meetings) that will be used for communication.	
6.2	Access and Availability	Ensure all stakeholders have access to necessary communication tools and resources.	
7	Feedback Mechanism		
7.1	Feedback Channels	Establish channels for receiving feedback from stakeholders (in line with PM²'s focus on stakeholder engagement)	PM²
7.2	Review and Adaptation	Outline how feedback will be reviewed and used to adapt the communication strategy.	
8	Training and Development		
8.1	Training Needs	Identify any training needs related to communication skills or tools.	
8.2	Development Plan	Develop a plan for training and skill enhancement for the project team.	
9	Monitoring and Reporting		
9.1	Monitoring Plan	Describe how the effectiveness of communication will be monitored (using metrics or KPIs).	PMBOK
9.2	Reporting	Establish a reporting mechanism for communication effectiveness, including frequency and method of reporting.	
10	Approval and Review		
10.1	Approval	Include sections for approval sign-offs by key project authorities.	
10.2	Review	Set a schedule for reviewing and updating the communication plan, ensuring it remains effective and relevant throughout the project lifecycle.	PRINCE2

ID	Field	Description	Input
11	Document Control		
11.1	Version Control	Maintain a record of versions of the communication plan.	
11.2	Document Distribution	List who will receive copies of the communication plan and any updates.	

The Stakeholder Communication Plan template draws on PMBOK's comprehensive approach to communication planning (Project Management Institute, 2017), PRINCE2's stakeholder-focused strategies (Axelos, 2017), and PM²'s emphasis on effective communication channels and feedback (European Commission, 2018).

It is designed to ensure that all project communication is well-planned, clear, and effective, meeting the needs of all stakeholders and supporting the project's goals. Adjustments can and should be made based on the specific requirements of the project or organisation.

7.5.6 Team Charter

The document Team Charter is a fundamental document that serves as a blueprint for team collaboration and performance within a project. It outlines the team's purpose, values, goals, roles, and responsibilities, providing a shared understanding and a solid foundation for working together effectively. Integrating PMBOK, PRINCE2, and PM² principles, the Team Charter develops cohesion, communication, and alignment with project objectives.

Definition and Purpose

The Team Charter is a powerful tool in project management that plays a crucial role in establishing a high-performing and motivated project team. By drawing from the PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) project management frameworks, the Team Charter ensures that the team's values, goals, and roles are clearly defined, contributing to a collaborative and productive work environment.

In PMBOK (Project Management Institute, 2017), the Team Charter is developed during the project planning phase and is an integral part of the project management plan.

According to the PMBOK Guide, the Team Charter outlines the following key elements:

- Team Purpose and Objectives: clearly define the team's purpose and the specific objectives they are expected to achieve. This includes aligning the team's goals with the overall project objectives;
- Roles and Responsibilities: identify the roles within the team and define the responsibilities of each team member. This establishes clarity regarding who is accountable for what tasks and deliverables;
- Project Scope and Constraints: communicate the project's scope and any constraints that may impact the team's work. This helps the team understand the boundaries and limitations they need to operate;
- Communication Guidelines: establish communication protocols within the team and with external stakeholders. This ensures effective information exchange and minimizes miscommunication;
- Decision-Making Procedures: define how decisions will be made within the team and specify who has the authority to make particular decisions;
- Team Values and Norms: set out the team's values and behavioural norms to guide interactions, promote a positive team culture, and manage potential conflicts.

In PRINCE2 (Axelos, 2017), the concept of the Team Charter aligns with the Roles and Responsibilities theme. While PRINCE2 does not explicitly refer to a Team Charter, the theme stresses the importance of clearly defining roles and responsibilities within the project team.

Critical aspects of the Team Charter in PRINCE2 include:

- Project Roles: identify the key roles within the team, including the Project Manager, Team Members, Project Board, and other stakeholders. Clearly define their responsibilities and authority;
- Communication and Reporting: establish how communication will flow within the team and with external stakeholders. Specify reporting requirements to keep everyone informed about project progress;
- Team Empowerment: encourage empowerment by allowing team members to make decisions and take ownership of their tasks.

In the PM² methodology (European Commission, 2018), the Team Charter was developed as part of the People domain, which focuses on managing human resources within the project. While PM² does not

have a specific Team Charter template, the methodology highlights the importance of team collaboration and motivation.

Key aspects of the Team Charter in PM² include:

- Team Objectives: define the team's specific objectives in alignment with the project's overall goals. This helps the team members understand their contribution to the project's success;
- Roles and Competencies: clearly outline the roles within the team and the competencies required for each role. This ensures that team members have the necessary skills to fulfil their responsibilities;
- Collaboration Guidelines: establish guidelines for team collaboration, including communication channels, meeting frequency, and conflict resolution mechanisms;
- Continuous Improvement: encourage continuous improvement within the team, promoting an environment where team members are empowered to share ideas and contribute to the project's success.

Drawing from PMBOK, PRINCE2, and PM² principles, the Team Charter is a foundational document for effective team collaboration within a project. By clearly defining the team's purpose, goals, roles, and responsibilities, the team charter promotes a cohesive and motivated team aligned with the project's objectives.

It lays the groundwork for communication, decision-making, and project success, contributing to a positive project environment and driving the team towards achieving project goals, while supporting other documents from this framework.

It is important to note that the Team Charter is a collaborative document that should involve all team members. It serves as a reference and guide throughout the project, helping to align the team's efforts and establish a shared understanding of expectations.

Template

The Team Charter is a foundational document in project management that sets the tone for team collaboration and performance. By drawing from the project management frameworks of PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), the

Team Charter ensures that the team's values, goals, roles, and responsibilities are clearly defined, promoting a sense of purpose and direction for the team (Table 67).

Table 67 – Team Charter Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	State the purpose of the team charter, emphasising its role in guiding team operations and dynamics.	
1.3	Scope	Outline the scope of the team's work, aligning with the overall project scope.	PMBOK
2	Team Objectives and Goals		
2.1	Objectives	Clearly define the team's objectives, ensuring alignment with the project's goals (reflecting PMBOK's focus on goal alignment).	PMBOK
2.2	Success Criteria	Establish criteria for measuring the team's success, aligning with the project's success metrics (inspired by PM²'s results-driven approach).	PM²
3	Team Roles and Responsibilities		
3.1	Role Definitions	List and define each team role, including responsibilities and expectations (drawing from PRINCE2's defined roles).	PRINCE2
3.2	Assignment of Roles	Assign team members to each role, ensuring clarity in responsibility distribution.	PMBOK
4	Team Processes and Procedures		
4.1	Decision-Making Process	Define the process for making team decisions, including any consensus or voting mechanisms (reflecting PM²'s emphasis on governance).	PM²
4.2	Conflict Resolution	Outline procedures for resolving conflicts within the team (inspired by PMBOK's emphasis on team management).	PMBOK
4.3	Meeting Schedule and Format	Establish regular meeting schedules, formats, and expected outcomes.	
5	Communication Plan		
5.1	Communication Guidelines	Detail the team's communication norms and channels, ensuring everyone is informed and engaged (as per PM²'s communication focus).	PM²
5.2	Information Sharing	Describe how information will be shared within the team and with external stakeholders (aligning with PRINCE2's communication management strategy).	PRINCE2
6	Resource Allocation		
6.1	Resources	List the resources available to the team, including tools, technologies, and budget (PMBOK's resource management aspect).	PMBOK
6.2	Access and Usage Policies	Define policies for resource access and usage.	
7	Team Values and Culture		
7.1	Core Values	State the core values and principles guiding the team's work and interactions (inspired by PRINCE2's principles).	PRINCE2

ID	Field	Description	Input
7.2	Team Culture	Describe the desired team culture, emphasising collaboration, respect, and inclusivity.	
8	Training and Development		
8.1	Skill Development	Identify team members' training or development needs (reflecting PMBOK's focus on continuous improvement).	PMBOK
8.2	Training Plan	Develop a plan for addressing these training needs.	
9	Risk Management		
9.1	Potential Risks	Identify potential risks related to team dynamics or performance (as per PMBOK's risk management processes).	PMBOK
9.2	Mitigation Strategies	Outline strategies for mitigating identified risks.	PMBOK
10	Sign-off		
10.1	Team Agreement	Include a section for team members to sign, indicating their agreement and commitment to the charter.	
10.2	Project Manager Approval	Obtain the project manager's sign-off, endorsing the charter.	
11	Review and Update Mechanism		
11.1	Review Frequency	Set a regular schedule for reviewing and updating the team charter (in line with PRINCE2's principle of regular reviews).	PRINCE2
11.2	Update Process	Outline the process for making changes to the charter.	

This template combines the structured role clarity and resource management of PMBOK (Project Management Institute, 2017), the governance and results-oriented focus of PM² (European Commission, 2018), and the defined roles and principles of PRINCE2 (Axelos, 2017). It is designed to ensure that team members are aligned, roles are clearly defined, and processes are established to support effective teamwork and project success.

As a living document, the Team Charter should be regularly reviewed and updated to adapt to changing project dynamics, promote continuous improvement, and maintain team cohesion throughout the project lifecycle.

7.5.7 Team Toolkit

The Team Toolkit is a comprehensive set of resources, tools, and templates designed to support project teams throughout the project lifecycle. It is a centralised repository of valuable materials that aid in effective project execution, communication, collaboration, and problem-solving.

By integrating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), the Team Toolkit enhances team productivity, streamlines processes, and ensures alignment with project management best practices.

Definition and Purpose

The Team Toolkit is a critical component in project management, providing project teams with the necessary resources to carry out their tasks efficiently and effectively.

Drawing from the project management frameworks of PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), the Team Toolkit is a curated collection of tools and templates that support the team's efforts to plan, execute, and deliver successful projects.

In PMBOK (Project Management Institute, 2017), the Team Toolkit is essential to the Project Management Plan. The Project Management Plan encompasses all the subsidiary plans, including the Communication Plan, Risk Management Plan, and Quality Management Plan. These plans, together with the tools and templates, form the foundation of the Team Toolkit.

The Team Toolkit in PMBOK includes, but is not limited to, the following elements:

- Communication Templates: standardised templates for project status reports, meeting agendas, and meeting minutes, enabling consistent and clear communication within the team and with stakeholders;
- Risk Register Template: a template for documenting project risks, their potential impacts, and proposed mitigation strategies;
- Issue Log Template: a tool to track and manage project issues, including their status and resolution progress;
- Change Request Form: a standardised form for capturing and evaluating change requests, ensuring thorough assessment and decision-making;
- Project Schedule Template: a template for creating and maintaining the project schedule, providing a clear timeline for project activities;

- Lessons Learned Template: a tool for capturing and documenting project lessons learned to improve future project performance.

In PRINCE2 (Axelos, 2017), the concept of the Team Toolkit aligns with the Plans theme. Although PRINCE2 does not explicitly refer to a Team Toolkit, the Plans theme highlights the importance of creating tailored plans and using appropriate tools to manage the project effectively.

The Team Toolkit in PRINCE2 encompasses the following components:

- Product Descriptions: detailed descriptions of project deliverables outlining their purpose, composition, and quality criteria;
- Project Plan: a comprehensive plan that includes various subsidiary plans and outlines how the project will be managed and controlled;
- Issue Register: a tool to capture and monitor project issues, ensuring timely resolution and preventing them from becoming primary concerns;
- Risk Management Approach: a documented approach for identifying, assessing, and managing project risks throughout the project lifecycle;
- Quality Criteria: criteria that define the quality standards for project deliverables and enable effective quality control.

In the PM² methodology (European Commission, 2018), the Team Toolkit is a part of the Governance domain, specifically under the People and Processes aspects. PM² underlines the importance of providing teams with the right resources to deliver projects successfully.

The Team Toolkit in PM² includes, among other elements:

- Templates for Governance Deliverables: standardised templates for key governance deliverables, such as project charters, business cases, and progress reports;
- Resource Management Tools: tools for managing team resources, including workload, availability, and skill sets;
- Project Management Software: software and tools to support project planning, scheduling, and progress tracking;
- Collaboration Platforms: platforms for effective team collaboration, communication, and document sharing.

Drawing from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) principles, the Team Toolkit is a valuable resource hub for project teams. By providing standardised templates, tools, and resources, the Team Toolkit enhances team efficiency, furthers collaboration, and ensures compliance with project management best practices.

Template

The Team Toolkit is a vital asset in project management, providing project teams with a wealth of resources to support their endeavours.

By integrating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), the Team Toolkit offers a well-rounded and adaptable collection of tools and templates for various aspects of project planning and execution.

This toolkit allows project teams to streamline processes, enhance communication, and more effectively deal with challenges (Table 68).

Table 68 – Team Toolkit Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the toolkit's purpose, emphasising its role in supporting team efficiency and effectiveness.	
1.3	Scope	Outline the tools and resources' scope, aligning with project needs and methodologies.	
2	Project Management Methodologies Overview		
2.1	Project Management Methodologies	Provide brief overviews of the methodologies used, highlighting key principles and practices relevant to the team.	
2.2	Methodology Application Guide	Offer guidance on how to apply these methodologies in the team's work.	
3	Role and Responsibility Chart		
3.1	Team Roles	List all team roles as defined in the project charter.	PRINCE2
3.2	Responsibilities	Detail the responsibilities associated with each role (as recommended by PMBOK).	PMBOK
3.3	Contact Information	Include contact information for each team member.	
4	Project Documentation Templates		
4.1	Project Plan	Provide a template for the project plan.	PMBOK and PRINCE2
4.2	Risk Register	Include a risk register template.	PMBOK
4.3	Stakeholder Register	Offer a stakeholder register template.	PMBOK and PM²
5	Communication Tools		

ID	Field	Description	Input
5.1	Communication Plan Template	Include a template for developing a communication plan (as per PM²'s emphasis on communication).	PM²
5.2	Meeting Agenda and Minutes Template	Provide templates for meeting agendas and minutes to ensure effective meetings.	
6	Reporting and Monitoring Tools		
6.1	Status Report Template	Provide a status report template to standardize project updates (reflecting PMBOK's monitoring and controlling processes).	PMBOK
6.2	KPI Tracker	Include a tool for tracking Key Performance Indicators (KPIs).	PM²
7	Collaboration and Productivity Tools		
7.1	Recommended Software	List recommended software and tools for collaboration, project tracking, and document sharing.	
7.2	Access Instructions	Offer guidelines on how to access and use these tools.	
8	Problem-Solving and Decision-Making Frameworks		
8.1	Problem-Solving Guide	Provide a guide or framework for systematic problem-solving (drawing from PMBOK's processes).	PMBOK
8.2	Decision-Making Models	Include models and tools for effective decision-making (reflecting PM²'s governance approach).	PM²
9	Skill Development Resources		
9.1	Training Material	List available training resources and materials for skill development in project management (aligned with PMBOK's focus on continuous learning).	PMBOK
9.2	Workshops and Course Links	Provide links to relevant workshops, webinars, or courses.	
10	Risk Management Resources		
10.1	Risk Assessment Tools	Include tools and techniques for risk assessment and management (as per PMBOK guidelines).	PMBOK
10.2	Mitigation Strategy Examples	Offer examples or case studies on effective risk mitigation strategies.	
11	Quality Management Resources		
11.1	Quality Standards Guide	Outline relevant quality standards and best practices (reflecting PRINCE2's emphasis on quality).	PRINCE2
11.2	Quality Control Checklists	Provide checklists or templates for quality control processes.	
12	Review and Update Mechanism		
12.1	Feedback Process	Establish a process for team members to provide feedback on toolkit resources.	
12.2	Update Schedule	Set a schedule for regularly reviewing and updating the toolkit, ensuring its continued relevance and effectiveness.	

This template combines the structured and comprehensive approach of PMBOK, the governance and communication focus of PM², and the defined roles and quality emphasis of PRINCE2. It is designed to

equip the team with essential tools, templates, and resources to manage their project effectively, adapt to challenges, and ensure project success. The toolkit can be customised based on the specific needs and context of the project.

This versatile toolkit caters to the specific needs of each project, promoting adaptability and following industry best practices. By utilizing the Team Toolkit, project teams can go through complexities, maintain transparency, and deliver projects with greater efficiency and success.

This document will have countless inputs from other documents and will provide countless outputs for others.

7.5.8 Stakeholder Engagement Toolkit

The Stakeholder Engagement Toolkit is a comprehensive set of resources, techniques, and guidelines to facilitate effective engagement with project stakeholders. It is a valuable asset in project management, drawing on PMBOK, PRINCE2, and PM² principles to ensure that stakeholders are appropriately identified, engaged, and managed throughout the project lifecycle.

Definition and Purpose

The Stakeholder Engagement Toolkit is essential to successful project management, it enables project teams to establish meaningful relationships with stakeholders and effectively address their needs and expectations.

Integrating PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) principles, the Stakeholder Engagement Toolkit equips project managers with the tools and techniques necessary to create a collaborative environment, align project objectives, and promote stakeholder support and satisfaction.

PMBOK's Stakeholder Engagement Toolkit (Project Management Institute, 2017) is closely tied to the Stakeholder Management Plan. The Stakeholder Management Plan outlines the strategies and approaches for engaging stakeholders effectively. The Stakeholder Engagement Toolkit includes, but is not limited to, the following elements:

- Stakeholder Identification Techniques: methods for identifying and categorising stakeholders based on their level of influence, interests, and potential impact on the project;

- Communication Management Tools: templates for stakeholder communication, such as stakeholder engagement matrices, communication plans, and stakeholder analysis reports;
- Engagement Strategies: strategies for engaging different stakeholder groups effectively, ensuring their involvement and support throughout the project;
- Stakeholder Feedback Mechanisms: techniques for gathering feedback from stakeholders, such as surveys, interviews, and focus groups, to assess their satisfaction and identify improvement opportunities.
- Conflict Resolution Approaches: Guidelines for managing and resolving stakeholder conflicts to maintain positive relationships and mitigate risks.

In PRINCE2 (Axelos, 2017), the Stakeholder Engagement Toolkit aligns with the Processes theme, emphasising the importance of effective stakeholder engagement for project success. Although PRINCE2 does not have a specific Stakeholder Engagement Toolkit template, it encourages project managers to tailor their approach based on the project's context and requirements.

The Stakeholder Engagement Toolkit in PRINCE2 encompasses the following components:

- Stakeholder Analysis and Mapping: Techniques for analysing stakeholder interests, concerns, and influence on the project. Stakeholder mapping tools help identify key stakeholders and their relationships.
- Communication and Reporting Guidelines: Guidelines for effective communication and reporting with stakeholders, including templates for status updates, progress reports, and stakeholder briefings.
- Engagement Strategies: Strategies for engaging stakeholders at different project stages, such as stakeholder workshops, regular project board meetings, and stakeholder consultation sessions.

In the PM² methodology (European Commission, 2018), the Stakeholder Engagement Toolkit is part of the Governance domain under the People aspect. PM² accentuates the importance of stakeholder management for project success.

The Stakeholder Engagement Toolkit in PM² includes, among other elements:

- Stakeholder Identification and Analysis: techniques for identifying stakeholders and analysing their needs, expectations, and potential impact on the project;

- Communication and Collaboration Tools: resources for effective communication and collaboration with stakeholders, including templates for stakeholder engagement plans and stakeholder feedback forms;
- Engagement Strategies: facilitating collaboration and obtaining stakeholder buy-in, through engagement workshops and stakeholder focus groups.

The Stakeholder Engagement Toolkit, drawing on principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), is a valuable resource for project managers to engage with stakeholders effectively. By providing tools, techniques, and guidelines for stakeholder identification, communication, and engagement, the Stakeholder Engagement Toolkit ensures that stakeholders are actively involved, their concerns are addressed, and their support is secured throughout the project lifecycle.

Here are some advantages of having a Stakeholder Engagement Toolkit:

1. Standardised Approach: a toolkit ensures that stakeholder engagement is approached consistently across projects within an organisation. It establishes a standard set of practices and tools project teams can utilize, reducing ambiguity and enhancing efficiency;
2. Improved Stakeholder Understanding: the toolkit can include tools and techniques for stakeholder identification, analysis, and mapping. This helps project teams better understand stakeholder needs, interests, and influence, enabling more targeted and effective engagement strategies;
3. Enhanced Communication and Collaboration: the toolkit can provide templates and guidelines for communication planning, stakeholder messaging, and information dissemination. This promotes clear and consistent stakeholder communication, promoting collaboration, alignment, and trust;
4. Conflict Management and Issue Resolution: including conflict management techniques and approaches in the toolkit can help project teams proactively address conflicts and issues that may arise among stakeholders. It provides strategies and resources for managing disagreements and finding mutually beneficial solutions;
5. Training and Development: a Stakeholder Engagement Toolkit can also include training materials and resources to enhance the skills and competencies of project team members in stakeholder

management. This helps build a capable and knowledgeable team that can handle stakeholder dynamics effectively;

6. Lessons Learned and Continuous Improvement: the toolkit can incorporate mechanisms for capturing lessons learned and best practices from stakeholder engagement activities. This allows project teams to learn from past experiences and improve their stakeholder management approach;
7. Tailored Approach: while a toolkit provides a standardised approach, it can also be customised to suit different projects' specific needs and characteristics. Project managers can adapt the tools and techniques to align with the project's context, industry, and stakeholder scope.

Providing project teams with a stakeholder engagement toolkit can enable them to approach stakeholder management systematically and comprehensively. This, in turn, can lead to improved stakeholder satisfaction, reduced conflicts, increased support, and, finally, project success.

It is essential to regularly review and update the toolkit to incorporate new insights, emerging practices, and lessons learned from project experiences. This ensures that the toolkit remains relevant and aligned with the evolving needs of stakeholder management.

The specific contents and components of a stakeholder engagement toolkit can vary based on the project's complexity, stakeholder setting, and organisational requirements. To ensure its effectiveness, it is advisable to involve key stakeholders and experienced project management professionals in developing and refining the toolkit.

This comprehensive toolkit promotes transparency, builds trust, and enhances project outcomes by creating a collaborative and positive project environment. Adaptable and tailored to the specific needs of each project, the Stakeholder Engagement Toolkit is a powerful aid in navigating the complexities of stakeholder management and achieving project success.

Template

Stakeholders play a critical role in project success, and effective engagement is essential to gaining their support, managing their expectations, and addressing their concerns.

By incorporating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), the Stakeholder Engagement Toolkit provides project managers with well-rounded resources to manage stakeholder interactions confidently (Table 69).

