

# iscte

UNIVERSITY  
INSTITUTE  
OF LISBON

---

## Integrating Business Process Management and APIs into an Existing RPA Environment: A Case Study in Hyper-Automation

Miguel Alexandre Silva Figueiredo

Master in Computer Science

Supervisor:

PhD Rúben Filipe de Sousa Pereira, Assistant Professor

Iscte – Instituto Universitário de Lisboa

December 2025



iscte

TECHNOLOGY  
AND ARCHITECTURE

---

Department of Information Science and Technology

Integrating Business Process Management and APIs into an  
Existing RPA Environment: A Case Study in Hyper-Automation

Miguel Alexandre Silva Figueiredo

Master in Computer Science

Supervisor:

PhD Rúben Filipe de Sousa Pereira, Assistant Professor

Iscte – Instituto Universitário de Lisboa

December 2025



## Resumo

Esta dissertação investiga a integração de Business Process Management (BPM) e Application Programming Interfaces (APIs) num ambiente existente de Robotic Process Automation (RPA), com o objetivo de potenciar as capacidades de hiperautomação numa grande organização bancária. Seguindo a metodologia de estudo de caso de Yin, a investigação adota um desenho de caso único suportado por múltiplas fontes de dados, incluindo entrevistas semiestruturadas, documentação interna e métricas geradas pelos sistemas. O estudo aplica a técnica de pattern matching para testar proposições teóricas derivadas do Business Process Reengineering (BPR), do Technology Acceptance Model (TAM) e da teoria de Socio-Technical Systems (STS).

Os resultados demonstram que a combinação de BPM e APIs com RPA melhora a resiliência dos processos, a escalabilidade e a governação, reduzindo a fragilidade operacional. Embora a introdução de camadas de orquestração aumente inicialmente a complexidade técnica, esta permite, a médio e longo prazo, um melhor controlo, monitorização e otimização de processos. As conclusões sublinham a importância de estruturas de governação robustas, estratégias de gestão da mudança e preparação das APIs para assegurar uma transformação bem-sucedida.

Esta investigação contribui para a teoria ao fornecer evidência empírica sobre como a hiperautomação orientada por orquestração suporta a escalabilidade e a resiliência, e para a prática ao apresentar um quadro de implementação estruturado, adaptável a outros contextos organizacionais complexos.

**Palavras-chave:** Hiper-automação, Business Process Management, Robotic Process Automation, APIs, Transformação Digital



## Abstract

This dissertation investigates the integration of Business Process Management (BPM) and Application Programming Interfaces (APIs) into an existing Robotic Process Automation (RPA) environment, aiming to advance hyper-automation capabilities in a large banking organization. Following Yin's case study method, the research adopts a single-case design supported by multiple data sources, including semi-structured interviews, internal documentation, and system-generated metrics. The study applies pattern matching to evaluate theoretical propositions derived from Business Process Reengineering (BPR), the Technology Acceptance Model (TAM), and Socio-Technical Systems (STS) theory.

Results show that combining BPM and APIs with RPA improves process resilience, scalability, and governance, while reducing operational fragility. Although the introduction of orchestration layers initially increases technical complexity, it enables better monitoring, compliance, and process optimization. The results underscore the essential function of governance frameworks, change management strategies, and API readiness guaranteeing an effective transformation.

This research contributes to theory by providing empirical evidence on how orchestration-driven hyper-automation supports scalability and resilience, and to practice by offering a structured implementation framework adaptable to other complex organizational contexts.

**Keywords:** Hyper-automation, Business Process Management, Robotic Process Automation, APIs, Digital Transformation



# Table of Contents

Resumo	i
Abstract	iii
List of Figures	ix
List of Tables	xi
Abbreviations List	xii
Chapter 1. Introduction	1
Chapter 2. Literature Review	5
2.1. Theoretical Background	5
2.1.1 Digital Transformation	5
2.1.2 APIs	5
2.1.3 BPM	6
2.1.4 RPA	7
2.1.5 Hyper-Automation	8
2.1.6 Theoretical Frameworks Supporting Hyper-Automation	8
2.1.7 Theoretical Foundation: The Hyper-Automation Maturity Model (HAMM)	9
2.1.7.1 The Five Maturity Levels of HAMM	10
2.1.7.2 Progress Mechanisms and Critical Success Factors	12
2.1.7.3 Practical Use: The HAMM Assessment Framework	14
2.1.7.3.1 Maturation Evaluation Scorecard	14
2.1.7.3.2 Roadmap Planning	15
2.1.7.3.3 Theoretical Implication and Future Research	15
2.1.7.3.4 Constraints and Verification Criteria	16
2.2. Related work	17
2.3. SLR Report	20
Chapter 3. Methodological Framework – Case Study Approach	25
3.1. Research Design and Justification	25
3.2. Research Protocol	25
3.3. Validity and Reliability	26
	v