Table 69 – Stakeholder Engagement Toolkit Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the toolkit's purpose, focusing on enhancing stakeholder engagement and communication.	
1.3	Scope	Outline the toolkit's applicability in different stages of stakeholder engagement.	
2	Stakeholder Identification and Analysis Tools		
2.1	Stakeholder Identification	A template for identifying stakeholders.	PMBOK
2.2	Stakeholder Analysis Matrix	Assessment of stakeholder interests, influence, and potential impact on the project.	PM² and PRINCE2
3	Stakeholder Engagement Plan		
3.1	Engagement Plan	Provide a comprehensive template to plan stakeholder engagement (integrating PMBOK's systematic approach with PRINCE2's focus on stakeholder satisfaction).	PMBOK and PRINCE2
3.2	Engagement Strategies	Offer examples of different engagement strategies suitable for various types of stakeholders.	
4	Communication Plan		
4.1	Communication Plan	A detailed template for developing a communication plan (drawing on PM²'s emphasis on effective communication).	PM²
4.2	Methods and Channels	Suggest various methods and channels for stakeholder communication, suitable for different stakeholder groups.	
5	Monitoring and Feedback Tools		
5.1	Stakeholder Engagement Assessment Matrix	A tool for assessing the effectiveness of stakeholder engagement activities (aligned with PMBOK's monitoring and controlling process).	PMBOK
5.2	Feedback Collection Templates	Templates and methods for collecting stakeholder feedback (as per PM²'s focus on continuous improvement).	PM²
6	Reporting Templates		
6.1	Stakeholder Report	Provide templates for creating stakeholder reports, detailing engagement activities, and outcomes.	
6.2	Escalation Templates	Templates for reporting and escalating stakeholder issues (in line with PRINCE2's risk management principles).	PRINCE2
7	Conflict Resolution Resources		
7.1	Conflict Resolution Strategies	Offer strategies and best practices for resolving stakeholder conflicts, drawing from PMBOK's and PRINCE2's guidelines.	PMBOK and PRINCE2
7.2	Negotiation Techniques	Include techniques and tips for effective negotiation with stakeholders.	
8	Training and Development Resources		

ID	Field	Description	Input
8.1	Stakeholder Management Training Materials	Provide resources and links to training materials for building stakeholder management skills (as encouraged by PMBOK).	PMBOK
8.2	Workshops and Webinars	Links to relevant workshops and webinars focused on stakeholder engagement.	
9	Case Studies and Best Practices		
9.1	Success Stories	Share case studies demonstrating successful stakeholder engagement strategies.	
9.2	Lessons Learned Repository	Create a repository of lessons learned in stakeholder management (aligning with PM²'s and PRINCE2's learning from experience).	PM² and PRINCE2
10	Review and Update Mechanism		
10.1	Review Schedule	Set a regular schedule for reviewing and updating the toolkit.	
10.2	Continuous Improvement Process	Establish a process for continuously improving the toolkit based on feedback and evolving project needs.	
11	Additional Resources		
11.1	Useful Links	Provide links to additional resources, articles, and guidelines on stakeholder engagement.	
11.2	Contact Information	List contact information for expert advice or support on stakeholder management.	

This template is designed to guide project managers and teams in effectively engaging with stakeholders, drawing on the best practices from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) methodologies. It includes various components such as tools for stakeholder identification and analysis, templates for engagement and communication plans, resources for conflict resolution, and mechanisms for monitoring and feedback.

This structured approach ensures that all aspects of stakeholder engagement are comprehensively covered, from initial identification to ongoing management and communication. The idea is to provide a ready-to-use framework that can be customised according to different projects' specific needs and circumstances.

This template, like all the others, receives countless inputs and provides many outputs, depending on the type of project.

7.5.9 Stakeholder Template

Stakeholder analysis and management are critical components of project management they enable project teams to identify, assess, and engage with individuals, groups, or organisations that have an interest in or influence on the project's success.

By drawing insights from PMBOK, PRINCE2, and PM² PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), stakeholders are given special attention as key players in the project's outcomes and overall success.

Definition and Purpose

Stakeholders are individuals or entities with a vested interest in the project or can affect, or be affected by, the project's outcomes. They include project sponsors, team members, customers, end-users, suppliers, regulatory bodies, and others who may directly or indirectly impact the project. Stakeholders define project requirements, provide resources, and influence project decisions.

In PMBOK (Project Management Institute, 2017), stakeholders are one of the ten knowledge areas addressed explicitly in the Stakeholder Management knowledge area. The PMBOK Guide acknowledges the importance of identifying, analysing, and managing stakeholders throughout the project lifecycle. Essential aspects of stakeholder management in PMBOK include:

- Stakeholder Identification: techniques for identifying all stakeholders and understanding their roles, interests, and expectations regarding the project;
- Stakeholder Analysis: methods for analysing stakeholders' power, influence, level of interest, and potential impact on the project;
- Stakeholder Engagement Strategies: developing plans and strategies to engage stakeholders effectively, ensuring their support and contribution to the project's objectives;
- Communication and Reporting: establishing communication channels and methods for sharing project information with stakeholders, favouring transparency and managing expectations;
- Managing Stakeholder Expectations: ensure stakeholder expectations are appropriately managed, and their concerns are addressed throughout the project.

In PRINCE2 (Axelos, 2017), stakeholders are an essential part of the Business Case theme. The PRINCE2 methodology affirms the significance of understanding stakeholder interests and obtaining their support for project success.

Key aspects of stakeholder management in PRINCE2 include:

- Stakeholder Mapping: techniques for mapping stakeholders based on their interests, influence, and relationship with the project;
- Engagement Strategies: developing plans for engaging stakeholders in decision-making, reviewing project progress, and obtaining necessary approvals;
- Communication and Reporting: ensuring appropriate communication with stakeholders by providing relevant and timely project updates;
- Managing Stakeholder Expectations: address stakeholder concerns and ensure the project meets their expectations and requirements.

In the PM² methodology (European Commission, 2018), stakeholders are central to the Governance domain. The PM² methodology indicates the need for effective stakeholder engagement and communication.

Key aspects of stakeholder management in PM² include:

- Stakeholder Identification and Analysis: techniques for identifying stakeholders and understanding their interests, concerns, and potential impact on the project;
- Engagement Strategies: develop plans for engaging stakeholders in project activities, seeking their involvement and support;
- Communication and Collaboration: ensuring effective communication with stakeholders to build trust and transparency.

Stakeholder analysis and management are essential practices in project management, emphasized in various ways across PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018).

By employing techniques for identifying stakeholders, analysing their interests, and developing appropriate engagement strategies, project managers can promote positive relationships with stakeholders, gain their support, and ensure successful project outcomes.

Template

The Stakeholder Analysis and Management template is a fundamental tool for project managers, enabling them to proactively engage with stakeholders and address their needs, concerns, and expectations.

Stakeholders play a critical role in project success, and their involvement can significantly impact project outcomes.

By drawing insights from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), this template helps project managers identify key stakeholders, understand their interests and influence, and develop appropriate strategies to manage stakeholder engagement effectively. Our proposed template can be seen in Table 70:

Table 70 – Stakeholder Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the template's purpose, focusing on its role in identifying stakeholders.	
1.3	Scope	Outline the template applicability in different stages of the project.	
2	Stakeholder Identification		
2.1	Stakeholder Name	The full name of the stakeholder.	PMBOK and PRINCE2
2.2	Organisation/Department	The stakeholder's affiliated organisation or department within the organisation.	PMBOK and PRINCE2
2.3	Role in Project	Define the stakeholder's role or anticipated role in the project (e.g., sponsor, team member, supplier).	PMBOK and PRINCE2
2.4	Contact Information	Include email, phone number, and other relevant contact details.	PMBOK and PRINCE2
2.5	Risk Relevance	Note if the stakeholder is directly related to any specific risks or risk categories.	PMBOK
3	Stakeholder Classification		
3.1	Internal/External	Distinguish if the stakeholder is part of the organisation (internal) or outside it (external), impacting communication strategy and engagement approach.	PMBOK and PRINCE2
3.2	Type/Category	Broad categorisation (e.g., government, community, customer) helps in tailoring engagement strategies.	PM²
3.3	Influence on Risk	Identify if the stakeholder has a role in risk creation, escalation, or mitigation.	PMBOK
4	Influence and Interest Assessment		
4.1	Influence Level	Assess how much power the stakeholder has to impact the project's course (high, medium, low), helping prioritize stakeholder management efforts.	PMBOK
4.2	Interest Level	Evaluate their level of interest in the project's outcomes (high, medium, low), indicating the degree of engagement required.	PM²
4.3	Risk Impact Assessment	Assess the potential impact of the stakeholder on project risks (either in increasing or mitigating risks).	PMBOK
5	Stakeholder Needs and Expectations		

ID	Field	Description	Input
5.1	Key Interests/Needs	Identify what the stakeholders hope to gain or what concerns they may have regarding the project.	PRINCE2
5.2	Potential Impact on Project	Assess how their interests or needs could affect the project, positively or negatively.	PMBOK and PRINCE2
5.3	Risk-Related Needs/Concerns	Identify any of the stakeholders' needs or concerns related to project risks.	PMBOK
5.4	Risk Mitigation Contribution	Evaluate how the stakeholder can contribute to risk mitigation efforts.	
6	Communication Preferences		
6.1	Preferred Communication Method	Note whether the stakeholder prefers emails, phone calls, in-person meetings, etc.	PM²
6.2	Frequency of Communication	Indicate preferred regularity of updates (daily, weekly, monthly).	PM²
6.2	Risk Communication Needs	Determine any specific needs or preferences the stakeholder has regarding communication about risks.	
7	Engagement Strategy		
7.1	Planned Engagement Approach	Outline specific actions for engaging this stakeholder, such as regular meetings, consultation in decision-making, or periodic reports.	PMBOK and PRINCE2
7.2	Responsibility	Assign a team member who is responsible for engaging with this stakeholder, ensuring clear accountability.	PMBOK
7.3	Risk-Related Engagement	Plan engagement strategies that consider the stakeholder's role in risk mitigation. This could involve regular risk review meetings or consultations on risk management strategies.	
8	Additional Notes		
8.1	Special Considerations	Any unique aspects about engaging with this stakeholder, like cultural considerations, time zone differences, language barriers, etc.	PRINCE2
8.2	Risk Notes	Any additional notes about the stakeholder's relation to project risks, such as previous experiences, expertise in risk management, etc.	
9	Review and Update		
9.1	Last Updated	The date when the stakeholder information was last updated.	
9.2	Risk Review	Include a note on whether stakeholder-related risks have been reviewed and updated.	
9.3	Next Review Date	The scheduled date for the following review of this stakeholder's information to ensure it remains current and relevant.	

This template integrates PMBOK's thorough approach to stakeholder analysis, PM²'s focus on effective communication and adaptability, and PRINCE2's emphasis on understanding stakeholders within the project environment and tailoring engagement strategies accordingly.

By incorporating stakeholder analysis and management in their project practices, project managers can proactively address stakeholder needs and expectations, mitigating potential risks and enhancing overall project performance.

Risk management considerations are integrated throughout, aligning with PMBOK's focus on risk assessment in stakeholder management, PRINCE2's emphasis on understanding stakeholder influence on risks, and PM²'s approach to adaptive communication and engagement strategies in response to risks.

It ensures a comprehensive understanding of each stakeholder's role, influence, interests, and communication needs, facilitating effective engagement throughout the project.

7.5.10 Stakeholder Matrix

The Stakeholder Matrix is a crucial component of stakeholder analysis and management. It enables project managers to identify and categorise stakeholders based on their interest and influence in the project. This matrix provides valuable insights into stakeholders' expectations, concerns, and potential impacts on the project's success.

Definition and Purpose

The Stakeholder Matrix is typically represented as a two-dimensional chart, with one axis indicating stakeholders' level of interest in the project and the other axis representing their level of influence. Project managers can visually determine their categorisation by plotting stakeholders on the matrix and prioritize engagement efforts accordingly.

PMBOK's Stakeholder Matrix (Project Management Institute, 2017) is closely tied to the Stakeholder Management knowledge area. The PMBOK Guide emphasises the importance of proactively identifying and managing stakeholders to ensure project success. Critical aspects of the Stakeholder Matrix in PMBOK include:

- Stakeholder Identification: identify all project stakeholders and understand their roles, interests, and expectations regarding the project;
- Categorisation Criteria: define the criteria for categorising stakeholders based on their level of interest and influence. For example, stakeholders with high interest and influence are considered vital;

- Engagement Strategies: develop tailored strategies for engaging stakeholders based on their categorisation. This includes defining the frequency and channels of communication with different stakeholder groups.

In PRINCE2 (Axelos, 2017), the Stakeholder Matrix aligns with the Business Case theme. PRINCE2 points out the importance of understanding stakeholder interests and obtaining support for project success.

Critical aspects of the Stakeholder Matrix in PRINCE2 include:

- Stakeholder Mapping: techniques for mapping stakeholders based on their interests, influence, and relationship with the project;
- Engagement Strategies: developing plans for engaging stakeholders in decision-making, reviewing project progress, and obtaining necessary approvals.

In the PM² methodology (European Commission, 2018), stakeholder management is integral to the Governance domain, specifically under the People aspect. The PM² methodology accentuates the need for effective stakeholder engagement and communication.

Key aspects of the Stakeholder Matrix in PM² include:

- Stakeholder Identification and Analysis: techniques for identifying stakeholders and understanding their interests, concerns, and potential impact on the project;
- Engagement Strategies: develop plans for engaging stakeholders in project activities, seeking their involvement and support;
- Communication and Collaboration: ensuring effective communication with stakeholders to build trust and transparency.

The Stakeholder Matrix offers several benefits to project managers and project teams:

- Clear Visualization: the matrix provides a clear and concise visualization of stakeholders' level of interest and influence, making it easier to identify key stakeholders and their potential impact on the project;
- Prioritisation of Engagement: by categorising stakeholders, project managers can prioritize their engagement efforts and focus on key stakeholders who significantly influence the project;

- Effective Communication Strategies: the matrix helps tailor communication strategies based on stakeholders' needs and preferences, ensuring relevant information reaches the right stakeholders;
- Risk Identification and Mitigation: the matrix helps identify potential risks associated with stakeholders and their engagement. This allows project managers to proactively develop risk mitigation plans and address possible issues.

The Stakeholder Matrix, drawing insights from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), is a valuable tool in project management that gives project managers a comprehensive view of stakeholders and their significance to the project.

Using the Stakeholder Matrix, project managers can proactively engage with stakeholders, manage their expectations, and create the necessary conditions for the emergence of positive relationships that helps enhance project success. It is a strategic tool for practical stakeholder analysis and management, enabling project teams to manage stakeholder complexities and achieve project objectives more efficiently.

While the Stakeholder Matrix is valuable, its effectiveness relies on accurate stakeholder identification and analysis. Project managers should regularly review and update the matrix as the project progresses, and stakeholders' interests and influence may change over time.

Template

The Stakeholder Matrix is a fundamental component of stakeholder analysis and management, serving as a strategic guide for project managers to understand the significance of different stakeholders and tailor engagement strategies accordingly.

By integrating principles from PMBOK, PRINCE2, and PM², this template enables project managers to make informed decisions and address stakeholder expectations (Table 71).

Table 71 – Stakeholder Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the purpose of the stakeholder matrix, focusing on its role in managing stakeholders.	
1.3	Scope	Outline the matrix applicability in different stages of the project.	

ID	Field	Description	Input
2	Matrix Setup		
2.1	Axes Definition	• Horizontal Axis: Level of Influence (Low to High) (Reflects PMBOK's emphasis on assessing the power of stakeholders to affect project outcomes). • Vertical Axis: Level of Interest (Low to High) (aligns with PRINCE2's principle of tailoring communications to stakeholder needs and interests).	PMBOK and PRINCE2
2.2	Quadrants	• High Influence, High Interest: Key Players (critical focus group, requires close engagement). • High Influence, Low Interest: Keep Satisfied (necessary for project success but less hands-on). • Low Influence, High Interest: Keep Informed (interested but with limited power to influence). • Low Influence, Low Interest: Monitor (minimal effort for engagement).	PMBOK and PRINCE2
3	Stakeholder Categorisation		
3.1	Plotting Stakeholders	Assign each stakeholder to a quadrant based on their influence and interest (considering PM²'s focus on stakeholder alignment and communication).	PM²
3.2	Risk Mitigation Considerations		
3.3	Risk Relevance Indicator	Indicate stakeholders' roles in risk aspects (aligning with PMBOK's risk management process).	PMBOK
3.4	Risk Influence	Note the potential impact of stakeholders on project risks (incorporating PRINCE2's emphasis on managing project risks).	PRINCE2
4	Engagement Strategies		
4.1	Key Players	In-depth engagement, frequent communication, and decision involvement.	PMBOK and PRINCE2
4.2	Keep Satisfied	Adequate information flow to ensure satisfaction without over-engagement.	PMBOK and PRINCE2
4.3	Keep Informed	Regular updates to maintain interest and support.	PMBOK and PRINCE2
4.4	Monitor	Minimal engagement, watch for changes in their position.	PMBOK and PRINCE2
5	Additional Considerations		
5.1	Stakeholder Dynamics	Address the dynamics among stakeholders (reflecting PM²'s focus on effective governance).	PM²
5.2	Cultural and Ethical Considerations	Recognise cultural or ethical factors (in line with PRINCE2's principle of tailoring to the project environment).	PRINCE2
6	Review and Update Schedule		
6.1	Regular Reviews	Establish a schedule for regularly reviewing and updating the matrix (as per PRINCE2's and PMBOK's guidance on adaptability and responsiveness to change).	PMBOK and PRINCE2

The Stakeholder Matrix, supported by PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) insights, is a valuable tool for project managers to manage stakeholders effectively.

By visually representing stakeholders and their categorisation, project teams can prioritize engagement efforts and develop communication strategies that address stakeholders' needs and expectations.

This Stakeholder Matrix Template is structured to align with the strengths of each framework: PMBOK's detailed approach to stakeholder analysis and risk management, PRINCE2's focus on stakeholder satisfaction and adaptability, and PM²'s emphasis on communication and governance.

While the Stakeholder Matrix is valuable, its effectiveness relies on accurate stakeholder identification, analysis and continuous review and update of the matrix as the project progresses, and stakeholders' interests and influence may change over time.

7.5.11 Change Management

Change management is essential to project management. It focuses on successfully implementing changes within an organisation or a project and involves a structured approach to transitioning individuals, teams, and the organisation from the current state to the desired future.

By integrating principles from PMBOK, PRINCE2, and PM², change management emphasizes the importance of understanding changes' impacts.

Definition and Purpose

In PMBOK (Project Management Institute, 2017), change management is closely related to the area of Integration Management knowledge. The PMBOK Guide acknowledges the significance of change control and configuration management, both essential components of change management. Key aspects of change management in PMBOK include:

- Change Control: the process of reviewing, approving, and managing changes to project baselines, ensuring that only authorized and beneficial changes are implemented;
- Configuration Management: maintaining a comprehensive record of project baselines and their changes provides a basis for auditing and controlling configuration items;

- Change Request Process: the structured approach for submitting, reviewing, approving, and documenting changes. This process involves evaluating change impacts on scope, schedule, cost, quality, and other project constraints;
- Change Impact Analysis: The assessment of potential effects of changes on project deliverables, stakeholders, and other project components.

In PRINCE2 (Axelos, 2017), change management is a critical aspect of the Progress theme. PRINCE2 highlights the importance of controlling changes while ensuring the project remains aligned with its objectives. Key aspects of change management in PRINCE2 include:

- Change Authority: designating individuals or groups responsible for authorising and managing changes to the project. This helps maintain control and avoid unauthorized changes;
- Change Budget and Tolerance: defining tolerances for changes, including cost and time, to ensure that changes remain within acceptable limits;
- Change Control Approach: defining the approach to handle changes, including the criteria for assessing their impact and the process for approving or rejecting them;
- Configuration Management Strategy: outlines how the project's products and configurations will be identified, controlled, and maintained throughout the project lifecycle.

In the PM² methodology (European Commission, 2018), change management is essential to the Governance domain, specifically under the People aspect. The PM² methodology highlights effective change management to ensure project success. Key elements of change management in PM² include:

- Change Readiness Assessment: evaluating the organisation's readiness for change and identifying potential barriers to successful implementation;
- Change Communication: develop a communication plan to ensure stakeholders are informed about the reasons for change, its implications, and its benefits;
- Change Impact Analysis: assessing the impact of changes on the project, resources, stakeholders, and the organisation as a whole;
- Change Implementation Plan: develop a detailed change implementation plan, including a timeline, responsibilities, and risk mitigation strategies.

Change management is a critical discipline in project management, ensuring that changes are managed effectively and their impact on the project and the organisation is carefully evaluated.

Embracing change and adopting a structured change management approach enhances project success, improves stakeholder satisfaction, and enables organisations to adapt to dynamic environments.

By integrating change management principles from PMBOK, PRINCE2, and PM² frameworks, project managers can proactively address change-related challenges.

Template

Using a Change Management template is a fundamental resource for project managers and organisations to handle the complexities of change. Adapting and managing change is critical to achieving project success in today's fast-paced and ever-changing business environment.

This template draws insights from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), emphasising the importance of understanding the impact of changes, involving stakeholders, and favouring a culture that embraces change.

By implementing the Change Management template, project managers can effectively respond to evolving requirements, optimise project outcomes, and ensure smooth transitions (Table 72).

Table 72 – Change Management Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the purpose of the change management template, focusing on its role in managing stakeholders.	
1.3	Scope	Outline the template applicability in different stages of the project.	
2	Change Request Information		
2.1	Change Request ID	Captures basic information about the change request, a common practice in all methodologies	
2.2	Date of Request	Captures basic information about the change request, a common practice in all methodologies	
2.3	Requested By	Captures basic information about the change request, a common practice in all methodologies	
3	Description of the Change		
3.1	Detailed Description:	Clearly describe what the change entails.	
3.2	Reason for Change	Explain why this change is necessary, including its alignment with project objectives.	PMBOK and PRINCE2

ID	Field	Description	Input
4	Impact Analysis		
4.1	Scope Impact	Assess how the change will impact the project scope.	PMBOK
4.2	Time Impact	Evaluate the change's impact on the project timeline.	
4.3	Cost Impact	Determine the financial implications of the change.	
4.4	Quality Impact	Consider how the change will affect the project's quality.	
4.5	Risk Impact	Analyse the change's impact on existing risks or identify new risks.	PMBOK and PRINCE2
4.6	Resource Impact	Assess the impact on resources, including personnel, equipment, etc.	
5	Stakeholder Impact and Communication		
5.1	Affected Stakeholders	Identification of stakeholders affected by the change.	PMBOK and PRINCE2
5.2	Communication Needs	Outline the communication plan for informing stakeholders about the change.	PM²
6	Approval and Decision Making		
6.1	Recommendation	Provide a recommendation based on the impact analysis.	
6.2	Approval Authority	Identify who has the authority to approve the change.	PMBOK
6.3	Decision	Document the decision made on the change request.	PRINCE2
7	Implementation Plan		
7.1	Implementation Steps	Outline the steps required to implement the change.	
7.2	Timeline for Implementation	Provide a timeline for the implementation of the change.	
7.3	Responsible Parties	Assign individuals accountable for implementing the change.	
8	Monitoring and Review		
8.1	Monitoring Plan	Describe how the implementation of the change will be monitored and controlled.	PMBOK
8.2	Review Schedule	Set times to review the impact of the change post-implementation.	PRINCE2
9	Documentation and Record Keeping		
9.1	Change Log Entry	Update the change log with all relevant information about the change request and its status.	PMBOK and PRINCE2
9-2	Documentation Updates	List any project documents that need updating due to the change.	
10	Closure of Change Request		
10.1	Final Status	Document the final status of the change request (approved, implemented, rejected, deferred).	
10.2	Closure Date	Note the date when the change request was officially closed.	
11	Lessons Learned		
11.1	Insights Gained	Record any lessons learned or insights gained from this change request process.	PM² and PRINCE2

This Change Management Template combines PMBOK's thorough approach to documenting and analysing changes, PRINCE2's focus on the impact on project objectives and its structured decision-making process, and PM²'s emphasis on communication and learning.

The Change Management Template ensures a comprehensive and structured process for managing changes, from initial request to final closure, aligning with best practices for effective project change management.

7.5.12 Stakeholder Evaluation

Stakeholder evaluation in a social perspective involves assessing the social impact of a project on various stakeholders, communities, and society as a whole.

This evaluation considers not only the direct participants in the project but also those indirectly affected by its activities.

It addresses environmental sustainability, social responsibility, and ethical considerations, ensuring the project contributes positively to society.

Definition and Purpose

In PMBOK (Project Management Institute, 2017), stakeholder evaluation from a social perspective aligns with the Stakeholder Management knowledge area.

The PMBOK Guide acknowledges the importance of considering stakeholders' social and ethical concerns throughout the project lifecycle.

Key aspects of stakeholder evaluation from a social perspective from PMBOK include:

- Stakeholder Engagement Strategies: Develop strategies to engage with stakeholders meaningfully and inclusively, considering their social concerns and contributions.
- Sustainability Considerations: Addressing environmental and social sustainability concerns by implementing practices that minimize negative impacts and promote responsible resource management.
- Ethical Practices: Ensuring that project activities and decisions adhere to ethical principles and respect the rights and well-being of stakeholders and communities.

- Social Impact Assessment: Evaluating the potential social consequences of the project and identifying measures to enhance positive social outcomes.

In PRINCE2 (Axelos, 2017), stakeholder evaluation from a social perspective is integrated into the Business Case theme. PRINCE2 dramatises the significance of considering social and ethical implications for project planning and decision-making. Key aspects of stakeholder evaluation from a social perspective from PRINCE2 include:

- Business Case Development: Including social and ethical considerations in the project's business case to ensure a holistic assessment of project benefits;
- Stakeholder Engagement Plan: Develop a plan to engage stakeholders and communities to understand their social concerns and incorporate their perspectives into project planning;
- Sustainability Impact Assessment: Assess the project's potential impacts on the environment and society and devise strategies for mitigating negative effects.

Stakeholder evaluation from a performance-wise perspective focuses on assessing stakeholders' contributions, satisfaction, and overall project performance. It involves measuring and analysing stakeholders' involvement and feedback to improve project processes, enhance stakeholder engagement, and achieve project objectives efficiently.

In PMBOK, stakeholder evaluation from a performance-wise perspective is interconnected with various knowledge areas, including Stakeholder Management, Project Integration Management, and Project Communication Management.

Key aspects of stakeholder evaluation from a performance-wise perspective from PMBOK (Project Management Institute, 2017), include:

- Stakeholder Performance Metrics: defining metrics to evaluate stakeholders' contributions, engagement level, and satisfaction with project outcomes;
- Communication Management Plan: developing a communication plan that promotes regular feedback from stakeholders and enables project teams to address concerns and optimise performance;
- Stakeholder Performance Review: conduct periodic reviews to assess stakeholders' contributions and identify opportunities for improvement in stakeholder engagement.

In PRINCE2 (Axelos, 2017), stakeholder evaluation from a performance-wise perspective aligns with the Progress theme and the Business Case theme. PRINCE2 affirms the importance of monitoring performance metrics and stakeholder feedback to ensure project success. Key aspects of stakeholder evaluation from a performance-wise perspective from PRINCE2 include:

- Project Controls: implementing project controls to monitor stakeholder performance and identify areas for enhancing stakeholder involvement and satisfaction;
- Project Assurance: engaging stakeholders in project assurance activities to gather valuable feedback on project progress and performance.

Incorporating social aspects involves addressing environmental sustainability, social responsibility, and ethical practices, while performance-wise evaluation focuses on measuring stakeholders' contributions, engagement levels, and satisfaction.

Integrating these aspects allows project managers to create a more comprehensive stakeholder evaluation, contributing to the project's long-term success, sustainability, and positive societal impact.

Template

The Stakeholder Evaluation template, from a social and performance perspective, is an essential instrument for project managers to assess stakeholders' influence, engagement, and satisfaction.

It incorporates two critical dimensions of evaluation: the social perspective, which involves considering the social impact, ethical considerations, and sustainability aspects of stakeholders, and the performance-wise perspective, which consists in measuring stakeholders' contributions, involvement, and satisfaction metrics.

By integrating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), this template (Table 73) offers project managers a comprehensive approach to understanding stakeholder dynamics, encouraging sustainable relationships, and maximising project outcomes.

Table 73 – Stakeholder Evaluation Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	

ID	Field	Description	Input
1.2	Purpose	Define the purpose of the stakeholder evaluation template, focusing on its role in managing stakeholders.	
1.3	Scope	Outline the template applicability in different stages of the project.	
2	Stakeholder Information		
2.1	Stakeholder Name	General stakeholder information as recommended by PMBOK, PRINCE2, and PM².	
2.2	Affiliation	General stakeholder information as recommended by PMBOK, PRINCE2, and PM².	
2.3	Role in Project	General stakeholder information as recommended by PMBOK, PRINCE2, and PM².	
2.4	Contact Information	General stakeholder information as recommended by PMBOK, PRINCE2, and PM².	
3	Stakeholder Influence and Interest		
3.1	Level of Influence	Assess the power of the stakeholder in the project context.	PMBOK
3.2	Level of Interest	Determine the stakeholder's degree of concern or investment in the project's outcomes.	PRINCE2 and PM²
4	Social Impact Assessment		
4.1	Social Influence	Evaluate the stakeholder's influence in social settings or communities (considering the broader social impact and alignment with PM²'s focus on the broader project environment.	PM²
4.2	Social Interest	Assess the stakeholder's interest or concern in social outcomes related to the project (considering the broader social impact and alignment with PM²'s focus on the broader project environment.	PM²
5	Engagement and Communication		
5.1	Preferred Communication Method	Tailor communication to stakeholder preferences.	PM²
5.2	Frequency of Communication	Determine the regularity of updates.	
6	Contribution to Project		
6.1	Skills/Resources Offered	List skills or resources the stakeholder contributes to the project.	PMBOK
6.2	Social Contribution	Identify contributions or roles the stakeholder plays in social aspects related to the project.	
7	Risk and Opportunity Assessment		
7.1	Associated Risks	Identify risks related to this stakeholder, including social risks.	PMBOK and PRINCE2
7.2	Opportunities	Highlight opportunities the stakeholder brings, focusing on social benefits or improvements.	
8	Social Responsibility and Ethics		
8.1	Ethical Considerations	Note any ethical considerations associated with the stakeholder.	PRINCE2
8.2	Corporate Social Responsibility (CSR) Alignment	Evaluate how the stakeholder's involvement aligns with CSR goals.	
9	Feedback and Concerns		
9.1	Feedback Received	Document feedback received from or about the stakeholder, especially regarding social aspects.	

ID	Field	Description	Input
9.2	Concerns Raised	Note any concerns raised by or about the stakeholder, focusing on social impact.	
10	Review and Update		
10.1	Last Reviewed	General information as recommended by PMBOK, PRINCE2, and PM².	PMBOK, PRINCE2, and PM².
10.2	Next Review Date	General information as recommended by PMBOK, PRINCE2, and PM².	PMBOK, PRINCE2, and PM²
11	Additional Notes		
11.1	Special Notes	Any other relevant information or notes about the stakeholder, particularly related to social impact or community involvement.	

This template suggestion goes deep down into the main frameworks such as:

- The Stakeholder Evaluation template aligns with the Stakeholder Management knowledge area in PMBOK. It emphasises the importance of assessing and engaging stakeholders' social concerns throughout the project lifecycle.
- In PRINCE2, the Stakeholder Evaluation template is integrated into the Business Case theme. PRINCE2 highlights the significance of considering social and ethical implications for project planning and decision-making.
- The PM² methodology deems stakeholder evaluation essential to the Governance domain, specifically the People aspect. The PM² methodology also emphasizes the need for effective stakeholder engagement and communication.

It ensures a comprehensive understanding of each stakeholder's influence, interests, and impact, extending past the project to encompass social considerations. This is particularly important in projects with significant social implications or those aiming to enhance social outcomes.

Project managers can better understand stakeholder dynamics and optimise engagement efforts by considering social aspects and performance metrics.

Drawing insights from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), this template enables project teams to create and maintain sustainable relationships with stakeholders, address social and ethical concerns.

7.5.13 Risk Management

Risk management is an essential process in project management, aiming to proactively address potential risks that may affect stakeholders' interests and objectives.

From a stakeholder perspective, this reiterates the importance of engaging stakeholders throughout the risk management process, considering their concerns, expectations, and requirements to optimise risk responses.

Definition and Purpose

By integrating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), risk management from a stakeholder's perspective ensures that projects effectively identify, assess, and manage risks, ultimately achieving stakeholder satisfaction and project success.

In PMBOK (Project Management Institute, 2017), risk management from a stakeholder's perspective aligns with the area of risk management knowledge. The PMBOK Guide recognises the significance of considering stakeholders' perspectives in risk management. Key aspects of risk management from a stakeholder's perspective in PMBOK include:

- Stakeholder Risk Identification: involving stakeholders in the identification of potential risks, leveraging their expertise and knowledge to identify risks that might not be evident to the project team;
- Stakeholder Risk Tolerance: understanding stakeholders' risk tolerance levels and aligning risk responses to ensure risks are managed within acceptable thresholds;
- Stakeholder Communication: maintaining open and transparent communication with stakeholders throughout the risk management process to keep them informed about identified risks, their impacts, and response plans;
- Stakeholder Risk Response Planning: considering stakeholders' concerns and expectations while developing risk response plans, ensuring that responses are aligned with stakeholders' interests.

In PRINCE2 (Axelos, 2017), risk management from a stakeholder perspective is integrated into the Risk theme. PRINCE2 highlights the need to involve stakeholders in risk management activities and considers their perspectives during risk assessments.

Critical aspects of risk management from a stakeholder perspective in PRINCE2 include:

- Stakeholder Risk Analysis: engaging stakeholders in risk analysis workshops or discussions to gain insights into potential risks and their impacts on the project;
- Stakeholder Risk Ownership: assigning risk ownership to relevant stakeholders, ensuring they take responsibility for managing specific risks;
- Stakeholder Risk Reporting: regularly update stakeholders about the status of risks, risk assessments, and risk response actions through clear and concise reporting.

In the PM² methodology, risk management from a stakeholder perspective is a critical aspect of the Governance domain, specifically under the "People" aspect. The PM² methodology recognises that stakeholder involvement is vital for effective risk management. Critical aspects of risk management from a stakeholder perspective in PM² include:

- Stakeholder Risk Perception: understanding how stakeholders perceive risks and their potential impact on the project to tailor risk responses accordingly;
- Stakeholder Risk Mitigation: engaging stakeholders in risk mitigation strategies to ensure that the responses align with their expectations and project objectives;
- Stakeholder Risk Review: involving stakeholders in periodic risk reviews to assess the effectiveness of risk responses and adjust strategies as needed.

Risk management from a stakeholder perspective is an integral part of project management, ensuring that stakeholders' concerns and expectations are considered throughout the risk management process.

By integrating principles from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), risk management from a stakeholder perspective optimises identifying, assessing, and responding to risks that may impact stakeholders' interests and objectives.

Template

From a stakeholder perspective, the risk management template is a critical resource for project managers to address potential risks that may affect stakeholders' interests and objectives.

This template ensures that risks are identified, analysed, and managed in accordance with stakeholders' expectations by considering their viewpoints and concerns.

Drawing insights from PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), this template (Table 74) offers project teams a structured approach to engaging stakeholders, optimising risk responses, and enhancing overall project success through effective risk management.

Table 74 – Risk Management Template Fields

ID	Field	Description	Input
1	Project Title		
1.1	Title	A brief, descriptive name for the project.	
1.2	Purpose	Define the purpose of the change management template, focusing on its role in managing stakeholders.	
1.3	Scope	Outline the template applicability in different stages of the project.	
2	Risk Identification		
2.1	Risk ID	ID of the identified risk.	PMBOK
2.2	Risk Description	Provide a detailed description of the risk.	PMBOK
2.3	Category	Classify the risk (e.g., operational, financial, social, environmental).	PMBOK
2.4	Date Identified	Date of the identified risk.	PMBOK
2.5	Identified By	Name of the stakeholder that has identified the risk.	PMBOK
3	Risk Analysis		
3.1	Probability of Occurrence	Assess the likelihood of the risk occurring.	PMBOK
3.2	Impact Level	Evaluate the potential impact on the project and broader social aspects.	PMBOK and PRINCE2
3.3	Urgency Level	Determine the urgency of addressing the risk.	
4	Stakeholder Impact		
4.1	Affected Stakeholders	Identify which stakeholders are impacted by this risk.	
4.2	Stakeholder Influence	Assess how stakeholders might influence the risk or its management.	PRINCE and PM²
5	Risk Response Planning		
5.1	Proposed Responses	Outline potential risk management strategies (mitigate, accept, transfer, avoid).	PMBOK and PRINCE2
5.2	Responsible Party	Assign a person or team responsible for managing the risk.	PMBOK and PRINCE2
6	Social and Ethical Considerations		
6.1	Social Impact	Assess the risk's impact on social aspects related to the project.	

ID	Field	Description	Input
6.2	Ethical Implications	Consider any ethical implications of the risk and its management.	PRINCE2
7	Monitoring and Control		
7.1	Monitoring Plan	Describe how the risk will be monitored throughout the project.	PMBOK
7.2	Control Measures	Identify measures to control or reduce the risk.	
7.3	Review Schedule	Set regular intervals for reviewing the risk status.	
8	Reporting		
8.1	Reporting Requirements	Define how and when the risk will be reported, especially critical for high-impact risks.	PM²
8.2	Documentation	Specify where the risk documentation will be stored and who has access.	
9	Risk Closure		
9.1	Closure Criteria	Define what constitutes the closure of this risk.	
9.2	Final Status	Document the final status of the risk (resolved, ongoing, escalated).	
10	Lessons Learned		
10.1	Insights Gained	Record any lessons from managing this risk, including social and ethical learnings.	PM² and PRINCE2
11	Review and Update		
11.1	Last Updated	Regular updates are essential (as per PMBOK and PRINCE2), to reflect changes in risk status and environment.	PMBOK and PRINCE2
11.2	Next Review Date	Regular updates are essential (as per PMBOK and PRINCE2), and reflect changes in risk status and environment.	PMBOK and PRINCE2

When creating a template for risk management with this kind of perspective, there are several aspects to consider, considering existing frameworks for project management. Here are some key considerations:

- The Risk Management in a Stakeholders Perspective template aligns with the Risk Management knowledge area in PMBOK (Project Management Institute, 2017). It indicates the importance of engaging stakeholders throughout the risk management process.
- PRINCE2 (Axelos, 2017) Integrates the Risk Management in a Stakeholders Perspective template into the Risk theme. PRINCE2 highlights the need to involve stakeholders in risk management activities and considers their perspectives during risk assessments.
- In the PM² (European Commission, 2018) methodology, risk management from a stakeholder perspective is a critical aspect of the Governance domain, specifically under the "People" aspect. The PM² methodology recognises that stakeholder involvement is vital for effective risk management.

The Risk Management in a Stakeholders Perspective template is a valuable resource for project managers to effectively manage risks that may impact stakeholders' interests and objectives.

This Risk Management Template combines the systematic and detailed approach of PMBOK, PRINCE2's emphasis on stakeholder influence and ethical considerations, and PM²'s focus on documentation and continual learning. It ensures a comprehensive view of risk management, encompassing project-specific risks and broader social and ethical aspects, which are vital for projects with significant societal impacts or considerations.

Engaging stakeholders throughout the risk management process ensures that their concerns and expectations are considered, contributing to the overall satisfaction of all project stakeholders.

7.6 Document Classification

Classifying documents based on access level is crucial to information management, especially in complex projects like those involved in smart city development. Stakeholder management in these contexts requires careful consideration of who can access information.

It is also important to note that all the documents have different classifications regarding access and whether they can be consulted or edited. We consider to be pertinent the following suggestions for access rules to them (Table 75), which can, and should be, tailored according to circumstances and stakeholders:

Table 75 – Type of Restrictions by Document

		Classification		
#	Document	Free	Restricted	Classified
1	Business Case	x		
2	Contract		x	
3	Project Charter	x		
4	Stakeholder Matrix		x	
5	Responsibilities and Substitution Matrix		x	
6	Team Charter		x	
7	Communication Plan	x		
8	Stakeholder Engagement Toolkit			x
9	Stakeholder Template		x	
10	Risk Management		x	
11	Team Toolkit		x	
12	Change Management			x
13	Stakeholder Evaluation			x

Classifying the documents listed as free access, restricted access, or classified depends on the sensitivity and confidentiality of the information contained in each document, as well as the organisation's policies and security requirements.

It should be noted that the classification presented before considered the following premises:

- Free Access does not mean the documents should be publicly accessible (e.g. on the internet). These documents should be readily available to various stakeholders within the organisation or consortium working on the project.
- Restricted Access means that access to the documents should be limited to those directly involved in the relevant aspects of the project (e.g. key stakeholders).
- Classified implies that the documents should be kept confidential and only accessible to a select group of individuals who clearly need to know the information contained within.

A general guideline for classifying these documents can be found in Table 76:

Table 76 – Documents Access Restrictions Definition

Classification	Description
Free Access	• Business Case: This document helps stakeholders understand the project's value and feasibility and is often used to gain support. While it contains crucial information, there is usually no harm in making it widely accessible. • Project Charter: This high-level document outlines the project's objectives, scope, and stakeholders. Making this document accessible helps in creating transparency and alignment among stakeholders. • Communication Plan: Describes the communication strategies for stakeholders and team members. Providing access to this document helps in setting clear expectations.
Restricted Access	• Stakeholder Matrix: Contains sensitive information about stakeholders' interests and influence, which might be misused if accessed by unauthorized persons. • Responsibilities and Substitution Matrix: Details critical roles and potential substitutions, which is sensitive operational information. • Team Charter: Outlines the internal working agreements of the project team, which might include sensitive information about team dynamics or individual responsibilities. • Stakeholder Template: Tracks stakeholder communication, status, and feedback, which might be sensitive and should be restricted to ensure privacy and integrity. • Team Toolkit: Assembles specific tools and resources for the project team. Access might need to be controlled to ensure that resources are used correctly. • Risk Management: Contains sensitive information about potential project risks, which could be exploited if accessed by unauthorized persons.
Classified	• Contract: Formal agreements with external stakeholders, including confidential financial or operational details. • Stakeholder Engagement Toolkit: This might include bespoke strategies for engaging specific stakeholders, potentially with sensitive or proprietary information. • Change Management: Procedures for handling changes to project scope, timeline, or resources, which might be sensitive and should be controlled to maintain project integrity. • Stakeholder Evaluation: Evaluate stakeholder engagement and the project's impact on stakeholders, potentially with sensitive feedback or critiques.

Adjustments to these classifications may be required depending on the specific context of the project, the stakeholders involved, and the potential sensitivity of the document information. The potential impact of information disclosure should always be considered when determining access levels.

The model associated with document classification has undergone some changes throughout the five actions. However, as mentioned repeatedly, each project may adopt a different approach to document access.

This characterisation in terms of access will make it possible to correctly disseminate knowledge to the respective stakeholders, individuals, groups, or organisations.

7.7 Project Framework Metro Line

Projects consist of distinct phases and various efforts specific to each phase, which, when viewed independently, appear unique. However, as the project progresses, certain aspects emerge that necessitate leveraging the flexibility inherent in various project management methodologies.

Recognizing this, the primary objective of the proposed framework is to ensure the capability to revisit and adapt all steps based on emerging needs, thereby providing solutions that allow for both forward and backward adjustments as required.

This mindset has enabled us to design a subway line map (Figure 60) that guides us to an unfamiliar city where the primary requirement for visitors is efficient transportation to reach their destination.

This graphical representation of a mature metro line model illustrates the route and respective stations, representing the documents of the selected project classification. These stations enable you to reverse travel directions or make transfers.

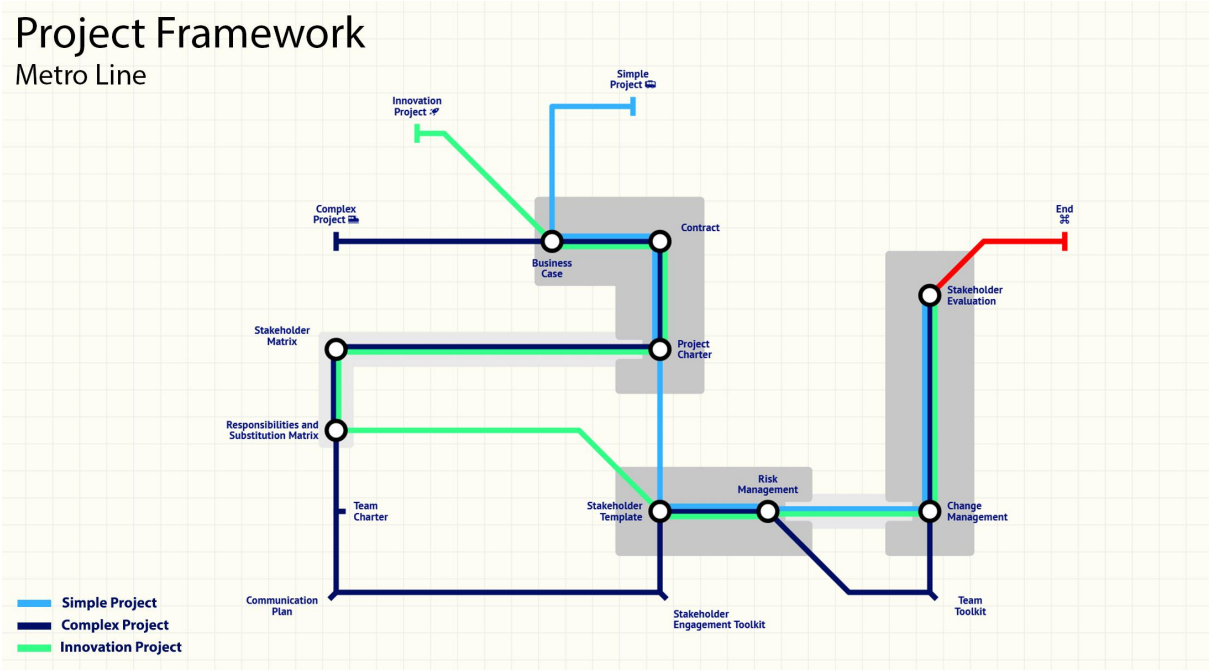


Figure 60 – Project Framework Metro Line

Stations shown in light grey are common to two types of projects, while those in dark grey are common to all project types. This colour scheme highlights how changes and transfers can be performed easily and conveniently. Using the analogy of metro line design, the proposed model is depicted in Figure 61.