3.4.	Data Collection	27
3.5.	Unit of Analysis and Context	28
3.6.	Data Analysis Strategy	28
3.7.	Ethical Considerations	29
3.8.	Summary	30
Chapter 4. Case Study		31
4.1.	Introduction and Case Study Background	31
4.2.	Unit of Analysis	31
4.3.	Theoretical Propositions	32
4.4.	Case Study Protocol	32
4.5.	Data Collection and Triangulation	33
4.6.	Analytical Strategy	35
4.7.	Rational for Single Case Design	36
4.8.	Implemented Solution	37
4.9.	Timeline of Implementation	39
4.9.1.	Planning and Evaluation	39
4.9.2.	Team Involvement	40
4.9.3.	Management and business stakeholders	40
4.9.4.	External partners and operational teams	41
4.10.	Process Selection and Risk Classification	42
4.11.	Challenges in Live Implementation	43
4.11.1.	The Rationale for Transformation	43
4.11.2.	Implementation Challenges and Metrics	44
4.12.	Connecting Findings to Theory	46
4.13.	Limitations and Reliability	47
4.14.	Summary of Finding	49
4.15.	Discussion and Alignment with Existing Literature	50
Chapter 5. Discussion		53
5.1.	Overview	53
5.2.	Interpretation of Key Findings	53
5.3.	Consequential Outcomes	54
5.4.	Analysis: Critical Trade-offs for Long-term Complexity Management Benefits	55

5.5. Contributions to Theory	56
5.6. Limitations of the Study	57
5.7. Future Research Directions	59
Chapter 6. Conclusion	60
References	62
Appendix A – Systematic Literature Review Supplement	65
Appendix B – Practical Implementation Framework	6



## List of Figures

FIG. 2.1 – Line Graph about the number of Articles retrieved grouped by year.....	20
FIG. 2.2 - Graph with the results between databases.....	21
FIG. 2.3 – Graph With the Results of the Articles Grouped by Technology Focus.....	22
FIG. 4.1 – Venn diagram about how all technologies work together of Each Technology Within the Context and Tools Used .....	37
FIG. 4.2 – Timeline of the beginning of the implementation .....	39



## List of Tables

Table 2.1 – Table of the Five Levels Maturity Characteristics, Key Indicators and Organizational Profile .....	10
Table 2.2 – Table about the correlation between the variables presented in this research .....	24
Table 4.1 – Purpose of Each Technology Within the Context and Tools Used.....	38
Table 4.2 – Table of Risk classification of each robot following company policy.....	42
Table 4.3 – Table of average execution time between before and after implementation of RPA and its average variation.....	43
Table 4.4 – Table of Comparative Complexity .....	45
Table 4.5 – Table of Complexity of each Technology implemented .....	45
Table 5.1 – Summary of Key Findings .....	54



## **Abbreviations List**

- API – Application Programming Interface
- BPM – Business Process Management
- BPR – Business Process Reengineering
- CI/CD – Continuous Integration / Continuous Deployment
- RPA – Robotic Process Automation
- STS – Socio-Technical Systems
- TAM – Technology Acceptance Model
- HAMM – Hyper-Automation Maturity Model
- GDPR - General Data Protection Regulation
- CoE - Center of Excellence
- TCO - Total Cost of Ownership
- ROI - Return on Investment
- KPI - Key Performance Indicator
- ML - Machine Learning
- AI - Artificial Intelligence



## Introduction

The concept of Digital Transformation (DT) has been connected to several key developments in society over the past few decades [1], [2], [3], [4], [5]. These include the introduction of the internet [6], [7], [8], the transition from paper-based documentation to digital notetaking on tablets, and the spread of gadgets that produce new data, like wearable technology [9], [10], which is becoming more and more popular with the public.

As DT develops, society's need for more speed, efficiency, and productivity grows [1], [11]. As new inventions continue to develop, companies are under pressure to either adapt to these technological breakthroughs or risk becoming obsolete.

At this point, it becomes essential to assess which process elements may receive help from automation and to what extent it would be suitable.

The creation of Application Programming Interfaces (APIs) is one noteworthy advancement in this regard [12]. Structured methods for accessing and sharing data that were previously unavailable or challenging to incorporate are now offered via modern APIs [13]. Consequently, the amount of data that is now accessible has increased dramatically, which has increased the focus on effective data management. Globally, it is estimated that 394 zettabytes of data would be gathered by 2028 [14].

The need for automation inside businesses is highlighted by the exponential growth in data availability and the time-consuming nature of human processing. Since human cognitive processing rates cannot meet the needs of DT, automation is a vital tool for effectively managing and analyzing large datasets.

Many automation approaches have been developed to accelerate data processing as organizations look to manage enormous volumes of data more effectively. These techniques improve the quality and consistency of data handling while simultaneously lessening the workload for human workers. Through the integration of automation tools like AI and RPA, companies may enhance their ability to structure and analyze information, leading to more insightful and better decision-making. As these technologies keep growing, a variety of opportunities for streamlining data processes become available, enhancing the viability of managing intricate datasets with little manual involvement.

Data workflows can be automated using a variety of methods [15], [16]. Artificial Intelligence (AI), for example, makes it possible to classify and arrange data in previously impractical ways, leading to new discoveries. In contrast, automatic data extraction and

processing based on pre-established criteria is made possible by robotic process automation (RPA) [17], [18]. These technologies are only a small part of the numerous options available for improving workflows in data processing.

Businesses may drastically increase productivity and cut down on processing times by integrating AI and RPA into data operations. Although bringing these technologies into practice also brings with them difficulties with data processing, content aggregation, and retrieval. Careful consideration of elements including data origin, storage location, and accessibility is necessary to ensure smooth automation. To improve the advantages of automation while preserving data integrity and usability, several factors must be taken into consideration.

Businesses may cut down on processing times and improve overall efficiency in handling massive amounts of data by using AI and RPA. Nevertheless, automation presents difficulties with data processing, content aggregation, and retrieval, much like any other technological development. The origin, storage location, and accessibility of data are key factors to consider [19].

Organizations must assess whether operations may be automated and how well automation fits with their operational goals to refine the advantages of automation. Achieving hyper-automation—a term that entails the thorough integration of automation technologies—requires this assessment. Through the systematic organization and optimization of different process steps, Business Process Management (BPM) offers chances to improve productivity and overall organizational performance [20], [21].

Businesses must carefully assess which operations may be automated and how well these technologies fit with their strategic goals to fully benefit from automation. To achieve hyper-automation, the smooth integration of several automation systems to increase efficiency, this evaluation is important. As automation advances, tools like RPA help handle ever-more complex data environments while simultaneously streamlining repetitive processes. Organizations may increase productivity and adjust to the increasing demands of contemporary systems by integrating automation with structured process management.

Since the early years of the twenty-first century, automation has gone through significant developments [22], [23]. Due to technological developments, RPA was created and has since become widely used in the market. Along with automating tasks that are often connected with BPM, RPA also helps businesses handle much higher data quantities, which is in line with the growing complexity of contemporary systems.

An enhanced method to automation that improves performance, and efficiency can be identified as hyper-automation, which combines RPA, BPM, and APIs.

This study intends to explore the ways in which hyper-automation—the incorporation of innovative technologies like APIs, BPM, and RPA—can benefit businesses by simplifying processes, increasing productivity, cutting expenses, and other concepts inside an organization.

This research is intended to answer the following questions:

- What is the hyper-automation concept?
- Is it possible to connect API, BPM, RPA to call to impact Digital Transformation?
- What are the features of all the layers mentioned that deeply impact bringing automation into an organization?



## Literature Review

### 2.1 Theoretical Background

#### 2.1.1 Digital Transformation

DT can be defined as “the transformation of business processes, procedures, capabilities, and policies to take advantage of the changes and opportunities presented by new digital technologies, as well as the impact they have on society, while always thinking about current and future trends” [24].

Although broad, this definition distinguishes DT from digitization and digitalization, which are often conflated, weakening DT’s precise meaning. For example, as described in[25]:

- Digitization is the process of converting analog information into digital formats, such as transforming paper archives into digital files. It marks the initial steps of incorporating technology but does not inherently involve transforming processes or creating new opportunities.
- Digitalization refers to the integration of digital technologies into existing processes, allowing organizations to enhance products or services, improve efficiency, and gain competitive advantages. For instance, digitalization enables companies to offer traditional services (e.g., banking) through digital platforms.

But DT is more than that; it's a fundamental change in how companies develop, run, and provide value. It serves as the basis for sophisticated tactics like hyper-automation, which combines AI, machine learning, RPA, BPM, and APIs to produce intelligent, end-to-end automation solutions.

#### 2.1.2 APIs

APIs drive digital transformation by enabling seamless system integration, fostering scalable and agile networked ecosystems.

An API is a structured method for enabling communication between computer applications over a network, typically the Internet, using a shared protocol [24] APIs operate based on predefined contracts that applications adhere to for seamless interaction.

By acting as linkages between automation tools, APIs enable businesses to:

- Improve process flexibility, enabling dynamic workflow adjustments.
- Integrate legacy and new systems, guaranteeing seamless data flow.

Because APIs offer real-time data access, they can facilitate AI-driven decision-making.

For RPA and BPM systems to communicate data seamlessly, APIs are essential. BPM offers an organized method for controlling and streamlining corporate operations, whereas RPA is excellent at automating repetitive, rule-based tasks by simulating human interactions with digital systems. By serving as a bridge, APIs enable RPA bots to connect with databases, corporate apps, and BPM platforms without depending entirely on screen scraping or user interface (UI) interactions. This connection lowers operational bottlenecks, improves automation scalability, and guarantees real-time data synchronization. Additionally, RPA may connect with numerous systems in a dynamic and context-aware way thanks to APIs, which increases the flexibility of automated operations. Although APIs improve RPA and BPM interoperability, there are certain difficulties in implementing them, especially regarding security and data protection.

When combining RPA and BPM systems, enterprises need to address the serious security flaws that APIs present, notwithstanding their advantages. If APIs are not adequately protected, they may become attack vectors since they act as gateways for data sharing. Unauthorized access, data breaches, API endpoint exploitation, and man-in-the-middle attacks are common risks that have the potential to jeopardize confidential company data. Furthermore, an insecure API might be used to obtain access to vital systems since RPA systems frequently run with elevated rights to carry out automated operations. To reduce these dangers, strong encryption protocols, rate-limiting strategies, and authentication methods (such OAuth 2.0 or API keys) must be put in place. However, since too many security measures might cause delay and decrease automation efficiency, it is important to strike a balance between assuring security and preserving API speed.