The design implemented here, identical to a metro solution, highlights the various generic stations that only serve each of the lines, as in type of projets, or the stations where it is possible to transfer because they are common to two or three lines.

The respective shading (light grey and dark grey) is intended to accentuate the synergies between the combination of two types of projects and also in the combination of three types of projects.

For the effort related to Metro Line and its preliminary versions, we use the following coding to represent its evolution:

- Metro Line V1.x - simple projects;
- Metro Line V2.x – same model used in V1.1 with the inclusion of innovation projects;
- Metro Line V3.x - same model used in V2.0 with the inclusion of complex projects.

Once again, we emphasize that the main goal was to create a logical model, and we believe we can get closer to that goal by using everyday tools, that everyone may be familiar with.

7.8 Astrolabe4SM

The codename Astrolabe4SM serves as a metaphorical bridge between the historical significance of the astrolabe in the age of exploration and the modern-day intricacies of stakeholder management in innovation projects, particularly within the dynamic and evolving context of Smart Cities.

Just as the astrolabe was an essential navigational tool for Portuguese explorers in the 15th and 16th centuries, guiding them through uncharted waters and enabling the discovery of new lands, this framework aims to guide project managers through the complex landscape of stakeholder interactions, ensuring successful outcomes in innovative urban projects.

In the realm of Smart Cities and innovation projects, stakeholder management is akin to navigating uncharted waters. Projects aimed at enhancing urban environments through technological advancements involve diverse stakeholders, each with their own interests, expectations, and influence.

The Astrolabe4SM framework draws inspiration from the historical use of the astrolabe, emphasizing precision, adaptability, and strategic guidance. As Portuguese navigators relied on the astrolabe to chart their course and mitigate risks, modern project managers must employ sophisticated stakeholder management strategies to steer their projects towards success.

Having delineated the diverse processes and initiatives that constitute this framework, including the processes for classifying projects, identifying and defining stakeholders, and detailed characterising relevant documentation, as discussed throughout this chapter, it is now imperative to introduce a unifying element.

This element aims to integrate all the various components, thereby enabling a cohesive and comprehensive approach.

Therefore, by synthesizing all the inputs consistently recognized across various project management models, a block diagram that illustrates the integration of the different elements can be constructed.

This diagram, as shown in Figure 61, represents the formation of what we designate as Astrolabe4SM.

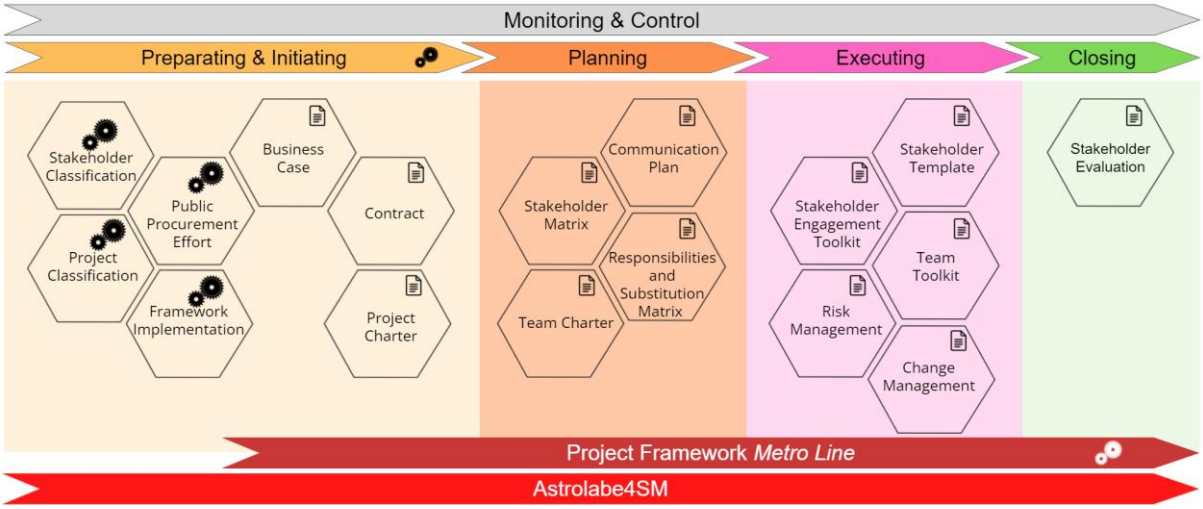


Figure 61 – Astrolabe4SM
Stakeholder Management Framework for Project Management Practices

This illustrates the relationship of Astrolabe4SM in multiple facets, including project type identification using public procurement, deploying various processes for stakeholder classification, and utilising distinct templates tailored to each project phase. A particular emphasis is placed on monitoring and control throughout the project's lifecycle.

The Appendix section of this document contains extra detail from the Astrolabe4SM—Stakeholder Management Framework for Project Management Practices and all the versions that preceded the final version.

The framework Astrolabe4SM emphasises the importance of early and continuous stakeholder engagement, advocating for a proactive approach to identifying, understanding, and addressing stakeholder needs and concerns.

7.9 Conclusions

Our proposed framework is grounded in an exhaustive analysis of existing literature and best practices, enriched by insights from real-world smart city projects.

It is structured to guide practitioners through the various phases of a project, from initiation and planning to execution, monitoring, and closure, diligently considering stakeholder perspectives at every step.

Chapter 8 begins by exploring solutions that make it possible to define and classify the type of project at hand, thus enhancing the categorisation of that project and the application of the resulting process, representing the main objective of this PhD effort.

This is followed by identifying and defining various stakeholders that we believe are relevant to innovative projects related to Smart Cities, clearly defining what constitutes a stakeholder in smart city projects, how to identify them, and elucidating the roles and responsibilities different stakeholders may assume.

Following this, we enter the stakeholder classification, highlighting this categorisation by their interest, influence, and impact on the project, where a model is suggested.

During the next phases, we introduce several templates to offer some scrutiny and methods for managing all the stakeholders, granting some valuable tools to introduce to any method used for managing the project.

The size of this framework and its surroundings means that there is an intense and almost redundant use of countless data to be transcribed into various documents. For this reason, we made a map of all the fields (Figure 62) present in the multiple documents and where they fit into others, thus enabling the application of copy automation (extra detail can be seen in the Appendix section of this document):

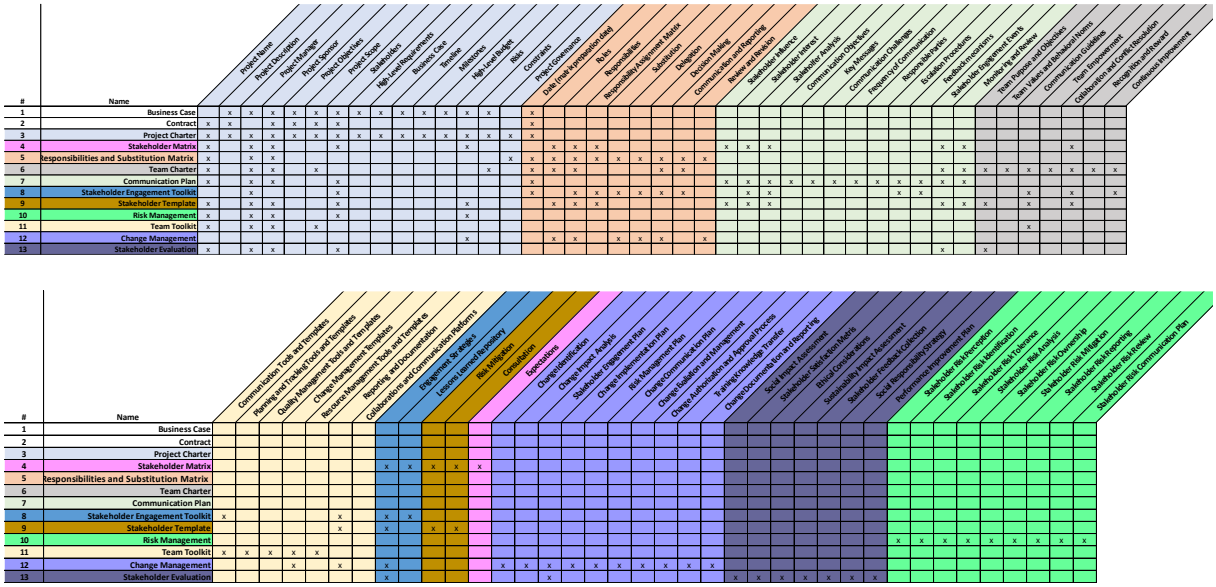


Figure 62 – Framework Documents and Fields Mapping

In proposing the Astrolabe4SM framework, we recognise that managing stakeholder perspectives is not linear or one-size-fits-all. Smart city projects are characterised by their dynamism and complexity, requiring a flexible and adaptive approach to stakeholder management. The Astrolabe4SM framework is thus designed to be customisable, allowing practitioners to tailor it to their projects' specific context, scale, and nature.

By placing stakeholder perspectives at the heart of project management, this chapter contributes to a growing body of knowledge and practice in smart city development. It acknowledges the critical role that stakeholders play in determining a project's success or failure and provides a robust and practical framework to navigate the complexities of stakeholder interests and expectations.

It seeks to promote a more inclusive, transparent, and effective method for managing smart city projects, ultimately aiding in achieving smart, sustainable, and resilient urban futures.

The relationship between this framework and the respective project classification is based on customising the former for each type of project, e.g., simple, complex, or innovation projects.

With all the effort described throughout this document, representing the attempt to pour about five years of effort into an 8-chapter document, it is now only necessary to create a logo that helps materialize the framework as any other methodology would try to do.

The logo, shown in Figure 63, encapsulates the essence of the innovative framework. The design features interconnected circles representing the various stakeholders involved in smart city projects, emphasising the collaborative nature of innovation and the ideas generated from it.

Including digital and urban elements within the baseline reflects our approach of integrating advanced technology with urban environments.



Figure 63 – Framework logo
(AI-assisted and adapted)

The logo stands for Unity and Innovation — values at the heart of the developed framework. These principles guide our methodologies and objectives, ensuring every stakeholder's voice is heard, and each innovation is impactful and sustainable.

This image, Figure 63, represents the interaction between man and machine, representing the insights from an organic computer (brain) and its machine counterpart.

This systemic approach, established from the inception of this doctoral project, has facilitated the seamless integration of all developed components, ensuring their compatibility as if by default. This alignment guarantees that the framework meets the maturity levels necessary to meet the expectations set forth with this doctorate's primary and secondary objectives.

PART IV – Epilogue

"I am glad that you are here with me," said Frodo. "Here at the end of all things, Sam."

- Frodo Baggins, The Lord of the Rings: The Return of the King, J.R.R. Tolkien

8. Conclusions

This chapter encapsulates the culmination of extensive research efforts undertaken throughout this doctoral project. It serves as a reflective overview of the key findings, lessons, and future directions the work suggests.

By reflecting on various components, this chapter aims to provide a comprehensive closing to the PhD effort, offering valuable perspectives for future research and practice in the field.

8.1 Introduction

The rapid evolution of Smart Cities demands innovative approaches in project management that go beyond the bounds of traditional methodologies and ways of managing or even thinking. This thesis builds upon the established frameworks of PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018) — each recognised for its rigorous standards and widespread applicability in various project environments.

This research aimed to extend these methodologies to develop a specialized framework that enhances project management practices, particularly stakeholder management for smart city innovation projects.

Another informal objective was to design a solution that responds to the first objective without making it too overwhelming or complex, making it possible for anyone with some knowledge of project management to set off on a trip that leads to success.

In a world where agile and lean methodologies are increasingly gaining ground, it would be counterproductive to create a process just for the sake of creating and responding to the objectives that are typically part of a research process, so the effort made here was not just to obtain a final validation in the doctoral degree and then see it placed on a shelf, but to create value in one of the most interesting topics at the moment, which is project management, whether in an industrial or urban environment.

8.2 Lessons Learned

Smart Cities integrate various stakeholders, including government entities, private companies, and the public, whose interests and influences are complex and intertwined. While providing a robust structure, traditional project management methods often require adaptations to address the unique challenges presented by these diverse stakeholder groups in the context of innovative urban development.

By systematically analysing the principles and processes outlined in PMBOK (Project Management Institute, 2017), PRINCE2 (Axelos, 2017), and PM² (European Commission, 2018), this study identifies the potential for tailoring these standards when applied to smart city projects and proposes necessary extensions.

The choice of research methodology fell on Action Research, allowing us to collect the necessary inputs in the five actions representing real-world scenarios to validate the proposed effort.

The resulting framework incorporates various processes accompanying the project in all its phases, from initiation to closure, tailored to meet the dynamic needs of smart city projects. It bridges the gap between traditional project management practices, and the demands of innovation in urban settings, and ensures that all stakeholder voices are heard and integrated into the project lifecycle.

The initial perspective on this effort was to carry out extensive research to choose a project management methodology and then adapt that methodology and fill in the logical gaps concerning stakeholder management. However, we quickly realised that the main methodologies, or those that we ended up approaching, would have some particularities, which, if not a *feature*, would create limitations, for instance, its flexibility and adaptability:

- PMBOK (Project Management Institute, 2021) is often viewed as a more rigid framework that provides a wide array of tools and techniques but may not specify how to adapt these in rapidly changing or highly innovative project environments like those found in Smart Cities;
- PRINCE2 (Axelos, 2017) is highly structured and process-oriented, which can be a limitation in projects that require quick adaptation to changing technologies and stakeholder needs;
- PM² (European Commission, 2023) is designed to be flexible and easily integrate with other methodologies, yet it might lack the detailed guidance needed to manage highly complex and technologically driven projects.

Another subject that we found to be important when abandoning the possibility of using only one methodology was stakeholder engagement, especially considering that while all three methodologies recognise the importance of stakeholder management, the depth and flexibility of engagement strategies might be insufficient for smart city projects, where stakeholders can vary widely from public officials and local communities to technology providers and international investors. We consider that these projects require continuous engagement and negotiation that goes outside the standard practices guidelines.

We cannot close the door to one particular requirement on innovation projects, like innovation or creativity, and traditional project management methodologies like PMBOK (Project Management Institute, 2017) and PRINCE2 (Axelos, 2017) can sometimes emphasize process over product, potentially stifling innovation. They tend to prioritize control and documentation over experimentation and iterative development, which are crucial in innovation-driven projects. On the other hand, PM² (European Commission, 2018), while offering a more straightforward and adaptable framework, may not provide enough support for the iterative testing and development cycles typical in innovation projects.

We also believe that another factor that could be a limitation is risk management, particularly the socio-political risks that come with the large-scale implementation of new technologies in urban areas, such as privacy concerns and public acceptance.

Finally, cultural adaptability and scale, i.e. the scope considered here and the international context, for example, PMBOK (Project Management Institute, 2017) and PRINCE2 (Axelos, 2017), originating from the United States and the United Kingdom, respectively, might not always align well with the governance structures and cultural contexts of other countries adopting smart city projects, especially considering that one crucial part of this framework is the classification of the type of project that uses the European procurement laws. PM² (European Commission, 2018), being European-centric and a recent methodology, might also face limitations when applied outside its intended context without significant adjustments.

To overcome these so-called limitations, our research focused on developing extensions of these methodologies that incorporate greater flexibility, more robust and continuous stakeholder engagement mechanisms, and enhanced risk management for emerging technologies.

This thesis demonstrates the necessity of using our Astrolabe4SM framework in order to extend project management practices for innovation projects in Smart Cities, focusing on stakeholder management in many project management contexts. It helps bridge the project management governance with the human

part of it, by implementing a new perspective in terms of stakeholder management, specific processes that help and support project managers and the project team, who are often baffled by real-world concerns related to project management and the volatile environment that Smart Cities efforts offer typically.

8.3 Comments on the Actions

The Action Research methodology proved to be highly pertinent to the topics covered and the objectives to which we were committed, enhancing the use of actions and their stopping conditions for the conclusions necessary for the evolution of the proposed framework.

Table 77 shows the results of all the evaluations carried out on the enablers of all the actions. Considering that the maximum evaluation would be 28 points (7 attributes * 4 maximum points per attribute), the action with the best evaluation was the final one, BRT @ Braga Project, with a progressive evaluation from the first action to the last, considering that it was intended that the actions should have an increase in maturity, this result was a behaviour that helped achieve the final validation of the Astrolabe4SM framework proposed here.

Table 77 – Scores for the Enablers of all Actions

Elements	Attributes to Score	Business Case Project	GDPR Project	Traffic Flow Prediction Project	BUILD Project	BRT Project
Approach	Sound	1	3	4	4	4
	Integrated	2	3	3	3	4
Deployment	Implemented	1	3	4	3	4
	Systematic	1	3	4	4	4
Assessment and Review	Measurement	1	3	3	3	4
	Learning	2	4	3	4	4
	Improvement	2	3	3	3	4
Total		**10**	**22**	**24**	**24**	**28**

Figure 64 shows a graphical representation of the enablers of all the actions, the progressive evolution of all five actions, separated by complexity and taking place over a certain period of time within the doctoral effort, is more noticeable.

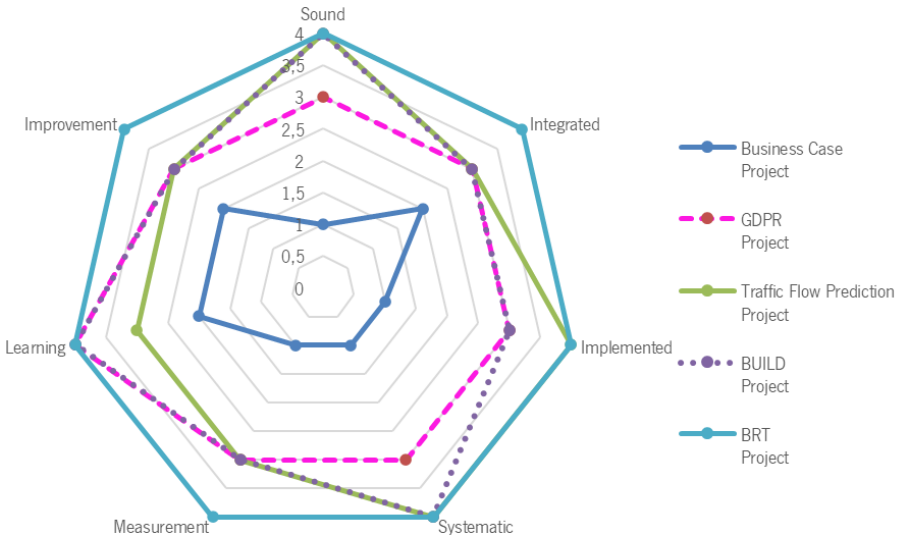


Figure 64 – Comparison of the Enablers of the Actions

Table 78 shows the results inherent in the actions, and it is important to note that the results are closely related to the requirements and objectives of each project.

The first two projects have greyed-out metrics because this matrix has grown over time, however, we chose to apply the final matrix to these projects even though they would not consider these metrics in terms of evaluation in its early stages.

Table 78 – Values for the Results of all Actions

#	Metric Scope	Dimension of Analysis	Metric Name	Business Case Project	GDPR Project	Traffic Flow Prediction Project	BUILD Project	BRT Project
C1	Complexity	Requirements	Requirements Complexity	3	4	4	4	4
C2		Cost	Total Predicted Investment	2	1	3	2	2
E1	Engagement	Quality	Governance	2	3	3	4	3
E2		Engagement	Communication	2	3	4	4	4
E3		Quality	Stakeholder Influence	3	4	2	3	4
E4		Requirements	Change Management	3	4	6	15	9
E5		Performance	Project Team Experience	2	3	5	7	10
M1	Monitoring	Quality	Changes to the Team Project	2	2	2	3	3
M2		Cost	Project Cost	100%	95%	100%	100%	100%
M3		Time	Time Deviation	166%	107%	115%	127%	100%
TP1	Team Perception	Requirements	Team Perception	-	complete	complete	satisfactory	complete

Team perception, being a qualitative assessment, received full ratings in all projects except the BUILD project, due to the numerous constraints and the change of project manager, which led to multiple changes in the project governance and also to short periods of time for new members who would later join the project.

The remaining points follow a metric formula that ends up being either an interval of values or an evaluation, and the results where directly related to how the projects were carried out and the circumstances identified.

8.4 Critical Analysis

In the pursuit of extending project management practices for innovation projects in Smart Cities, focusing on stakeholder management, this thesis has critically researched existing project management methodologies. Their applicability was considered in the context of smart city projects.

Throughout the five actions, we have always used the objectives of this doctoral project as a benchmark, more specifically, the primary and secondary research goals, and have thus carried out a comparison to help us determine the path to choose for the future, this analysis can be seen in Table 79.

Table 79 – Evaluation of Stopping Conditions for all Actions

#	Metric Name	Business Case Project	GDPR Project	Traffic Flow Prediction Project	BUILD Project	BRT Project
MG	Extending project management practices for innovation projects in smart cities, focusing on stakeholder management	not achieved	partially	achieved	achieved	achieved
SG1	Creation of a framework for the engagement of the stakeholders for innovation projects in smart cities	not achieved	partially	partially	achieved	achieved
SG2	Improvement of the identification process for implicit and explicit stakeholders in innovation projects in smart cities	not achieved	partially	partially	partially	achieved
SG3	Definition of new practices for managing explicit and implicit stakeholders in the framework for innovation projects in smart cities	partially	achieved	partially	achieved	achieved
SG4	Definition of guidelines to incorporate the smart city strategy in the project scope for innovation projects in smart cities	not achieved	not achieved	achieved	achieved	partially

The main goal (MG) was achieved in the last three actions, however, a satisfactory result was considered for these actions regarding the different stages that were faced in terms of maturity and demand. The last action was the final validation, where the rigorous principles were applied, and total success was achieved.

The secondary goal SG1 and the secondary goal SG2 were not achieved in the first project as expected, but they were partially met in the second and third projects. This is mainly due to the low level of maturity, or absence of it, on the two processes that were developed and implemented after the second project and during the third. We consider to achieve meeting the secondary goal SG2 on the fourth action,

although partially meeting the secondary goal SG3 because we still thought that this would require a final validation.

The third secondary goal, SG3, was partially met on the first action considering that this was the initial spark and from that resulted the first concepts. With the advancement for the second simple project, which is also the second action, we consider this secondary goal SG3 achieved. The third action offers an innovation project and we had to implement a different solution in terms of practices and therefore we consider having partially met this objective. The fourth and fifth action were the main enablers and validators, therefore the final evaluation of achieved.

The Smart Cities theme requires aggregated and integrated thinking, representing the fourth secondary objective, SG4, which would not have been implemented in the first and second actions. In the third and fourth actions, however, we believe that this would have been validated and therefore achieved, both because of the integrated thinking of the solutions and because of the commitment obtained through the contract between all the stakeholders. The last action has a rating of partially achieved because of the time it took and stopped. We believe that if it had taken place for another six months, we would have positively validated this final secondary objective in the last action.

Table 80 compares the planned and actual efforts, comparing what could have been expected with what happened. Here we have an increase of around 12 real months, an academic year caused by the part-time concept associated with this doctoral project, considering the researcher's full-time work, and the pandemic period, which made it very difficult to correlate the actions and the respective planned times.

Another circumstance was more personal, such as the researcher's two serious accidents, operations and, respective hospitalizations and recovery, as well as the birth of the researcher’s daughter in 2021.

Table 80 – Execution of the phases of the PhD

#	Name	Planned Start	Real Start	Planned End	Real End	Description
1	Preparation	March 2018	March 2018	April 2019	April 2019	Theoretichal research, drawing state-of-the-art and classes on the first year
2	Thesis Proposal	April 2019	April 2019	January 2021	December 2021	Define the contribute, the research questions and the main goal
3	Execution of Actions	June 2018	October 2018	December 2020	December 2023	Implement and analyse the Actions
4	Conclusions and Text Revision	January 2021	september 2023	1st semester 2022	April 2024	Extract conclusions from the Actions and define proposals for improvements
5	Thesis presentation	1st semester 2022	1st semester of 2024	1st semester 2022	2nd semester of 2024	Public discussion of the thesis

The first phase complied with all the time assumptions, while the end of the second phase started the time default. Unfavourable circumstances began in 2019 and 2020, making guaranteeing compliance within the expected period challenging.

However, despite an almost dantesque analysis of the deadlines mentioned above, it was possible to make several parallel efforts and trim around six months off the total period, leaving just 12 months extra to all the effort documented here.

This concluding chapter synthesizes the comprehensive insights gained through rigorous research, offering a refined framework that enhances traditional project management practices with a strong emphasis on stakeholder management, and the mentioned validations on five actions, distinct in complexity and dimension.

In sum, this conclusion does not merely aim to recapitulate the research but to contextualize its importance in the ongoing evolution of the project management discipline, regarding the Smart Cities context, with a focus on stakeholder management, and the story that can be taken from these five years.

8.5 Future Work

The most important proposals for future work relate to the future of project management and all the spaces that all the methodologies left intentionally.

Project management in an urban environment or with an impact on citizens and users of the city can't just be about sending emails and attending meetings; it must involve and hold accountable everyone involved to create traceability in the responsible use of all the resources involved and in fulfilling the expectations created in society.

We believe there is enormous potential in the future projects of cities that want to be increasingly intelligent, becoming smarter cities, where all significant projects are structural, have a high impact, and are incredibly media-overlapping, using the framework proposed here and elevating it.

It is precisely because of the responsibilities and media coverage associated with this type of project that it is necessary to develop a solution that allows digitized management of the framework developed, with the interconnection of all the fields of each artefact developed here. The aim here would be to develop digital tools, which can be implemented according to the type of project and the involvement of all stakeholders whose scope justifies it, thus creating the desired traceability and involvement in order to safeguard all parties involved.

There are also countless opportunities brought about by the numerous national funding programs in each member state and internationally, which require adaptation of all efforts and new project classifications. This allows the researcher to work on solutions that could be made compatible with the numerous applications, from services to purchases, and with the European strategy aligned with these assumptions.

This is where there is a greater need for rigour in managing and monitoring costs, whether they come from different sources, such as functional or external costs, and how they can fall within the scope of each of the general or global objectives.

Another issue that could impact the Smart Cities concept is the portfolio management of all the projects in cities or regions, creating conditions for a uniform political vision, combining the vision and the political cycles and all the impacts brought by the same cycles.

Bibliography

Alanazi, M. H. (2021). Towards a further step in understanding business excellence models: a comparative approach. *Benchmarking*, *28*(8), 2465–2495. https://doi.org/10.1108/BIJ-08-2020-0407

Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J. R., Leung, S., Mellouli, S., Nam, T., Pardo, T. A., Scholl, H. J., & Walker, S. (2012). Building understanding of smart city initiatives. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *7443 LNCS*, 40–53. https://doi.org/10.1007/978-3-642-33489-4_4/COVER

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092

Algeo, C. (2012). Action research in project management: an examination of Australian project managers. *5th International Conference of Education, Research and Innovation, ICERI2012 Proceedings*, 5857–5867.

Almeida, A. (2017). *Introdução aos Métodos de Investigação*. http://pt.scribd.com/doc/40389834/Introducao-aos-Metodos-de-Investigacao

Alvarez, C. E. de, Bragança, L., Rodrigues, E. A. N., Lyra, A. P. R., & Ramos, L. L. A. (2018). *Congresso Internacional Sustentabilidade Urbana: 14ª Jornada Urbenere e 2ª Jornada Cires* (A. P. R. L. e L. L. A. R. Cristina Engel de Alvarez, Luís Bragança, Edna Aparecida Nico-Rodrigues, Ed.). Editores.

Angelidou, M. (2015). Smart cities: A conjuncture of four forces. *Cities*, *47*, 95–106. https://doi.org/10.1016/J.CITIES.2015.05.004

Ângelo, M., & Rodrigues, V. (2005). *A NOVA GESTÃO PÚBLICA NA GOVERNAÇÃO LOCAL*. http://repositorium.sdum.uminho.pt/bitstream/1822/4545/1/INA2005.pdf

APM. (2012). Association for Project Management Body of Knowledge. In *APM Body Of Knowledge: Vol. 6th Editio*. https://doi.org/10.1080/10894160.2010.508411

APOGEP. (2017). *National Competence Baseline - NCB 4.0*. ssociação Portuguesa de Gestão de Projetos.

Assembleia da República. (2018). PROPOSTA DE LEI N.º 120/XIII (3.ª). *Debate Parlamentar Da Assembleia Da República*, 30–48.

Association for Project Management. (2012). *APM body of knowledge.*

Avison, D. E., Lau, F., Myers, M. D., & Nielsen, P. A. (1999). Action research. *Communications of the ACM*, *42*(1), 94–97. https://doi.org/10.1145/291469.291479

Axelos. (2017). *Managing Successful Projects with PRINCE2 ®*. TSO (The Stationery Office).

AXELOS Limited. (2019). ITIL Foundation ITIL 4 Edition. In *AXELOS* (Vol. 4, Issue 3).

Baccarini, D. (1999). The Logical Framework Method for Defining Project Success. *Project Management Journal*, *Volume 30*(Issue 4), 25–32. https://doi.org/10.1086/250095

Bargal, D. (2006). Personal and intellectual influences leading to Lewin's paradigm of action research: Towards the 60th anniversary of Lewin's 'Action research and minority problems'(1946). *Action Research*, *4*(4), 367–388.

Baskerville, & L., R. (1999). Investigating information systems with action research. *Communications of the AIS*, *2*(3es), 4.

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., & Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics*, *214*, 481–518.

Bentley, C. (2010). *Prince2: a practical handbook*. Routledge.

Bentley, C. (2015). *The PRINCE2® Practitioner - From Practitioner to Professional*. *1*. http://www.mgmtplaza.com/elearn/files/The-PRINCE2-Training-Manual.pdf

Besner, C., & Hobbs, B. (2013). Contextualized project management practice: A cluster analysis of practices and best practices. *Project Management Journal*, *44*(1), 17–34. https://doi.org/10.1002/pmj.21291

Bibri, S. E., & Krogstie, J. (2021). *A novel model for data-driven smart sustainable cities of the future: A strategic roadmap to transformational change in the era of big data*.

Bourne, L. (2016). *Stakeholder relationship management: a maturity model for organisational implementation*. Routledge.

Bourne, L., & Walker, D. H. T. (2005). Visualising and mapping stakeholder influence. *Management Decision*, *43*(5), 649–660. https://doi.org/10.1108/00251740510597680

Bourne, L., & Walker, D. H. T. (2006). Visualizing Stakeholder Influence — Two Australian Examples. *Project Management Journal*. https://doi.org/10.1177/875697280603700102

Bower, J. L. (1977). Effective public management. *Harvard Business Review*, *55*(2), 131–140. http://resolver.ebscohost.com/openurl?url_ver=Z39.88-2004&url_ctx_fmt=info%3Aofi%2Ffmt%3Akev%3Amtx%3Actx&rft_val_fmt=info%3Aofi%2Ffmt%3Akev%3Amtx%3Ajournal&rft.atitle=EFFECTIVE+PUBLIC+MANAGEMENT&rft.aufirst=JL&rft.aulast=BOWER&rft.date=1977&rft.epage=140&

Bryman, A. (2012). Social Research Methods. In *Social Research* (Vol. 2nd). https://doi.org/10.4135/9781849209939

Bryson, J. M. (2004). What to do when Stakeholders matter. *Public Management Review*, *6*(1), 21–53. https://doi.org/10.1080/14719030410001675722

Caragliu, A., del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, *18*(2), 65–82. https://doi.org/10.1080/10630732.2011.601117

Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart Cities in Europe. *Journal of Urban Technology*, *18*(2), 65–82. https://doi.org/10.1080/10630732.2011.601117

Caragliu, A., Del Bo, C., & Nijkamp, P. (2013). Smart cities in Europe. In *Creating Smart-er Cities* (pp. 65–82). Routledge.

Carapeto, C., & Fonseca, F. (2014). *Administração Pública - Modernização, Qualidade e Inovação* (Lda. Edições Sílaboa, Ed.; Edições Si).

Chinyio, E., & Olomolaiye, P. (2009). *Construction stakeholder management*. John Wiley & Sons.

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo, T. A., Scholl, H. J., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo, T. A., & Scholl, H. J. (2012). Understanding Smart Cities: An Integrative Framework. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2289–2297. https://doi.org/10.1109/HICSS.2012.615

Chun, B., & Lee, S. (2015). Review on ITS in smart city. *Advanced Science and Technology Letters*, *98*, 52–54.

Clarkson, M. E. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. *Academy of Management Review*, *20*(1), 92–117.

Cláudia Margarida Ramos Teixeira. (2019). *As Parcerias para a Inovação*. Universidade de Lisboa.

Cleland, D. I., Ireland, L. R., & Ireland, L. (2000). *Project manager's portable handbook*. McGraw Hill New York.

Código dos Contratos Públicos (CCP). (2008). *Diário Da República n.º 20/2008, Série I*. https://dre.pt/dre/legislacao-consolidada/decreto-lei/2008-34455475

Cohen, B. (2015). The 3 generations of smart cities. *Inside the Development of the Technology Driven City.[2]*.

Cooke-Davies, T. (2002). The "'real'" success factors on projects. In *International Journal of Project Management* (Vol. 20). www.elsevier.com/locate/ijproman

Cooper, D. R., & Schindler, P. S. (2003). Business research methods. In *Business* (Issue 2000). http://130.209.236.149/headocs/31businessresearch.pdf

Crawford, L. (2007). Global Body of Project Management Knowledge and Standards. In *The Wiley Guide to Managing Projects* (pp. 1150–1196). https://doi.org/10.1002/9780470172391.ch46

CT 169 (IPQ). (2007). *NP 4457: Gestão da Investigação, Desenvolvimento e Inovação (IDI)*. http://www1.ipq.pt/PT/site/clientes/pages/documentViewer.aspx?ctx=&local=Internet&documentId=IPQINTER-380-110510&tipoSubscricao=1

Dai, C. X., & Wells, W. G. (2004). *An exploration of project management office features and their relationship to project performance*. https://doi.org/10.1016/j.ijproman.2004.04.001

Danny Burns. (2007). *Systemic action research: A strategy for whole system change* (1st edition). Policy Press.

David, F. R. (2011). *Strategic Management: concepts and cases*. http://irresearchers.ir/upload/docs/StrategicManagementDavid.pdf

Deming, W. E. (2000). Out of the Crisis. In *Journal of Intelligent Information Systems* (Vol. 1, Issue 2). http://www.amazon.com/Out-Crisis-W-Edwards-

Deming/dp/0262541157?SubscriptionId=0NM5T5X751JWT17C4GG2&tag=ws&linkCode=xm2&camp=2025&creative=165953&creativeASIN=0262541157

Dick, B. (2002). Postgraduate programs using action research. *The Learning Organization*.

Donaldson, T., & Preston, L. E. (1995). The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. *The Academy of Management Review*, *20*(1), 65. https://doi.org/10.2307/258887

Duarte, F. J. (2014). *Automated software systems generation for process-oriented organizations*.

EFQM. (2019). *Modelo EFQM* (EFQM, Ed.). EFQM.

Elias, A. A., Cavana, R. Y., & Jackson, L. S. (2002). Stakeholder analysis for R&D project management. *R and D Management*, *32*(4), 301–310. https://doi.org/10.1111/1467-9310.00262

Elkington, A. R. (1997). Cannibals with Forks: The Triple Bottom Line of 21st Century Business. *Eye*, *1*(5), 636–636. https://doi.org/10.1038/eye.1987.103

El-Sherif, D. M., & Khalil, E. E. (2022). Training smart city workforces with a wide range of electronic and digital technologies. *Smart Cities Policies and Financing: Approaches and Solutions*, 197–203. https://doi.org/10.1016/B978-0-12-819130-9.00042-5

ENGIMIND. (2023). *Braga BRT Insertion Study and Insertion Alternatives Evaluation Report* .

Eskerod, P., Huemann, M., & Ringhofer, C. (2015). Stakeholder Inclusiveness: Enriching Project Management with General Stakeholder Theory. *Project Management Journal*, *6*(1), 36–50. https://doi.org/10.1108/17538371311291017

European Commission. (2018). PM² Project management methodology – Guide 3.0. In D. European Commission (Ed.), *Complete Project Management Office Handbook, Second Edition*. Office of the European Union. https://doi.org/10.2799/755246

European Commission. (2019). *What is personal data? | European Commission*. https://ec.europa.eu/info/law/law-topic/data-protection/reform/what-personal-data_en

European Commission. (2023). *PM² Project management methodology – Guide 3.1*. Publications Office of the European Union. https://doi.org/doi/10.2799/970188

European Union. (2012). TRATADO SOBRE O FUNCIONAMENTO DA UNIÃO EUROPEIA (VERSÃO CONSOLIDADA). In *Jornal Oficial da União Europeia*.

European Union. (2024). *Contratos públicos | Fichas temáticas sobre a União Europeia | Parlamento Europeu*. https://www.europarl.europa.eu/factsheets/pt/sheet/34/contratos-publicos

Fernandes, G., Dooley, L., O'Sullivan, D., & Rolstadås, A. (2021). Managing Collaborative R&D Projects. *Contributions to Management Science*, 1–15. https://doi.org/10.1007/978-3-030-61605-2_1

Fernandes, G., & O'Sullivan, D. (2021). Benefits management in university-industry collaboration programs. *International Journal of Project Management*, *39*(1), 71–84. https://doi.org/10.1016/J.IJPROMAN.2020.10.002

Fernandes, G., Santos, J. M. R. C. A., Ribeiro, P., Ferreira, L. M. D. F., O'Sullivan, D., Barroso, D., & Pinto, E. B. (2023). Critical success factors of university-industry R&D collaborations. *Procedia Computer Science*, *219*, 1650–1659. https://doi.org/10.1016/J.PROCS.2023.01.458

Fernandes, G., Ward, S., & Araújo, M. (2013). *Identifying useful project management practices: A mixed methodology approach*. www.sciencesphere.org/ijispm

Fonseca, L. (2021). The EFQM 2020 model. A theoretical and critical review. *Https://Doi.Org/10.1080/14783363.2021.1915121*, *33*(9–10), 1011–1038. https://doi.org/10.1080/14783363.2021.1915121

Fonseca, L., Amaral, A., & Oliveira, J. (2021). Quality 4.0: The efqm 2020 model and industry 4.0 relationships and implications. *Sustainability (Switzerland)*, *13*(6). https://doi.org/10.3390/SU13063107

Freeman, R. E., & Mcvea, J. (2008). A Stakeholder Approach to Strategic Management. *The Blackwell Handbook of Strategic Management*, *January*, 183–201. https://doi.org/10.1111/b.9780631218616.2006.00007.x

Freeman, S., & Cavusgil, S. T. (1984). Strategic management. A stakeholder approach. *Journal of International Marketing*.

Friedman, A. L., & Miles, S. (2006). *Stakeholders: Theory and practice*. Oxford University Press on Demand.

Fusco, G., Colombaroni, C., & Isaenko, N. (2016). Short-term speed predictions exploiting big data on large urban road networks. *Transportation Research Part C: Emerging Technologies*, *73*, 183–201.

Gable, G. G. (1994). Integrating Case study and survey research methods: an example in information systems. *European Journal of Information Systems*, *3*(2), 112–126. https://doi.org/10.1057/ejis.1994.12

Garau, C., Masala, F., & Pinna, F. (2016). Cagliari and smart urban mobility: Analysis and comparison. *Cities*, *56*, 35–46.

Garber, J. (2018). GDPR – compliance nightmare or business opportunity? *Computer Fraud & Security*, *2018*(6), 14–15. https://doi.org/10.1016/S1361-3723(18)30055-1

Giffinger, R., Fertner, C., Kramar, H., & Meijers, E. (2007). City-ranking of European medium-sized cities. *Cent. Reg. Sci. Vienna UT*, *9*(1), 1–12.

Goddard, M. (2017). The EU General Data Protection Regulation (GDPR): European regulation that has a global impact. *International Journal of Market Research*, *59*(6). https://doi.org/10.2501/IJMR-2017-050

Gohari, S., Ahlers, D., Nielsen, B. F., & Junker, E. (2020). The Governance Approach of Smart City Initiatives. Evidence from Trondheim, Bergen, and Bodø. *Infrastructures 2020, Vol. 5, Page 31*, *5*(4), 31. https://doi.org/10.3390/INFRASTRUCTURES5040031

Gonçalo Guerra Tavares. (2022). *Comentário ao Código dos Contratos Públicos* (Almedina, Ed.; 2nd ed.). https://www.almedina.net/comentario-ao-codigo-dos-contratos-publicos-1657795511.html

Goves, C., North, R., Johnston, R., & Fletcher, G. (2016). Short term traffic prediction on the UK motorway network using neural networks. *Transportation Research Procedia*, *13*, 184–195.

Great Britain, O. of G. C. (2017). *Managing successful projects with PRINCE2*. TSO.

Great Britain. Office of Government Commerce. (2017). *Managing successful projects with PRINCE2*. TSO.

Gretzel, U., Werthner, H., Koo, C., & Lamsfus, C. (2015). Conceptual foundations for understanding smart tourism ecosystems. *Computers in Human Behavior*, *50*, 558–563. https://doi.org/10.1016/J.CHB.2015.03.043

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. *IBM Journal of Research and Development*, *54*(4), 1–16.

Heras-Saizarbitoria, I., Marimon, F., & Casadesús, M. (2012). An empirical study of the relationships within the categories of the EFQM model. *Https://Doi.Org/10.1080/14783363.2012.669541*, *23*(5–6), 523–540. https://doi.org/10.1080/14783363.2012.669541

Hermano Rebolledo, V. (2013). *The Project-Based firm as a new organization form: A dynamic capabilities approach*. Universidad de Valladolid. Facultad de Ciencias Económicas y Empresariales.

Hobbs, P. (2009). Project Management. In DK (Ed.), *Project Management*.

Hollands, R. G. (2008). Will the real smart city please stand up? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

Houser, K., & Voss, W. G. (2018). GDPR: The End of Google and Facebook or a New Paradigm in Data Privacy? *SSRN Electronic Journal*, *October*. https://doi.org/10.2139/ssrn.3212210

Huemann, M., Pernille Eskerod, & Ringhofer, C. (2016). *Rethink! Project Stakeholder Management* (Project Management Institute, Ed.). Project Management Institute. https://www.pmi.org/-/media/pmi/documents/public/pdf/research/research-summaries/huemann_summary_rethink_v2.pdf

IIBA. (2015). *A Guide to the Business Analysis Body of Knowledge (BABOK® Guide) – Version 3.0*. 514.

Instituto Português da Qualidade. (2007a). *NP4456:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI), Terminologia e definições das actividades de IDI* (pp. 1–31). Instituto Português da Qualidade.

Instituto Português da Qualidade. (2007b). *NP4457:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI), Requisitos de um projecto de IDI* (pp. 1–31). Instituto Português da Qualidade.

Instituto Português da Qualidade. (2007c). *NP4458:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI), Requisitos do sistema de gestão da IDI* (pp. 1–15). Instituto Português da Qualidade.

IPMA. (2015). *Individual Competence Baseline for Project, Programme and Portfolio Management* (4th editio). http://products.ipma.world/wp-content/uploads/2016/03/IPMA_ICB_4_0_WEB.pdf

Ives, M. (2005). Identifying the Contextual Elements of Project Management with Organizationsl and Their Impact on Project Success. *Project Management Journal*.

Jensen, T., & Sandström, J. (2011). Stakeholder theory and globalization: The challenges of power and responsibility. *Organization Studies*, *32*(4), 473–488. https://doi.org/10.1177/0170840611400290

Jergeas, G. F., & et al. (2000). Stakeholder Management on Construction Projects. *AACE International Transactions*, *September*, 12.

Joaquim Filipe Araújo. (2000). *Improving public service delivery: the crossroads between agencification and traditional bureaucracy*. https://repositorium.sdum.uminho.pt/bitstream/1822/4544/1/VersãoFinalDefinitiva.pdf

Jonathan Woetzel, Jaana Remes, Brodie Boland, Katrina Lv, Suveer Sinha, Gernot Strube, John Means, Jonathan Law, Andrés Cadena, & Valerie von der Tann. (2018). *Smart Cities: Digital Solutions for a more livable future* .

Jorge Andrade da Silva. (2024). *Código dos Contratos Públicos - Comentado e Anotado* (Almedina, Ed.). https://www.almedina.net/codigo-dos-contratos-publicos-comentado-e-anotado-1711595038.html

Jugdev, K., & Müller, R. (2005). A Retrospective Look at Our Evolving Understanding of Project Success. *Article in Project Management Journal*. https://doi.org/10.1177/875697280503600403

Julia Powles. (2018). *The G.D.P.R., Europe's New Privacy Law, and the Future of the Global Data Economy*. The New Yorker. https://www.newyorker.com/tech/annals-of-technology/the-gdpr-europes-new-privacy-law-and-the-future-of-the-global-data-economy

Kanter, R. M. (1999). The enduring skills of change leaders. *Leader to Leader*, 15–22. https://doi.org/10.1002/ltl.40619991305

Kerzner, H. (2021). Project management: a systems approach to planning, scheduling, and controlling. In Wiley (Ed.), *New York* (12th ed.).