### **2.1.3 BPM**

To make sure that organizational processes are effective, efficient, and flexible enough to meet changing demands, BPM is a methodical approach to analysis, design, optimization, and monitoring. BPM systematically evaluates, optimizes, and aligns business processes with corporate objectives. Its effectiveness is amplified when combined with automation technologies like RPA. BPM is defined as:

- “Is the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities... is about managing entire chains of events, activities and decisions that add value to the organization and its customers. These ‘chains of events, activities and decisions’ are called *processes*”[25].

Process optimization and operational efficiency are improved by the potent constructive interaction that is produced when RPA and BPM are combined. BPM offers a methodical framework for overseeing business operations, guaranteeing that procedures are clear, consistent, and in line with corporate objectives. In contrast, RPA serves as an enabler, automating rule-based and repetitive operations in these processes to increase speed and decrease manual labor. They work well together because RPA automates some jobs inside these processes, providing faster execution and better accuracy, while BPM coordinates the end-to-end flow of operations. Through operational simplification without the need for extensive system redesigns, this constructive interaction enables businesses to attain increased agility. Even while this combination has many advantages, relying too much on RPA might present problems that could reduce the flexibility of BPM.

#### **2.1.4 RPA**

Although RPA works well for task-level automation, an over-reliance on it can result in inflexible process architectures that limit the flexibility of BPM. Workflows may be modified in response to changing business requirements because of BPM's ability to provide continuous process improvement. But because RPA is frequently rule-based and functions at the user interface level, modifications to underlying systems or procedures may disrupt automated workflows, necessitating regular bot maintenance. Furthermore, overuse of RPA might result in patchwork automation rather than actual process transformation, which can lead to inefficiencies in situations when end-to-end process reengineering—rather than just task automation—is needed. RPA does not naturally offer insight into more general company goals, in contrast to BPM, which improves procedures holistically. This might result in automation silos that impede organizational agility.

Beyond automating repetitive tasks, RPA enhances BPM by streamlining workflows and reducing manual intervention. RPA does more than just enhance workflows; it also removes the need for human interaction in tasks like data input and validation, customer service automation, and invoice processing and reporting.

RPA is defined by the IEEE Standards Association as:

- "A preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management" is how the IEEE Standards Association defines RPA mentioned at[26].

### 2.1.5 Hyper-automation

Hyper-automation leverages AI and ML to create adaptive, intelligent, and self-improving processes, surpassing traditional automation. Hyper-automation is more than just automating monotonous human jobs; it can also:

- Analyze processes and find possibilities for automation.
- Optimize workflows dynamically using AI-driven decision-making.
- Coordinate end-to-end automation across many departments and systems.

Automation of almost any repetitive job has progressed to the point that it can now recognize which processes may be automated and create bots to complete those activities [27].

### 2.1.6 Theoretical Frameworks Supporting Hyper-Automation

Understanding the frameworks that govern the acceptance, execution, and effects of hyper-automation is crucial as more enterprises adopt it. The effective integration of hyper-automation into corporate processes and human workflows necessitates a strategic strategy, which goes beyond just implementing innovative technology like AI, BPM, RPA, and ML. Several theoretical frameworks offer insightful information in this regard, like **Technology Acceptance Model (TAM)**, **Business Process Reengineering (BPR)**, and **Sociotechnical Systems Theory (STS)**.

An essential tool for comprehending the uptake and use of hyper-automation technologies is the **TAM**. It describes how a person's intention to adopt and incorporate automation tools into workflows is influenced by their perceived utility and usability. Since hyper-automation includes intelligent workflows, RPA, and AI-driven decision-making, it becomes essential for evaluating how businesses and workers adopt these technologies. However, it does not adequately address the structural and process-oriented changes that hyper-automation requires, even if it emphasizes user acceptability, at this point **BPR** can help close this gap.

The goal of **BPR** is to drastically increase agility, cost effectiveness, and performance. When processes are redesigned to remove duplication and take advantage of AI-driven optimization, hyper-automation flourishes. While TAM clarifies user acceptability, BPR makes sure that hyper-automation is an integral change in how businesses function rather than just a digital tool overlay. The effectiveness of process automation, however, hinges on how effectively the technological, social, and human aspects are balanced, which is where **STS** enters the picture.

Based on this, **STS** promotes a comprehensive strategy for achieving hyper-automation by highlighting the interactions among people, technology, and organizational structures. It makes sure that human elements, such staff adaptability, teamwork, and job redesign, are considered alongside technological improvements, whereas BPR concentrates on efficiency and process optimization. This viewpoint is essential as hyper-automation may create disruptions to the workforce, necessitating careful integration to improve both technological efficiency and human welfare. Thus, a full framework for the effective deployment of hyper-automation is provided by TAM for assessing user acceptability, BPR for process change, and STS for balancing socio-technical dynamics.

### **2.1.7 Theoretical Foundation: The Hyper-Automation Maturity Model (HAMM)**

Drawing upon such developed theoretical foundations, this work proposes a new model that amalgamates these theories into a workable organizational hyper-automation progression maturity model.