Kevin Gibson. (2000). The moral basis of stakeholder theory. *Journal of Business Ethics*, *26*(3), 245–257.

Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, *79*, 1–14.

Kolb, D. A. (1984). Experience as the source of learning and development. *Upper Sadle River: Prentice Hall*.

Komninos, N. (2011). Intelligent cities: Variable geometries of spatial intelligence. *Intelligent Buildings International*, *3*(3), 172–188.

Komninos, N. (2013). *Intelligent cities: innovation, knowledge systems and digital spaces*. Routledge.

Kumar, M. R. (2012). *Use of Action Research to Institutionalize Organizational Learning within TQM*. Quality Management Journal USA, vol.19, no.3.

Kwak, Y. H. (2005). A brief history of Project Management. *The Story of Managing Projects: An Interdisciplinary Approach*, *1916*, 1–10. http://discovery.ucl.ac.uk/46752/%5Cnhttp://home.gwu.edu/~kwak/PM_History.pdf%5Cnhttp://cds.cern.ch/record/1413876%5Cnhttp://books.google.com/books?hl=en&lr=&id=fxV7yNWb4_kC&oi=fnd&pg=PR9&dq=The+Story+of+Managing+Projects:+An+Interdisciplinary+Approach&ot

Lange, M. de, & Waal, M. de. (2018). The Hackable City - Digital Media and Collaborative City-Making in the Network Society. In *The Hackable City*. Springer. https://doi.org/10.1007/978-981-13-2694-3

Leonidou, E., Christofi, M., Vrontis, D., & Thrassou, A. (2018). An integrative framework of stakeholder engagement for innovation management and entrepreneurship development. *Journal of Business Research*, *November*, 1–14. https://doi.org/10.1016/j.jbusres.2018.11.054

Lewin, K. (1947). Frontiers in Group Dynamics. *Human Relations*, *1*(1), 5–41. https://doi.org/10.1177/001872674700100103

Lewin, K. (1951). *Field Theory in Social Sciences*. *Harper and Row*.

Liu, H., Zhang, K., He, R., & Li, J. (2009). A neural network model for travel time prediction. *2009 IEEE International Conference on Intelligent Computing and Intelligent Systems*, *1*, 752–756.

Logan, E. (2011). *LINKING FEDERAL IT C APITAL PLANNING AND INVESTMENT CONTROL AND PORTFOLIO MANAGEMENT: A CASE STUDY AT THE U.S. DEPARTMENT OF COMMERCE*. http://www.icoste.org/Slovenia2006Papers/icecFinal00058.pdf

Mack, N., Woodsong, C., McQueen, K. M., Guest, G., & Namey, E. (2011). Qualitative Research Methods: A data collector's field guide. In *Qualitative Research Methods: A data collector's field guide*. https://doi.org/10.1108/eb020723

Maclaren, V. W. (1996). Urban Sustainability Reporting. *Journal of the American Planning Association*, *62*(2), 184–202. https://doi.org/10.1080/01944369608975684

Maheshwari, D., & Janssen, M. (2014). Reconceptualizing measuring, benchmarking for improving interoperability in smart ecosystems: The effect of ubiquitous data and crowdsourcing. *Government Information Quarterly*, *31*(SUPPL.1), S84–S92. https://doi.org/10.1016/j.giq.2014.01.009

Maldonado, E. A., Maitland, C. F., & Tapia, A. H. (2010). Collaborative systems development in disaster relief: The impact of multi-level governance. *Information Systems Frontiers*, *12*(1), 9–27. https://doi.org/10.1007/s10796-009-9166-z

Martins, F., Amaral, L., & Ribeiro, P. (2020). Implementation of GDPR: Learning with a Local Administration Case Study. *Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST*, *323 LNICST*, 205–216. https://doi.org/10.1007/978-3-030-51005-3_19

Martins, F. R. G. (2017). *Desenvolvimento de um Template de Business Case e aplicação no ciclo de vida de um projeto de uma empresa municipal*. Universidade do Minho.

Martins, F., Ribeiro, P., & Duarte, F. (2018). *Improving Project Management Practice Through the Development of a Business Case: A Local Administration Case Study* (pp. 433–448). Springer, Cham. https://doi.org/10.1007/978-3-319-77703-0_43

Mckay, J., & Marshall, P. (2001). The dual imperatives of action research. *Information Technology & People*, *14*(1), 46–59. https://doi.org/10.1108/09593840110384771

McNiff, J., & Whitehead, J. (2002). *Action Research: Principles and Practice, Second Edition*. Routledge. https://saidnazulfiqar.files.wordpress.com/2013/09/action-research-princip-and-practice.pdf

Melin, U., & Axelsson, K. (2016). Action in action research. *Journal of Systems and Information Technology*, *18*(2), 118–147. https://doi.org/10.1108/JSIT-10-2015-0074

Merriam-Webster. (2019). *Definition of Informal by Merriam-Webster*. https://www.merriam-webster.com/dictionary/informal

Miguel, A. (2013). *Gestão moderna de projetos - melhores técnicas e práticas*.

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, *22*(4), 853–886.

Morgan, G. (1996). *Images of Organization* (S. Publications, Ed.).

Müller, R., Martinsuo, M., & Blomquist, T. (2008). Project portfolio control and portfolio management performance in different contexts. *Project Management Journal*, *39*(3), 28–42. https://doi.org/10.1002/pmj.20053

Munene, M. B., Swartling, Å. G., & Thomalla, F. (2018). Adaptive governance as a catalyst for transforming the relationship between development and disaster risk through the Sendai Framework? *International Journal of Disaster Risk Reduction*, *28*, 653–663. https://doi.org/10.1016/J.IJDRR.2018.01.021

Myers, M. D. (2019). *Qualitative research in business and management*. Sage.

Nam, T., & Pardo, T. A. (2011a). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research*, 282–291. https://doi.org/10.1145/2037556.2037602

Nam, T., & Pardo, T. A. (2011b). *Smart City as Urban Innovation: Focusing on Management, Policy, and Context*. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.838.4147&rep=rep1&type=pdf

Negre, E., Rosenthal-Sabroux, C., & Gascó, M. (2015). Introduction to smart cities and smart city government minitrack. *2015 48th Hawaii International Conference on System Sciences*, 2316.

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some stylised facts. *Cities*, *38*, 25–36.

Nenadál, J. (2020). The New EFQM Model: What is Really New and Could Be Considered as a Suitable Tool with Respect to Quality 4.0 Concept? *Quality Innovation Prosperity*, *24*(1), 17–28. https://doi.org/10.12776/QIP.V24I1.1415

Norrie, J., & Walker, D. (2004). A balanced scorecard approach to project management leadership. *Project Management Journal*. https://doi.org/10.1177/875697280403500406

Notícias, R. do J. de. (2019, June 12). *Aprovada versão final de execução do RGPD*. Jornal de Notícias. https://www.jn.pt/nacional/interior/aprovada-versao-final-de-execucao-do-rgpd-11003399.html

OECD. (2023). *Government at a Glance 2023*. OECD. https://doi.org/10.1787/3d5c5d31-en

Oliveira, J. (2013). *Utilização de Ferramentas Informáticas na Gestão de Projetos – Enfoque na Gestão Colaborativa*. https://repositorium.sdum.uminho.pt/bitstream/1822/27266/1/Tese_MEI_PG19676_Juliana Oliveira.pdf

Orłowski, C. (2014). Rule-Based Model for Selecting Integration Technologies for Smart Cities Systems. *Cybernetics & Systems*, *45*(2), 136. http://widgets.ebscohost.com/prod/customerspecific/ns000290/authentication/index.php?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,cookie,shib,uid&db=edb&AN=94987667&lang=pt-br&site=eds-live&scope=site

Pacheco, C., & Garcia, I. (2012). A systematic literature review of stakeholder identification methods in requirements elicitation. *The Journal of Systems and Software*, *85*, 2171–2181. https://doi.org/10.1016/j.jss.2012.04.075

Parkin, P. (2009). *Managing change in healthcare: Using action research*. Sage.

Paul, D., Yeates, D., & Cadle, J. (2010). *BUSINESS ANALYSIS Second Edition*. BCS The Chartered Institute for IT.

Pellegrinelli, S. (1997). Programme management: organising project-based change. *International Journal of Project Management*, *15*(3), 141–149. https://doi.org/10.1016/S0263-7863(96)00063-4

Petit, Y., & Hobbs, B. (2010). Project portfolios in dynamic environments: Sources of uncertainty and sensing mechanisms. *Project Management Journal*. https://doi.org/10.1002/pmj.20201

Pfeiffer, P. (2006). O Quadro Lógico: um método para planejar e gerenciar mudanças. *Planejamento e Orçamento Governamental*, 145–190. http://seer.enap.gov.br/index.php/RSP/article/view/320/326

PMI. (2013). *A Guide to the Project Management Body of Knowledge - PMBOK® Guide* (5th ed.).

Polson, N. G., & Sokolov, V. O. (2017). Deep learning for short-term traffic flow prediction. *Transportation Research Part C: Emerging Technologies*, *79*, 1–17.

Porter, M. E., & Kramer, M. R. (2011). Creating Shared Value. *Harvard Business Review*. https://doi.org/10.1108/09600039410055963

Prałat, E. E. (2019). *Public e-procurement tools in European Union*. https://doi.org/10.15584/nsawg.2019.2.14

Project Management Institute. (2013). A guide to the project management body of knowledge - PMBOK ® guide - 5th Edition. In *Project Management Institute*. https://doi.org/10.1002/pmj.20125

Project Management Institute. (2017). *A guide to the project management body of knowledge - PMBOK ® guide - 6th Edition* (6th ed.). https://doi.org/10.1017/CBO9781316091289.010

Project Management Institute. (2021). *A guide to the Project Management Body of Knowledge (PMBOK guide) and the Standard for project management - 7th Edition*.

Publications Office of the European Union. (2014). *Mapping smart cities in the EU.* https://doi.org/10.2861/3408

Ravn, I., & Nuri Babüroğlu, O. (1992). *Normative Action Research*. *Organizational Studies*.

República Portuguesa. (2008). *Decreto-Lei n.º 18/2008 - Código dos Contratos Públicos - CCP* (INCM, Ed.). https://diariodarepublica.pt/dr/legislacao-consolidada/decreto-lei/2008-34455475

República Portuguesa - Infraestruturas e Educação. (2023). *Relatório Anual 2022 - Contratação Pública em Portugal*. www.base.gov.pt

Rezania, D., & Ouedraogo, N. (2013). Organization development through ad hoc problem solving: A case of knowledge transfer capacity development in an ERP implementation project. *International Journal of Managing Projects in Business*. https://doi.org/https://doi.org/10.1108/IJMPB-11-2012-0067

Richard Baskerville, & Michael D. Myers. (2004). Special Issue on Action Research in Information Systems: Making IS Research Relevant to Practice. *MIS Quarterly*, *28*(3), 335. https://doi.org/10.2307/25148642

Richard Dobbs, Sven Smit, Jaana Remes, James Manyika, Charles Roxburgh, & Alejandra Restrepo. (2011). *Urban world: Mapping the economic power of cities*. www.mckinsey.com/mgi.

Robert Bosch GmbH. (2024). *RK Project Manager Qualification "Bosch Certified Project Manager"* (Robert Bosch Kolleg, Ed.).

Robinson, G., & Dechant, K. (1997). Building a Business Case for Diversity. In *The Academy of Management Executive (1993-2005)* (Vol. 11, pp. 21–31). Academy of Management. https://doi.org/10.2307/4165408

Roldão, V. S. (2007). *Gestão de Projectos - Abordagem instrumental ao planeamento, organização e controlo*. Monitor.

Rowley, T. J. (1997). Moving beyond dyadic ties: A network theory of stakeholder influences. *Academy of Management Review*. https://doi.org/10.5465/AMR.1997.9711022107

Sankaran, S., Ranjan, M., & Indian Railways, K. (2010). Implementing Organizational Change Using Action Research in Two Asian Cultures. *PMI Research and Education Conference Proceedings*.

Saunders, M., Lewis, P., & Thornhill, A. (2009). Research Methods for Business Students. In *Business* (Vol. 5th). http://books.google.com/books?id=u-txtfaCFiEC&pgis=1%5Cnhttps://is.vsfs.cz/el/6410/leto2014/BA_BSeBM/um/Research_Methods_for_Business_Students__5th_Edition.pdf

Shi, Q. (2011). Rethinking the implementation of project management: A Value Adding Path Map approach. *International Journal of Project Management*, *29*(3), 295–302. https://doi.org/10.1016/j.ijproman.2010.03.007

Silva, C., & Martins, F. (2020). Traffic Flow Prediction Using Public Transport and Weather Data: A Medium Sized City Case Study. *Advances in Intelligent Systems and Computing*, *1160 AISC*. https://doi.org/10.1007/978-3-030-45691-7_35

Simões, J. A. (2003). *Concepção, Execução e Avaliação das Políticas Públicas*.

Smith, L. W., & Smith, L. W. (2000). Project Clarity Through Stakeholder Analysis. *CROSSTALK*, 4–9.

Somekh, B. (2006). Action Research: A Methodology for Change and Development. *Maidenhead*, *UK:Open University Press*.

Spiekermann, K., & Wegener, M. (2003). Modelling Urban Sustainabilty. *International Journal of Urban Sciences*, *7*(1), 47–64.

Suárez, E., Calvo-Mora, A., Roldán, J. L., & Periáñez-Cristóbal, R. (2017). Quantitative research on the EFQM excellence model: A systematic literature review (1991–2015). *European Research on*

Management and Business Economics, *23*(3), 147–156. https://doi.org/10.1016/J.IEDEEN.2017.05.002

Sutterfield, J. S., Friday-Stroud, S. S., & Shivers-Blackwell, S. L. (2006). A Case Study of Project and Stakeholder Management Failures: Lessons Learned. *Project Management Journal*, *37*(5), 26–35. https://doi.org/10.1177/875697280603700504

Tabique. (2021). *Decision Support Study for a high-capacity transport system on its own site | Braga*.

Tavares. (2003). *A Nova Gestão Pública* (Apresentaç).

Tavares, L. V., Rosa, M. M., Graça, P. M., & Costa, A. A. (2009). Estudo dos Impactos Tecnológicos da Contratação Pública Electrónica. *Relatório Final Do Observatório de Prospectiva Da Engenharia e Da Tecnologia. Lisboa: OPET*.

Tereso, A., Ribeiro, P., Fernandes, G., Loureiro, I., & Ferreira, M. (2018). Project Management Practices in Private Organizations. *Project Management Journal*, *50*, 17.

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION. (2016). *REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679

Tikkinen-Piri, C., Rohunen, A., & Markkula, J. (2018). EU General Data Protection Regulation: Changes and implications for personal data collecting companies. *Computer Law & Security Review*, *34*(1), 134–153. https://doi.org/10.1016/J.CLSR.2017.05.015

Tiwana, A., & Keil, M. (2009). Control in Internal and Outsourced Software Projects. *Journal of Management Information Systems*, *26*(3), 9–44. https://doi.org/10.1007/s00204-002-0374-2

Townsend, A. M. (2013). *Smart cities: Big data, civic hackers, and the quest for a new utopia*. WW Norton & Company.

Turner, R., & Zolin, R. (2012). Forecasting Success on Large Projects: Developing Reliable Scales to Predict Multiple Perspectives by Multiple Stakeholders Over Multiple Time Frames. *Project Management Journal*. https://doi.org/10.1002/pmj

Van Dijck, J., Poell, T., & De Waal, M. (2018). *The platform society: Public values in a connective world*. Oxford University Press.

Vanolo, A. (2016). Is there anybody out there? The place and role of citizens in tomorrow's smart cities. *Futures*, *82*, 26–36. https://doi.org/10.1016/j.futures.2016.05.010

Varajão, J., Colomo-Palacios, R., & Silva, H. (2016). *ISO 21500:2012 and PMBoK 5 processes in information systems project management*. https://doi.org/10.1016/j.csi.2016.09.007

VTM. (2022). *Demand Study for the Implementation of a BRT in Braga*.

Waddell, S. (2017). *Societal learning and change: How governments, business and civil society are creating solutions to complex multi-stakeholder problems*. Routledge.

Wart, M. Van. (2003). Public-Sector Leadership Theory: An Assessment. *Public Administration Review*, *63*(2), 214–228. https://doi.org/10.1111/1540-6210.00281

Wu, J. (2010). Urban sustainability: an inevitable goal of landscape research. *Landscape Ecol*, 1–4. https://doi.org/10.1007/s10980-009-9444-7

Wu, J. J. (2008). Making the case for landscape ecology an effective approach to urban sustainability. *Landscape Journal*, *27*(1), 41–50.

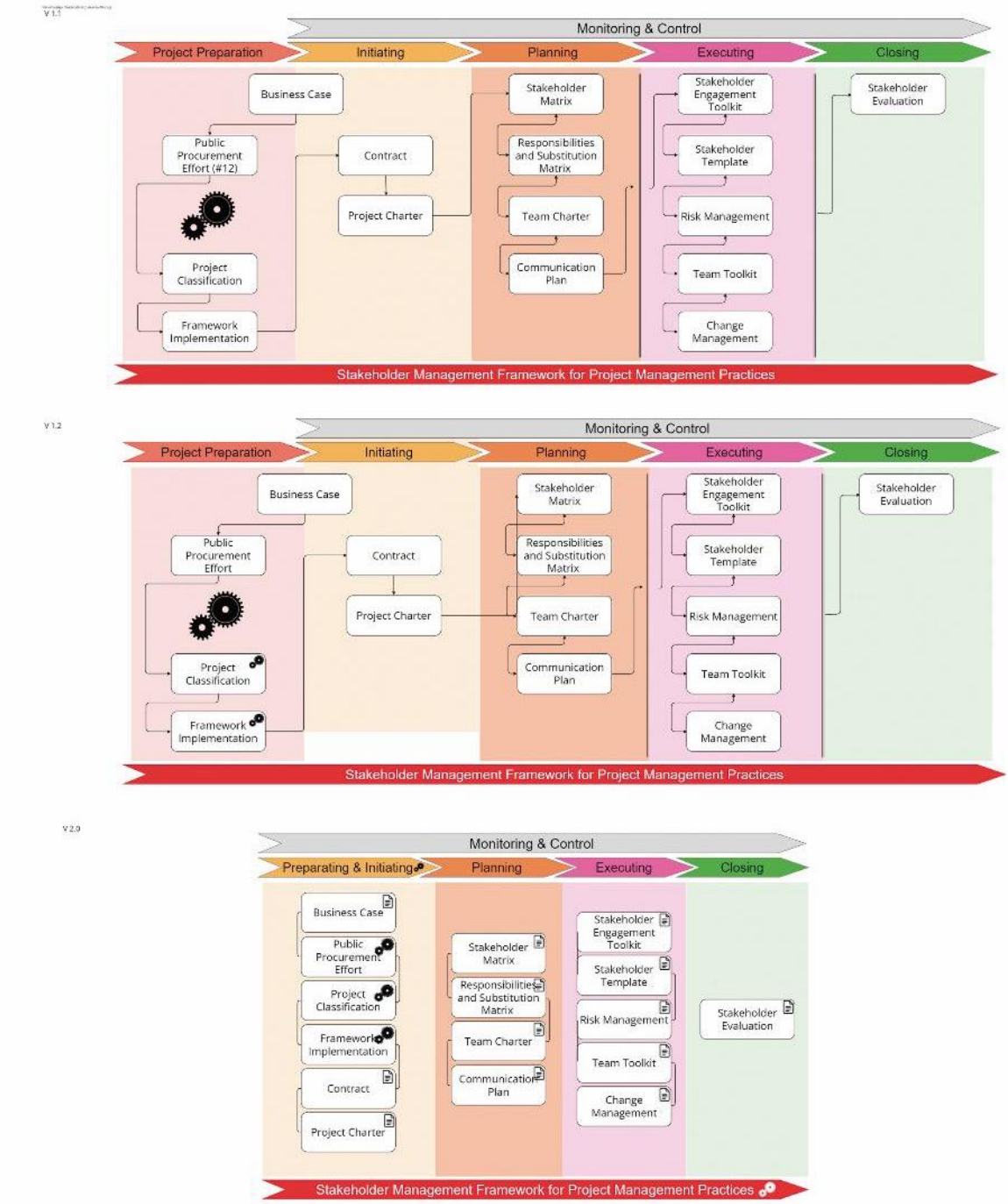
Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of things for smart cities. *IEEE Internet of Things Journal*, *1*(1), 22–32.

Zhuhadar, L., Thrasher, E., Marklin, S., & de Pablos, P. O. (2017). The next wave of innovation—Review of smart cities intelligent operation systems. *Computers in Human Behavior*, *66*, 273–281. https://doi.org/10.1016/j.chb.2016.09.030

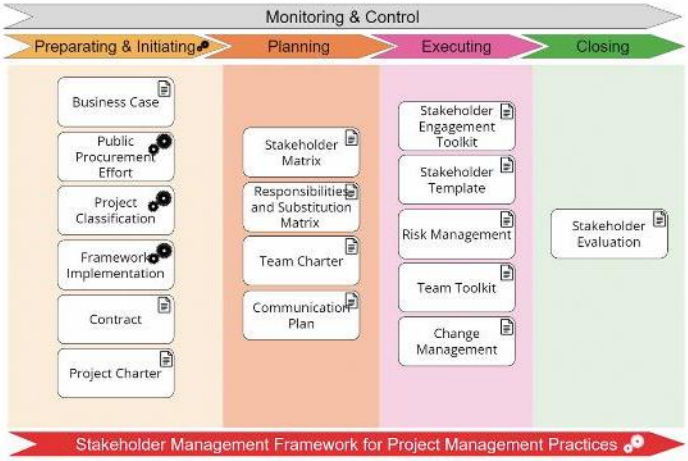
Zuber-Skerritt, O., & Perry, C. (2002). Action research within organisations and university thesis writing. *The Learning Organization*.

Appendix

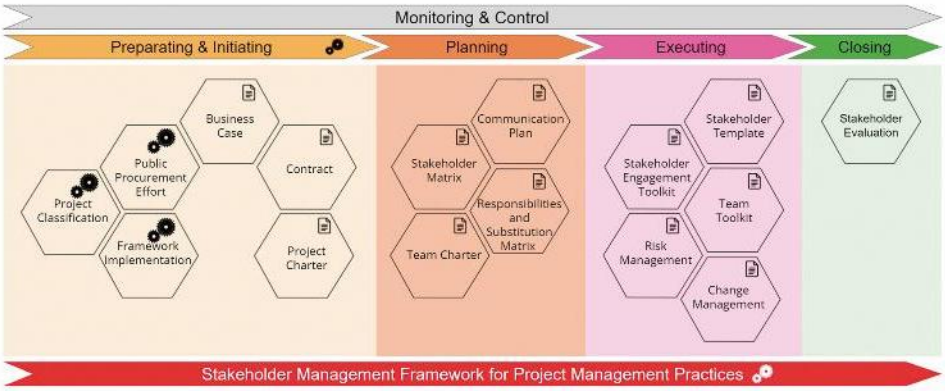
A. Astrolabe4SM



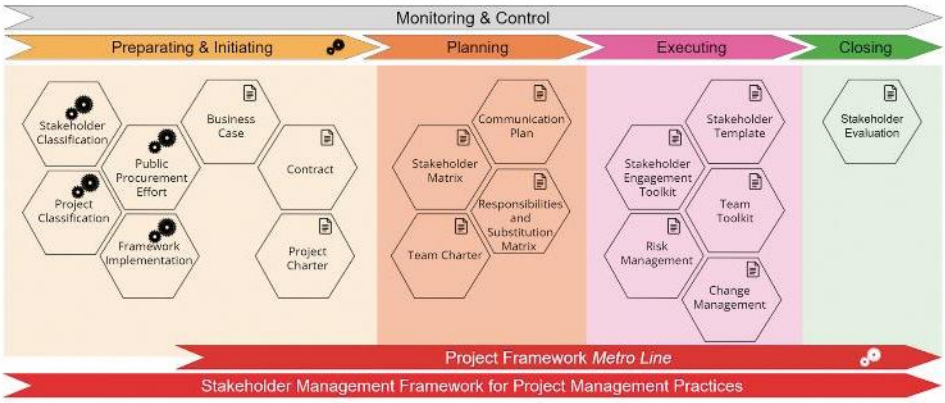
V 2.1



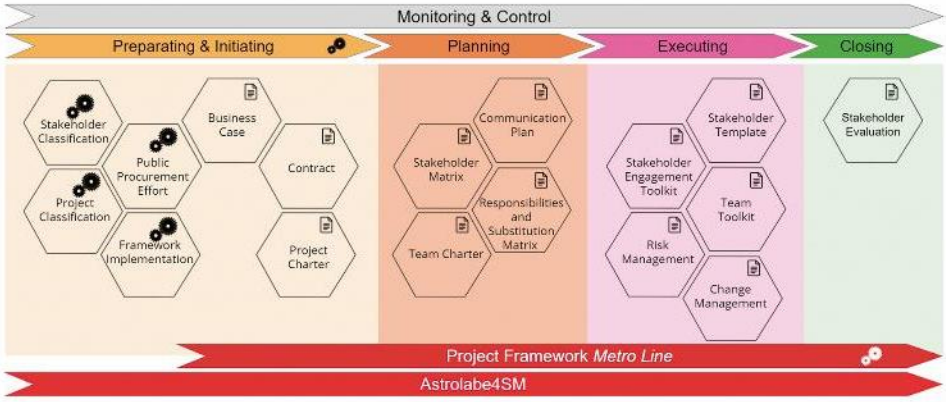
V 3.0



V 3.1

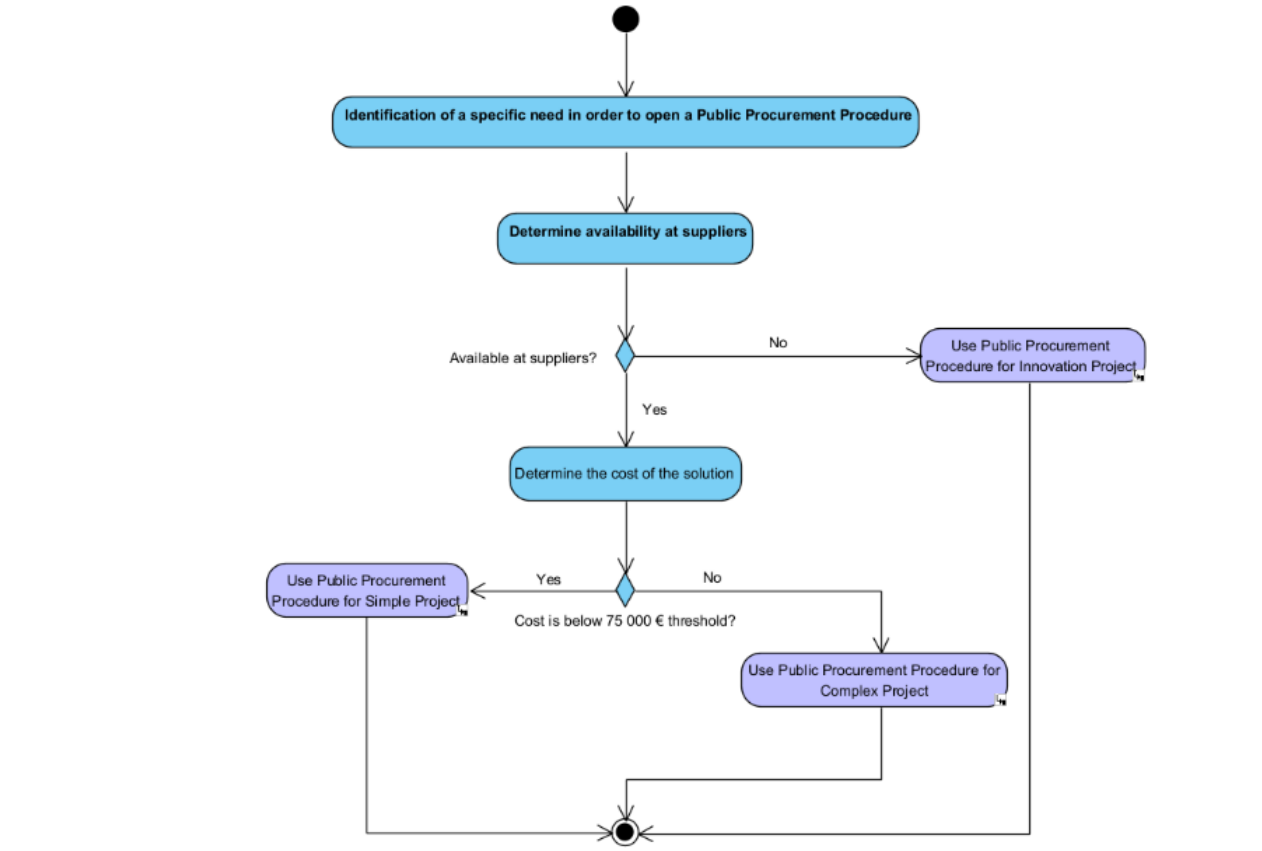


V 3.2

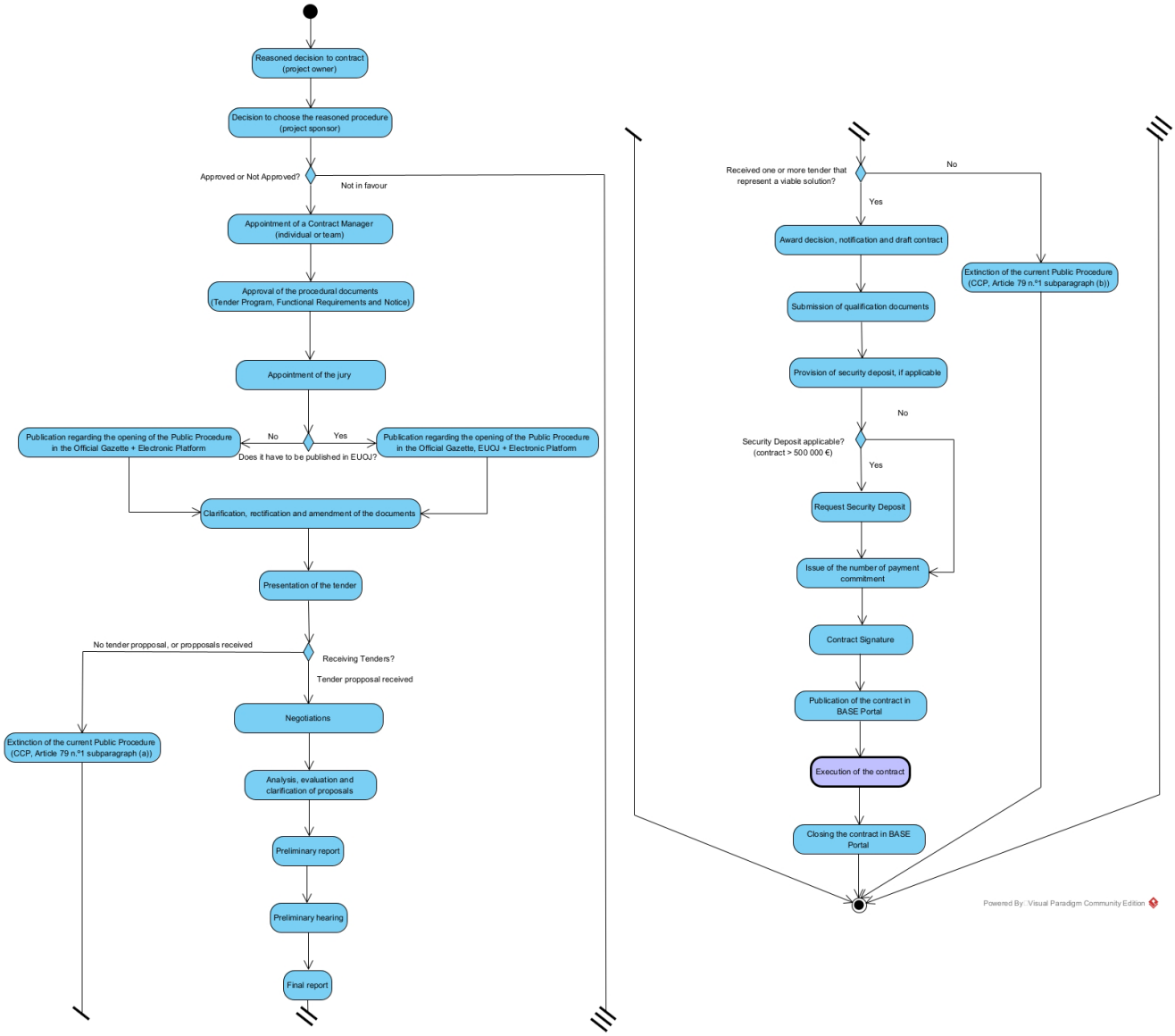


B. Activity Diagram

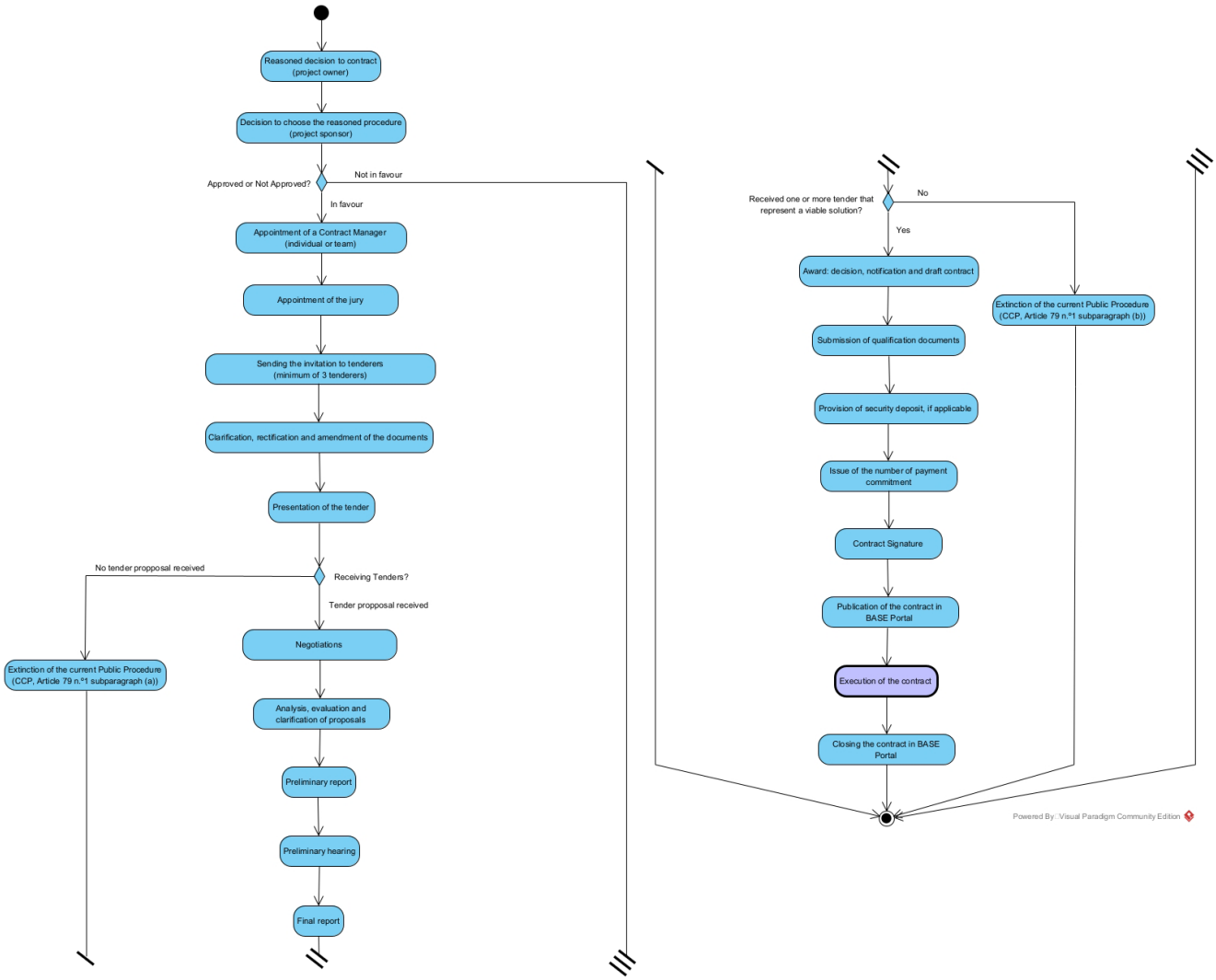
B.1 Selection of Contract



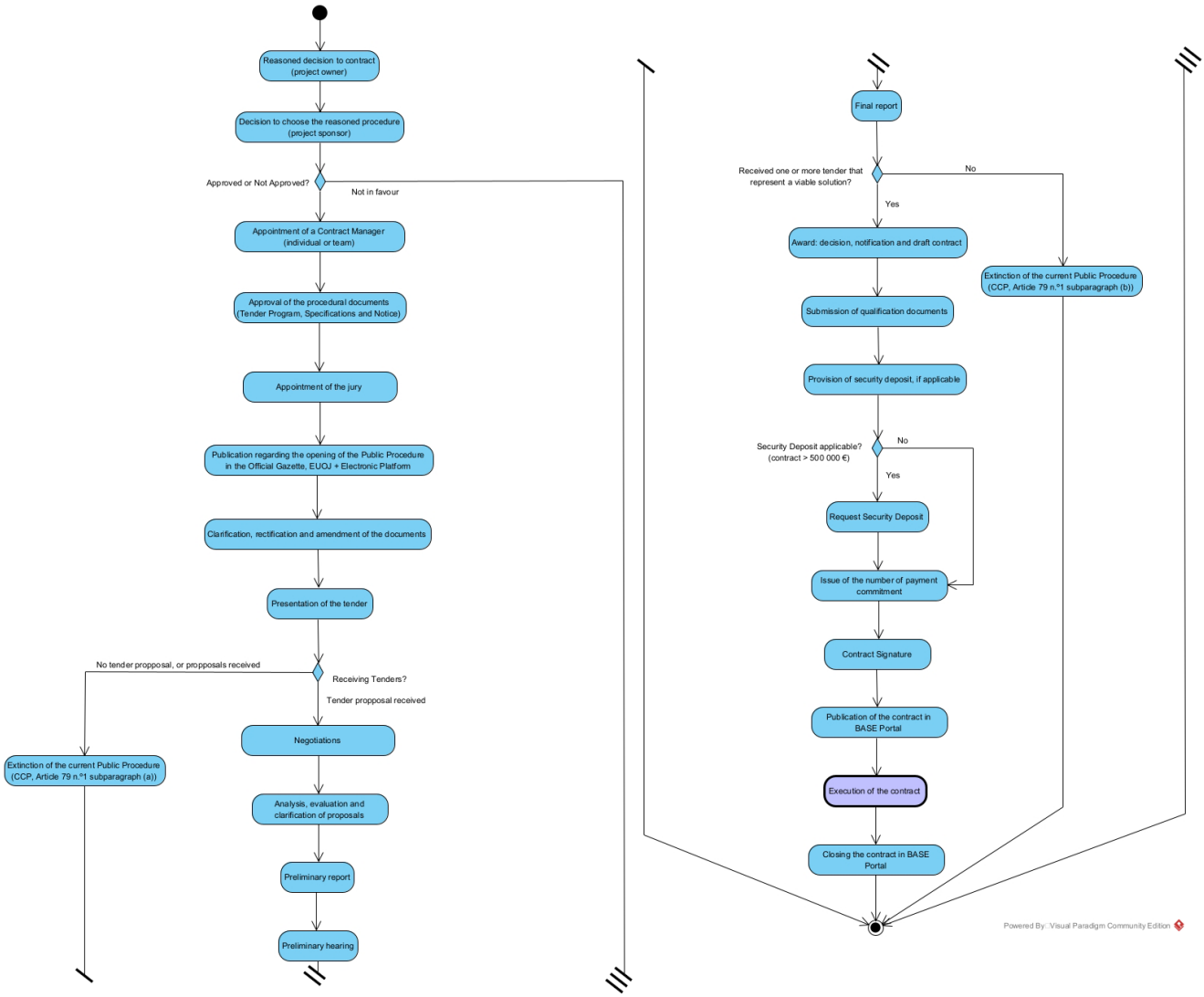
B.2 Public Procurement Innovation Project



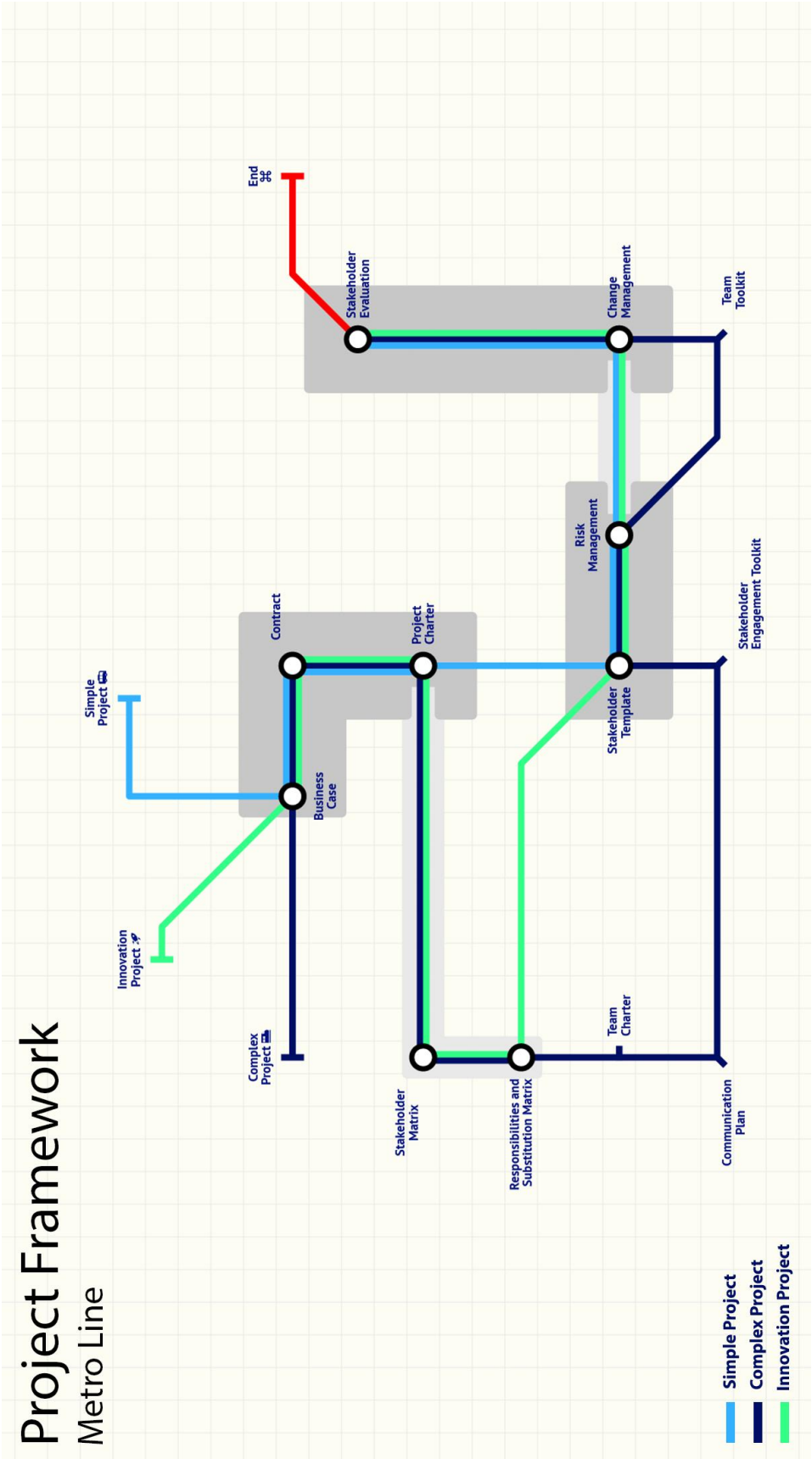
B.3 Public Procurement Procedure for Simple Project