Academic scholarship has thoroughly covered related models of developmental maturity in business process management and automation. Tarhan, Turetken, and Reijers[28]carried out a deep systematic review of business process maturity models, tracing critical attributes and evolutionary trajectories in organizational BPM capacities[28]. Their studies furnished essential foundations for conceptualizing how organizational entities move through maturity phases in process management situations. Röglinger, Pöppelbuß, and Becker[29] also put forth theory-guided models intended for BPM maturity model developments and validations, focusing on empirical validations and adaptation requirements in contexts[29] . These seminal works represent maturity models as practical tools in organizational capability developments assessment and transformational initiatives planning.

Recent research has recognized the need to evolve established BPM maturity models in response to contemporary challenges resulting from digital transformation and hyper-automation. Koç and Gülerüz [30] individually assessed the needed evolutionary BPM maturity evaluations in the times of digital transformation, underscoring the fact "the impact of hyper-automation and the increasing pace of change require the integration of maturity assessment with the BPM implementation methodology"[31] . Their research clarifies an important gap in the existing literature: whereas customary models investigate capabilities in BPM and RPA individually, there lacks an accompanying theoretical guidance for organizations to deploy integrated hyper-automation architectures combining BPM orchestration, API integration, and selective RPA deployment. Drawing on these theoretical foundations and remedying an identified gap, this research recommends an extension of established maturity models, designed exclusively for hyper-automation settings involving integration of multiple automation technologies across aligned enterprise architectures.

From empirical findings of this case research and grounded in substantiated theoretical foundations (BPR, TAM, STS), this research proposes the Hyper-Automation Maturity Model (HAMM) - a five-phase model that illustrates organizational development along a trajectory of disjointed task automation to integral, cognitive process orchestration.

It is a new theoretical contribution that integrates findings of this case study along with established automation theory. Unlike prevalent maturity models that are primarily about technology adoption, HAMM integrates socio-technical, governance ability, and strategy alignment aspects in a manner that results in a rich organizational hyper-automation evolution model.

**2.1.7.1 The Five Maturity Levels of HAMM**

This Table 2.1 details the five levels of automation maturity, from fragmented and reactive approaches to fully autonomous and transformative operations. It highlights the Characteristics, Key Indicators, and Organizational Profile for each level, providing a clear overview of the automation evolution journey.

**Table 2.1 – Table of the Five Levels Maturity Characteristics, Key Indicators and Organizational Profile**

Level	Maturity Level
1	<b>Ad-hoc Automation (Fragmented)</b> <b>Characteristics:</b>

- Isolated Robotic Process Automation (RPA) implementations focused on addressing individual pain points.
- Lack of central governance or coordination.
- UI-dependent automations with high maintenance overhead.
- A reactive approach to process optimization.

**Key Indicators:**

- 80% of automations are standalone RPA bots.
- Average bot lifespan is less than 18 months due to system changes.
- No API strategy or integration layer.
- Incident response time for automation failures is over 4 hours.

**Organizational Profile:**

- Technology-driven initiatives without prior process analysis.
- Departmental silos with independent automation decisions.
- Limited change management and user training.
- Focus is on quick wins rather than strategic transformation.

**2 Coordinated Automation (Managed)**

**Characteristics:**

- Centralized RPA governance and standards.
- Basic process documentation and standardization.
- Introduction of simple workflow orchestration.
- Proactive monitoring and maintenance procedures.

**Key Indicators:**

- 60-80% RPA and 20-40% workflow orchestration.
- Average bot lifespan is 18 to 36 months.
- Basic API integration for 30-50% of processes.
- Incident response time ranges from 2 to 4 hours.

**Organizational Profile:**

- An established Center of Excellence (CoE) for automation.
- Cross-functional process improvement teams.
- A structured approach to change management.
- A balance between operational efficiency and strategic goals.

**3 Integrated Orchestration (Defined)**

**Characteristics:**

- Business Process Management (BPM)-driven orchestration as the primary approach.
- APIs provide most of the system integration.
- RPA is reserved for specific edge cases and exceptions.
- Comprehensive governance and compliance frameworks.

**Key Indicators:**

- 30-50% RPA and 50-70% BPM orchestration.
- Average lifespan is over 36 months.
- API coverage for 70-90% of system integrations.
- Incident response time is 1 to 2 hours, with automated detection.

**Organizational Profile:**

- A process-centric organizational culture.
- Integrated technology and business strategy.
- Mature change management with strong stakeholder engagement.
- Focus on resilience and scalability over quick deployment.

**4 Intelligent Automation (Optimizing)****Characteristics:**

- Artificial Intelligence (AI) and Machine Learning (ML)-enhanced decision-making within orchestrated processes.
- Self-healing and adaptive automation capabilities.
- Real-time process optimization based on performance analytics.
- Predictive maintenance and proactive issue resolution.

**Key Indicators:**

- Less than 30% RPA and more than 70% intelligent orchestration.
- Process self-optimization occurs in real-time.
- Over 95% API coverage with intelligent routing.
- Incident response time is less than 1 hour, with predictive prevention.

**Organizational Profile:**

- Data-driven decision-making at all levels.
- A culture of continuous learning and adaptation.
- Advanced analytics capabilities are integrated into operations.

	<ul style="list-style-type: none"> <li>• Strategic focus on innovation and competitive advantage.</li> </ul>
<b>5</b>	<p><b>Autonomous Operations (Transformative)</b></p> <p><b>Characteristics:</b></p> <ul style="list-style-type: none"> <li>• End-to-end autonomous process execution.</li> <li>• Self-governing systems with minimal human intervention.</li> <li>• Continuous process discovery and optimization.</li> <li>• Dynamic adaptation to changing business requirements.</li> </ul> <p><b>Key Indicators:</b></p> <ul style="list-style-type: none"> <li>• Minimal manual intervention in routine operations.</li> <li>• Processes automatically evolve based on business context.</li> <li>• Full ecosystem integration with external partners.</li> <li>• Real-time business model adaptation capabilities.</li> </ul> <p><b>Organizational Profile:</b></p> <ul style="list-style-type: none"> <li>• Autonomous organizational units with AI-supported decision-making.</li> <li>• A culture of experimentation and rapid adaptation.</li> <li>• Ecosystem-wide optimization beyond organizational boundaries.</li> <li>• Strategic focus on market creation and disruption.</li> </ul>

### 2.1.7.2 Progress Mechanisms and Critical Success Factors

The transition through different levels of maturity automation is defined by a non-linear and uncertain path. The process is guided by specific catalysts and requires the fulfillment of key success determinants. Organizations are forced to navigate these transition stages effectively to gain greater proficiency automation and to reduce the opportunity costs of regressing.

#### Transition Triggers Between Levels

The transition to the next maturity level results from an intersection of technical, organizational, and strategic catalysts. For transitioning from Level 1 to Level 2, these catalysts are often reactions to preexisting challenges. From a technical standpoint, having over 50% of robots in need of monthly upkeep is an indication for needing a more routine approach. At an organizational level, arguments over allocation of resources across departments force the issue of centralized management. Strategically speaking, an executive mandate toward standardization and cost reduction is often the key impetus. The success in navigating through

this stage is contingent upon the establishment of a centralized COE, strong executive sponsorship, and the creation of essential process documentation.

The movement to Level 3 from Level 2 is typically driven by a shift from task-based automation to overall process optimization. The change is technologically triggered once the maturity of APIs reaches a significant milestone, hence making integrated systems a viable option. At the organizational level, the need to optimize processes across functional areas implies a need to break down departmental silos.

The strategic imperative is often an issue of regulatory compliance or competitive forces imposing the need to improve operational resilience and trackability. Success factors at this stage include a significant bet on a strong BPM platform, the creation of a formal strategy on APIs, and the capacity to reengineer business processes efficiently. Advancing to the advanced levels of maturity from Level 3 to Level 4 is characterized by the incorporation of intelligence into automation. The technology breakthrough is initiated when an organization's advanced analytics capabilities are sophisticated enough to justify implementing ML

. The organizational impetus is the rising need to capture real-time business insight to make better decisions. Strategically speaking, high market volatility may require more adaptive behavior. This level is achieved through the establishment of robust data infrastructure and specialized AI/ML capabilities and very important to this is developing an organization culture to value and exploit advanced analytics.

Finally, the transition from Level 4 to Level 5 represents an essential evolution toward truly autonomous operating. This technical advance is achieved through an overarching level of ecosystem integration to support automated behavior across the entire process. Organizationally, the focus shifts from optimization within the internal environment to a broader-based awareness of the full business ecosystem. Strategically, the change is motivated by the desire to become market leader through outstanding operating performance and the ability to dynamically change the business model. Keys to success include developing trust in autonomous systems, establishing strategic collaborations across the ecosystem, and implementing a form of governance adaptable and dynamic enough to change in response to advancing technology.

**Regression Risk Factors** Despite the obvious trajectory towards maturing, each subsequent level of maturity is vulnerable to certain unique risks that may induce an organization to reverse course. For Level 3, over-reliance on advanced orchestration in the absence of adequate governance may induce "orchestration sprawl," a state like the fragmented and ungovernable condition at Level 1 in the form of ad-hoc RPA. For organizations at Level 4, the greatest risk

is release of AI/ML technologies in the absence of adequate data governance and inducing erratic behavior and a return to less advanced but controllable paradigms of automation. Finally, at Level 5, in applying autonomous systems, risk is entailed in taking decisions in violation of quickly changing strategic goals and possibly inducing a re-imposition of intensive human oversight and an effective regression to an earlier level of maturity.

### **2.1.7.3 Practical Use: The HAMM Assessment Framework**

To traverse the path of maturity in automation in an efficient manner, organizations require a systematic framework to plan and evaluate. The Holistic Automation Maturity Model (HAMM) is one of these frameworks and offers a formal method of finding the present state of an organization and how to design a strategy to achieve advanced levels. The framework consists of two fundamental constituents: a Maturity Assessment Scorecard and a Roadmap Planning Tool.

#### **2.1.7.3.1 Maturation Evaluation Scorecard**

The Maturity Assessment Scorecard provides a quantitative method to measure the current state of automation maturity in an organization. The scorecard assigns a weighted score over four critical dimensions to enable an in-depth evaluation. **Technical Architecture** is the largest at 40%, reflecting the critical nature of technology. It considers the balance between RPA and orchestration, coverage of API, system integration complexity, and support associated with maintaining automation.