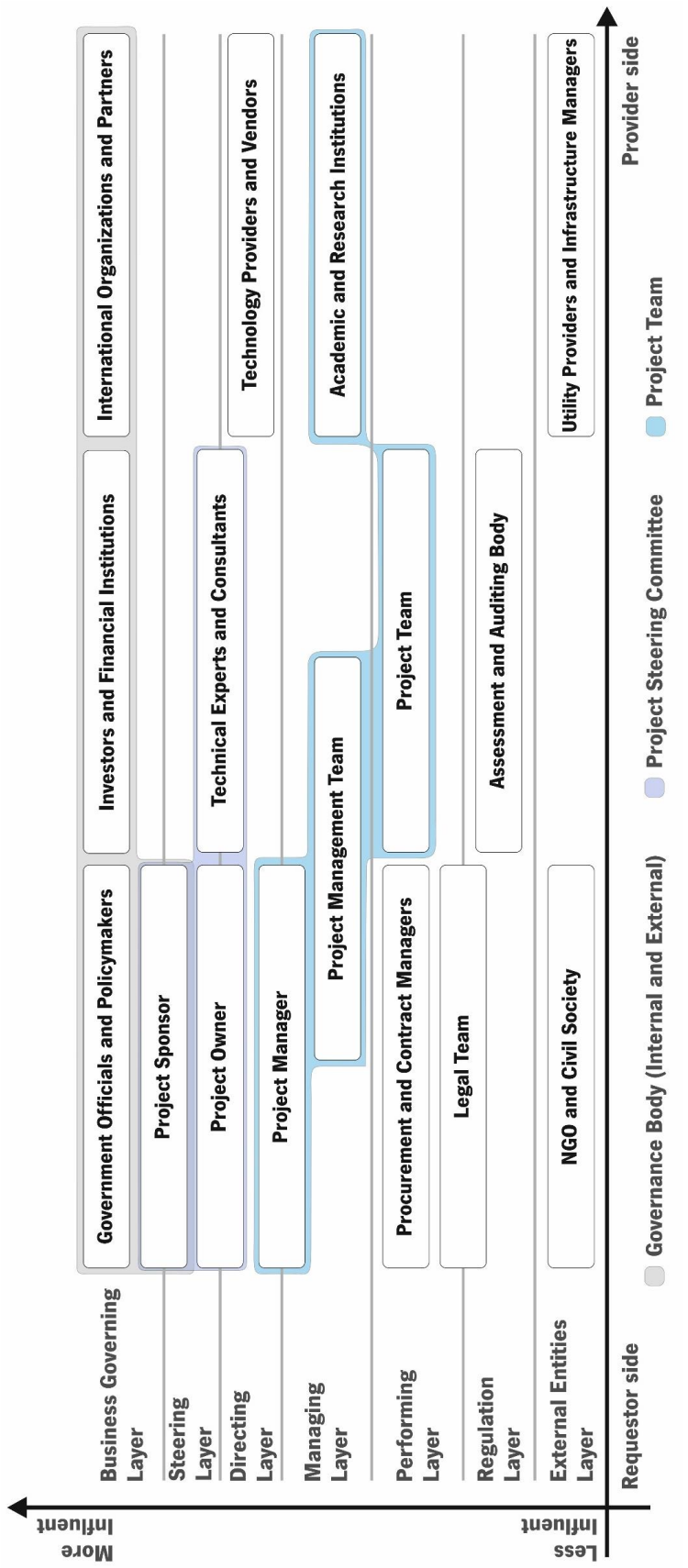
B.4 Public Procurement Procedure for Complex Project



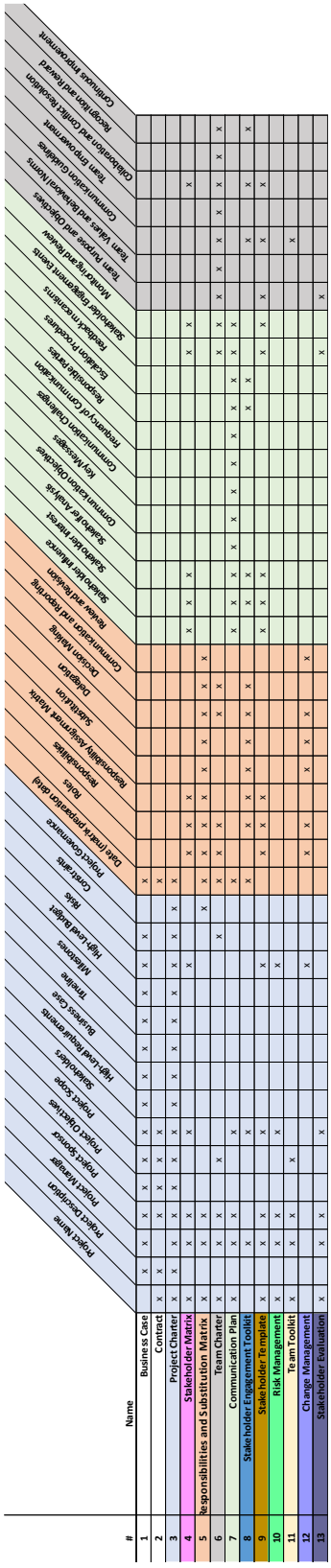
C. Project Metro Line

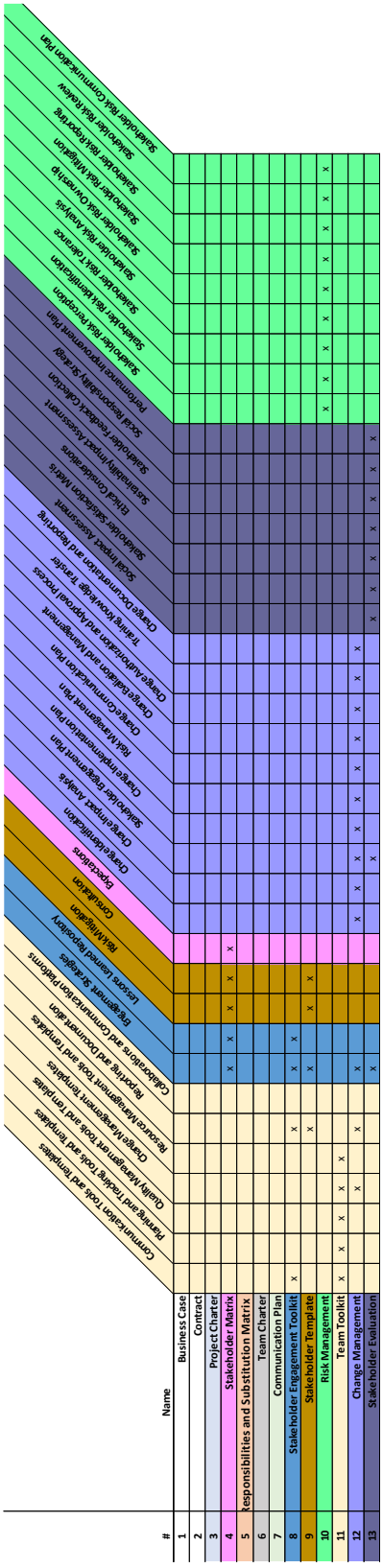


D. Stakeholder Mapping



E. Framework Documents and Fields Mapping





F. PhD Logo



EXTENDING PROJECT MANAGEMENT PRACTICES FOR INNOVATION PROJECTS IN SMART CITIES

FOCUSING ON STAKEHOLDER MANAGEMENT

G. Metrics matrix for the comparison of the results of Actions

Rev 1.0

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit
PC1	Project Complexity	Requirements	Complexity	1 - Simple 2 - Big 3 - Complex 4 - Innovation	
BC1	Business Case	Requirements	Benefits realization		
BC2		Quality	Project Coordinators		
BC3		Requirements	Stakeholders		
BC4		Cost	Project Team		
M1	Monitoring	Involvement	Meetings		
M2		Time	Plans		
M3		Quality	Outcomes		
M4		Requirements	Success Factors		
LL1	Lessons Learned	Quality	Lessons Learned		

Rev 1.1

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Fundamento
PC1	Project Complexity	Requirements	Complexity	1 - Simple 2 - Big 3 - Complex 4 - Innovation	Cmpx	CCP - Código Contratação Pública
BC1	Business Case	Quality	Project Coordinators	∑(project coordinators)	PC	
BC2		Requirements	Benefits realization	project coordinators perceived benefits / project coordinators	%	
BC3		Requirements	Stakeholders	∑(stakeholders)	stk	
BC4		Quality	Project Team Experie	Average number of years of experience	PTExp	
M1	Monitoring	Involvement	Communications Management Plan	Number of communications plans or changes to the same document	CMP	
M2		Cost	Project Cost	Executado / Planeado	%	
M3		Quality	Outcomes	number of delieverables deployed / number of expected deliverables	number	
LL1	Lessons Learned	Requirements	Lessons Learned	Number of lessons learned	LL	PMBOK

Rev 1.2

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Fundamento
PC1	Project Complexity	Requirements	Complexity	1 - Simple 2 - Big 3 - Complex 4 - Innovation	Cmpx	CCP - Código Contratação Pública
BC1	Business Case	Quality	Governance	1 - PMO 2 - Gestor Projeto 3 - 4 -		
BC2		Requirements	Benefits realization	project coordinators perceived benefits realized / project coordinators perceived benefits predicted	%	
		Quality	Team Perception	questionário associado a cada um dos participantes / equipas		Inquérito realizado
BC3		Requirements	Stakeholders	∑(stakeholders)	stk	
BC4		Quality	Project Team Experie	Average number of years of experience i	PTExp	
M1	Monitoring	Requirements	Communications Management Plan	Number of communications plans or changes to the same document	CMP	
M2		Cost	Project Cost	Executado / Planeado	%	
M3		Quality	Outcomes	number of delieverables deployed / number of expected deliverables	number	
LL1	Lessons Learned	Requirements	Lessons Learned	Number of lessons learned	LL	PMBOK

Rev 1.3

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Fundamento
PC1	Complexity	Cost	Complexity	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple		
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Other		
BC2		Requirements	Benefits realization	project coordinators perceived benefits realized / project coordinators perceived benefits predicted		
BC3		Quality	Stakeholder Influenc	1- Can stop the project 2 - Can change project requirements 3 - Can influence project timings 4 - Can influence project phases		
BC3		Influence	Change Management	Number of changes made by stakeholders to the project		
BC4		Performance	Project Team Experie	Average number of years of experience in similar projects		
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Change of Team Coordinator 2 - Addition / Removal Stakeholder 1 - Loss or Change of key element		
M2		Cost	Project Cost	Total € of Executed / Total € of planned	%	< 100 %
M3		Time	Time Deviation	Elapsed Time / Predicted Time	%	~ 100%
LL1	Lessons Learned	Requirements	Lessons Learned	Number of lessons learned		

Rev 1.4

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Fundamento
PC1	Complexity	Cost	Complexity	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple	4 > 1	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	4 > 1	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	3 - Push 2 - Interactive Communication 1 - Pull	3 > 1	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influenc	4- Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings 1 - Can influence the project phases	4 > 1	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	#	PRINCE2 (página 104)
BC5		Performance	Project Team Experie	Average number of years of experience in similar projects	#	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Change of Team Coordinator 2 - Addition / Removal Stakeholder 1 - Loss or Change of key element	4 > 1	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	% < 100 %	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	% ~100%	PMBOK and PM2
LL1	Lessons Learned	Requirements	Lessons Learned	Number of lessons learned	# > 3	
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	qualitative	PM2, PMBOK, PRINCE2

Rev 1.5

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Fundamento
PC1	Complexity	Requirements	Requirements Compl	??? Impacto da implementação dos requisitos		
PC1	Complexity	Cost	Total Predicted Inves	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple	4 > 1	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	4 > 1	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	3 - Push 4 - Interactive Communication 2 - Pull 1 - Basic Communication	3 > 1	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influenc	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	4 > 1	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	#	PRINCE2 (página 104)
BC5		Performance	Project Team Experie	Average number of years of experience in similar projects	#	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Change of Team Coordinator	4 > 1	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	% < 100 %	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	% ~0%	PMBOK and PM2
LL1	Lessons Learned	Requirements	Lessons Learned	Number of lessons learned	# > 3	
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	qualitative	PM2, PMBOK, PRINCE2

Rev 1.6

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Avaliação	Fundamento
PC1	Complexity	Requirements	Requirements Compl	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	4 > 1	Qualitativa "Quantificada"	
PC1	Complexity	Cost	Total Predicted Inves	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple	4 > 1	Quantitativa	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	4 > 1	Quantitativa	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	3 - Push 4 - Interactive Communication 2 - Pull 1 - Basic Communication	3 > 1	Qualitativa	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influenc	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	4 > 1	Qualitativa	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	#	Quantitativa	PRINCE2 (página 104)
BC5		Performance	Project Team Experie	Average number of years of experience in similar projects	#	Quantitativa	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Change of Team Coordinator	4 > 1	Qualitativa "Quantificada"	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	% < 100 %	Quantitativa	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	% ~0%	Quantitativa	PMBOK and PM2
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	qualitative	Qualitativa	PM2, PMBOK, PRINCE2

Rev 1.7

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Avaliação	Fundamento
PC1	Complexity	Requirements	quirements Complex	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	4 > 1	Qualitativa "Quantificada"	
PC1	Complexity	Cost	tal Predicted Investme	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple	4 > 1	Quantitativa	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	4 > 1	Quantitativa	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	3 - Push 4 - Interactive Communication 2 - Pull 1 - Basic Communication	3 > 1	Qualitativa	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influence	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	4 > 1	Qualitativa	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	#	Quantitativa	PRINCE2 (página 104)
BC5		Performance	roject Team Experienc	Average number of years of experience in similar projects	#	Quantitativa	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Change of Team Coordinator	4 > 1	Qualitativa "Quantificada"	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	% < 100 %	Quantitativa	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	% ~0%	Quantitativa	PMBOK and PM2
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	qualitative	Qualitativa	PM2, PMBOK, PRINCE2

Rev 1.8

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Avaliação	Fundamento
PC1	Complexity	Requirements	Requirements Complexity	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	#	Qualitativa "Quantificada"	
PC1	Complexity	Cost	Total Predicted Investment	4 - Innovation Project 3 - Complex 2 - Big 1 - Simple	#	Quantitativa	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	#	Quantitativa	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	3 - Push 4 - Interactive Communication 2 - Pull 1 - Basic Communication	#	Qualitativa	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influence	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	#	Qualitativa	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	min	Quantitativa	PRINCE2 (página 104)
BC5		Performance	Project Team Experience	Average number of years of experience in similar projects	max	Quantitativa	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Minimum changes to the team	#	Qualitativa "Quantificada"	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	%	Quantitativa	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	%	Quantitativa	PMBOK and PM2
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	max	Qualitativa	PM2, PMBOK, PRINCE2

Rev 1.9

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit	Avaliação	Fundamento
PC1	Complexity	Requirements	Requirements Complexity	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	#	Qualitativa "Quantificada"	
PC1	Complexity	Cost	Total Predicted Investment	3 - Innovation Project 2 - Complex 1 - Simple	#	Quantitativa	Código da Contratação Pública (CCP)
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	#	Quantitativa	PRINCE2 (página 29 em diante)
BC2		Engagement	Communication	4 - Interactive Communication 3 - Push 2 - Pull 1 - Basic Communication	#	Qualitativa	PMBOK and PRINCE2
BC3		Quality	Stakeholder Influence	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	#	Qualitativa	PM2
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	min	Quantitativa	PRINCE2 (página 104)
BC5		Performance	Project Team Experience	Average number of years of experience in similar projects	max	Quantitativa	PMBOK
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Minimum changes to the team	#	Qualitativa "Quantificada"	PMBOK
M2		Cost	Project Cost	Total € of Executed / Total € of planned	%	Quantitativa	PMBOK
M3		Time	Time Deviation	Elapsed Time / Predicted Time	%	Quantitativa	PMBOK and PM2
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	max	Qualitativa	PM2, PMBOK, PRINCE2

V 2.0

#	Metric Scope	Dimension of Analysis	Metric Name	Metric Formula	Unit
PC1	Complexity	Requirements	Requirements Complexity	4 - High External Impact 3 - High Internal Impact 2 - Low External Impact 1 - Low Internal Impact	#
PC1	Complexity	Cost	Total Predicted Investment	3 - Innovation Project 2 - Complex 1 - Simple	#
BC1	Engagement	Quality	Governance	4 - PMO 3 - Certified Project Manager 2 - Project Coordinators 1 - Project Support	#
BC2		Engagement	Communication	4 - Interactive Communication 3 - Push 2 - Pull 1 - Basic Communication	#
BC3		Quality	Stakeholder Influence	4 - Can stop the project 3 - Can change the project requirements 2 - Can influence the project timings and / or project phases 1 - Has Low influence on the Project	#
BC4		Requirements	Change Management	Number of changes made by stakeholders to the project	min
BC5		Performance	Project Team Experience	Average number of years of experience in similar projects	max
M1	Monitoring	Quality	Changes to the Team Project	4 - Change of Project Manager 3 - Loss or Change of key element 2 - Addition / Removal Stakeholder 1 - Minimum changes to the team	#
M2		Cost	Project Cost	Total € of Executed / Total € of planned	%
M3		Time	Time Deviation	Elapsed Time / Predicted Time	%
TP1	Team Perception	Requirements	Team Perception	Teams' perception of the fulfillment of the project's initial requirements and deviation from them	max

H. EFQM RADAR scoring attributes for Enablers criteria

Rev 1.0

Elements **Elementos**	**Attributes to Score** **Atributos a Avaliar**	**Description of Attribute** **Descrição do Atributo**
Approach Abordagem	Sound Sólida	The extent to which the approach has a clear rationale, defined processes and focuses on stakeholder needs. A medida em que a abordagem tem uma lógica clara, processos definidos e foca as necessidades das partes interessadas.
	Integrated Integrada	The extent to which the approach supports policy and strategy, and is linked to other approaches where appropriate. A medida em que a abordagem apoia a regra e a estratégia, estando ligada a outras abordagens quando tal for apropriado.
Deployment Implementação	Implemented Implementada	The extent to which the approach is implemented. Até que ponto a abordagem é implementada.
	Systematic Sistemática	The extent to which the deployment is carried out in a structured way with the method used to ensure deployment being itself planned and executed soundly. Até que ponto a implementação é realizada de forma estruturada pelo o método utilizado, de modo a garantir que a implementação seja ela própria planeada e executada de forma sólida.
Assessment and Review Avaliação e Revisão	Measurement Medida	The extent to which regular and appropriate measurement of the effectiveness of the approach and deployment takes place. Até que ponto se realiza uma medição regular e adequada da eficácia da abordagem e da utilização
	Learning Aprendizagem	The extent to which learning activities take place to identify best practices and improvement opportunities. Até que ponto se realizam actividades de aprendizagem para identificar as melhores práticas e oportunidades de melhoria.
	Improvement Melhorias	The extent to which the output from measurement and learning is analyzed and used in order to identify, prioritize, plan and implement improvements. Até que ponto os resultados da medição e aprendizagem são analisados e utilizados a fim de identificar, prioritizar, planear e implementar melhorias.

Rev 1.1

Elements	**Attributes to Score**	**Description of Attribute**
Approach	Sound	The extent to which the approach has a clear rationale, defined processes and focuses on stakeholder needs.
	Integrated	The extent to which the approach supports policy and strategy, and is linked to other approaches where appropriate.
Deployment	Implemented	The extent to which the approach is implemented.
	Systematic	The extent to which the deployment is carried out in a structured way with the method used to ensure deployment being itself planned and executed soundly.
Assessment and Review	Measurement	The extent to which regular and appropriate measurement of the effectiveness of the approach and deployment takes place.
	Learning	The extent to which learning activities take place to identify best practices and improvement opportunities.
	Improvement	The extent to which the output from measurement and learning is analysed and used in order to identify, prioritise, plan and implement improvements.

Elements	**Attributes to Score**	**Maturity Level**
Approach	Sound	
	Integrated	
Deployment Implementação	Implemented	
	Systematic	
Assessment and Review	Measurement	
	Learning	
	Improvement	

I. Actions Document Structure

Rev 1.0	
	Título Projeto

	- Purpose of Action
	- Pratical Action
	- Project Management
	  - PM Methodology
	  - Business Case
	  - Deliverables
	- Theory Adjustments
	  - Metrics And Lessons Learned
	  - Proposed Adjustments
	- Social Environment
	- Conclusions

Ver 1.1	
	Project Name

	- Purpose of Action
	- Pratical Action
	- Project Management
	  - PM Methodology
	  - Business Case
	  - Costs
	  - Schedules
	  - Deliverables
	- Stakeholders
	- Theory Adjustments
	  - Metrics And Lessons Learned
	  - Proposed Adjustments
	- Conclusions

Ver 1.2	
	Project Name

	- Purpose of Action
	- Pratical Action
	- Business Case
	- Project Management
	  - Project Management Methodology
	  - Investments and Costs
	  - Time and Schedules
	  - Objectives and Deliverables
	- Stakeholders
	- Theory Adjustments
	  - Metrics And Lessons Learned
	  - Proposed Adjustments
	- Conclusions

Ver 1.3	
	Project Name

	- Purpose of Action
	- Pratical Action
	- Project Management
	  - Project Management Methodology
	  - Investments and Costs
	  - Time and Schedules
	  - Objectives and Deliverables
	- Stakeholders
	- Theory Adjustments
	  - Metrics And Lessons Learned
	  - Proposed Adjustments
	- Conclusions

Ver 1.4	
	Project Name

	- Purpose of Action
	- Practical Action
	Project Management
	  - Project Management Methodology
	  - Investments and Costs
	  - Time and Schedules
	  - Objectives and Deliverables
	Stakeholders
	- Metrics And Lessons Learned
	- Theory Adjustments
	- Conclusions

Ver 1.5	
	Project Name

	- Purpose of Action
	- Practical Action
	Stakeholders
	Project Management
	  - Project Management Methodology
	  - Investments and Costs
	  - Time and Schedules
	- Metrics And Lessons Learned
	- Theory Adjustments
	- Conclusions

J. Document Classification Structure

Rev. 1.1		Classificação		
		Livre	Restrito	Confidencial
1	**Business Case**	x		
2	**Contract**			x
3	**Project Charter**	x		
4	**Stakeholder Matrix**	x		
5	**Responsibilities and Substitution Matrix**		x	
6	**Team Charter**		x	
7	**Communication Plan**		x	
8	**Stakeholder Engagement Toolkit**		x	
9	**Stakeholder Template**		x	
10	**Risk Management**		x	
11	**Team Toolkit**	x		
12	**Change Management**		x	
13	**Stakeholder Evaluation**		x	x

Rev. 1.2		Classificação		
		Livre	Restrito	Confidencial
1	**Business Case**	x		
2	**Contract**			x
3	**Project Charter**	x		
4	**Stakeholder Matrix**		x	
5	**Responsibilities and Substitution Matrix**		x	
6	**Team Charter**		x	
7	**Communication Plan**	x		
8	**Stakeholder Engagement Toolkit**			x
9	**Stakeholder Template**		x	
10	**Risk Management**		x	
11	**Team Toolkit**		x	
12	**Change Management**			x
13	**Stakeholder Evaluation**			x

Rev. 1.3		Classification		
		Free	Restricted	Confidential
1	**Business Case**	x		
2	**Contract**			x
3	**Project Charter**	x		
4	**Stakeholder Matrix**		x	
5	**Responsibilities and Substitution Matrix**		x	
6	**Team Charter**		x	
7	**Communication Plan**	x		
8	**Stakeholder Engagement Toolkit**			x
9	**Stakeholder Template**		x	
10	**Risk Management**		x	
11	**Team Toolkit**		x	
12	**Change Management**			x
13	**Stakeholder Evaluation**			x

K. Project Timeline