Next is **Governance & Process Management**, accounting for 25% of the total score. This is an indication of the depth of process documentation, maturity of change management practices, strength of compliance framework, and sophistication of performance monitoring. **Organizational Capabilities** have a weight of 20% and is related to the human and cultural dimensions. The degree of effectiveness in cross-functional collaboration, the skills and training in automation that exist, the strategic alignment of the automation projects, and the culture of improvement are in here. Finally, **Strategic Impact** has a weight of 15%, and it is an indication of direct results in the business. This is in terms of business value realization, creation of competitive advantage, empowerment of innovation, and level of ecosystems integration.

#### **2.1.7.3.2 Roadmap Planning**

Tool Based on the evaluation results, HAMM's Roadmap Planning Tool allows organizations to develop a strategic and executable plan for their automation advancement. This tool helps in the Definition of Target Level by aligning automation ambitions with the overall strategic objective of the organization and its readiness to transform. Then it facilitates the

achievement of the Definition of Transition Requirements, defining the specific technical, organizational, and governance requirements needed to transition to a next level.

Additionally, the tool helps in Estimating the Timeline and Resources needed for the transformation by using empirical evidence from other similar successful implementations to create reliable estimates. The tool is equally important in the context of Establishing Success Metrics, such as level-specific KPIs and progression indicators that will be used to track progress effectively. Finally, the tool is essential in Planning Risk Mitigation by anticipating and remediating the typical regression causes and implementation challenges that threaten to derail the automation journey.

### **2.1.7.3.3 Theoretical Implications and Future Research**

The HAMM is not only an enriched practical tool but a key theory contribution in automation and digital transformation. Through analyzing the intricate dynamics of the evolutionary process of automation, the HAMM expands established knowledge and finds new directions for future academic investigations.

#### **Progress to Established Theory**

The HAMM adds to existing maturity literature by bringing in socio-technical perspectives. Different to technical-only models, the HAMM recognizes **human and organizational factors** as key drivers to productive progress. Further to this, the model is supported by **empirical proof**, using an experiential case study in preference to speculative theory. Finally, the HAMM offers a **predictive capability**, such that organizations may anticipate prospective problems and requirements necessary to reach high levels of maturity.

Drawing upon the insights gleaned from the HAMM, several research hypotheses may be established for subsequent verification.

**Proposition A:** Organizations attempting to adopt maturity levels in skips (i.e., skipping from Level 1 to Level 3) will tend to have higher failure rates and regression risk compared to organizations adopting sequentially.

**Proposition B:** The optimum allocation of investments to technical, governance, and organizational capabilities depends on the maturity level. Earlier stages may even require an addition of more emphasis on governance investments, while higher levels entail more allocation on advanced technical sophistication.

**Proposition C:** The industry environment has a strong bearing on the best target maturity level. Highly regulated industries (e.g., finance and healthcare) might need at least at or above

Level 3 maturity, while dynamic industries (e.g., tech and retail) might derive the greatest value at Levels 4 and 5.

Tool Based on the evaluation results, HAMM's Roadmap Planning Tool allows organizations to develop a strategic and executable plan for their automation advancement. This tool helps in the Definition of Target Level by aligning automation ambitions with the overall strategic objective of the organization and its readiness to transform. Then it facilitates the achievement of the Definition of Transition Requirements, defining the specific technical, organizational, and governance requirements needed to transition to a next level.

Additionally, the tool helps in Estimating the Timeline and Resources needed for the transformation by using empirical evidence from other similar successful implementations to create reliable estimates. The tool is equally important in the context of Establishing Success Metrics, such as level-specific KPIs and progression indicators that will be used to track progress effectively. Finally, the tool is essential in Planning Risk Mitigation by anticipating and remediating the typical regression causes and implementation challenges that threaten to derail the automation journey.

#### **2.1.7.3.4 Constraints and Verification Criteria**

One should be conscious of the limitations of the HAMM in its present form to signal key areas of future research to enhance its robustness and usability.

##### **Present Restrictions**

The fundamental limitation of the HAMM is in its single-case validation, possibly limiting the usability of it in multiple contexts. The **industry specificity** is another problem in the sense that the developed model in the context of a banking industry might need to be adapted in other industry contexts. Finally, there are certain **temporal limitations**, in the sense that the paths to Levels 4 and 5 are presently theory-based and not evidence-based.

##### **Prospective Validity Criteria**

To transcend these limitations in the future, several validation dimensions are required. Adopting **multi-case studies** is paramount in validating the HAMM in various organizational and sectoral contexts. Adopting longitudinal studies is required in tracking organizations over time as these organizations go through multiple transitions in maturity levels. Quantitative validation is required in developing statistical models to connect maturity levels and measurable results in business directly. Finally, **cross-cultural validation** is required in validating the framework in the diversified cultural and regulatory environments across the globe.

## 2.2 Related work

A Systematic Literature Review (SLR) is a methodical, transparent, and repeatable approach to finding, assessing, and summarizing previous research on a particular subject. An SLR adheres to a defined approach, which ensures rigor and minimizes bias, in contrast to a narrative literature review[32]. According to Moher[33], the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) technique is often used for conducting systematic literature reviews (SLRs) in a variety of domains.

This SLR's main goal is to thoroughly examine how modern technologies like APIs, BPM, and RPA interact with one another in the context of hyper-automation. This investigation aims to answer important research questions, identify knowledge gaps, and spot patterns that might direct further research and real-world applications by methodically examining peer-reviewed literature.

This study performed an SLR across IEEE, ACM, Science Direct, and Web of Science to guarantee thorough analysis. These databases were chosen because they provide extensive coverage of studies in business technology, engineering, and computer science.

A multi-layered keyword strategy was used to find studies on hyper-automation, RPA, BPM, and APIs. While the exclusion criteria weeded out non-academic and non-English publications, the inclusion criterion guaranteed high-quality, peer-reviewed materials. Comprehensive search strings were constructed using keywords and Boolean operators:

Based on this group of keywords, the search string used was (("Digital Transformation" OR "Business process automation" OR "Digital process automation") AND ("Data" OR "Application Programming Interface" OR "APIs" OR "API") AND ("Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA") AND ("Business Process Management" OR "BPM")).

Keyword Group Rationale:

Group 1 - Business Automation Context: Encompasses the entire scope of process automation and digital transformation within which hyper-automation projects fall.

Group 2 - API Integration Layer: It identifies data integration studies and API-centric system connectivity, which are fundamental in automation architectures that are orchestrated.

Group 3 - RPA Technology Layer: Covers terms surrounding robotic process automation and intelligent process automation to support conversations based on task-level automation.

Group 4 - BPM Orchestration Layer: Aspires to find process-centric automation methods through targeting business process management writings.

This complex framework of Boolean helped to identify studies wherein convergence of such technologies was an area of interest, as opposed to studies involving individually disjointed elements, thus catering to research focus on integrated hyper-automation strategies.

Relevance and quality were ensured by defining this inclusion and exclusion criteria defined below:

1. Inclusion Criteria:

- a. Peer-reviewed journal articles and conference papers.
- b. Published between **2019-2025** (the result of this distribution is shown in Fig.2.1).
- c. Studies focusing on **APIs, BPM, RPA, and hyper-automation**.
- d. Empirical studies, theoretical frameworks, or case studies.

2. Exclusion Criteria:

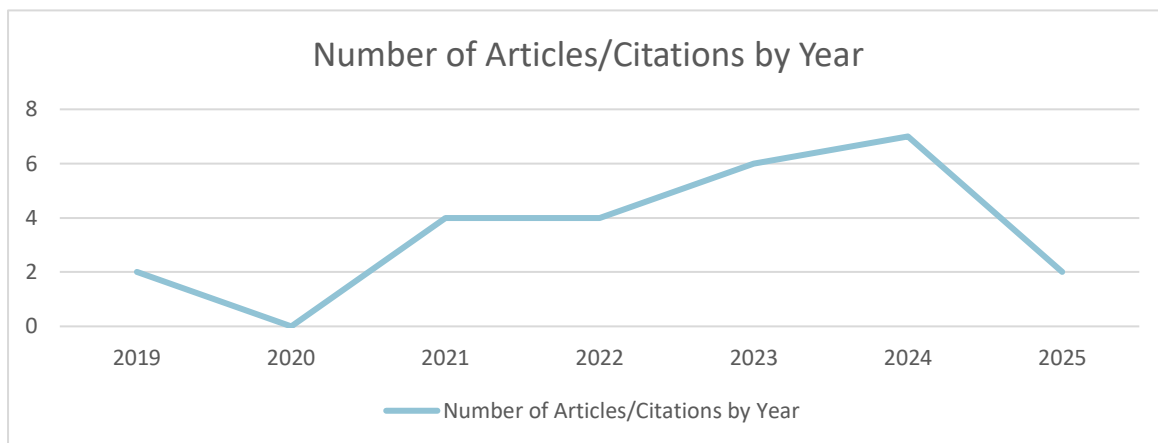
- a. Non-peer-reviewed sources like white papers, blog posts websites and so on.
- b. Studies focusing on **only one** technology without discussing integration.
- c. Non-English publications.

This section makes the search process transparent by going into detail about the databases, keywords, and filters that were utilized.

The SLR offers a robust framework for this study, guaranteeing that the conclusions are supported by the available data while presenting fresh perspectives on how hyper-automation propels digital transformation. To ensure accuracy and consistency, a systematic approach was followed during the selection process.

Titles and abstracts were evaluated for relevancy using the predetermined inclusion and exclusion criteria once the initial search results were retrieved. The selection of studies for the review was then completed by full-text reviews. To organize references and expedite the process, Mendeley was utilized.

A quality evaluation approach was used to make sure the studies included were valid and dependable. Each study was assessed using criteria including methodological rigor, relevance to the research issues, and the reliability of the sources. The final analysis did not include studies that did not satisfy the minimal quality level. This section provides a detailed description of the evaluation procedure, guaranteeing that the SLR's conclusions are supported by excellent research.



**FIG. 2.1 – Line Graph about the number of Articles retrieved grouped by year**

Key information from the chosen studies was methodically gathered using a consistent data extraction methodology. Fields like publishing details, study aims, techniques, findings, and conclusions were all included in the template. This stage made sure that all pertinent data were recorded for later synthesis by using a uniform methodology. Finding trends, gaps, and patterns in the corpus of current knowledge is based on the retrieved data.

The results were divided into major categories, including how APIs are integrated, how BPM functions in digital processes, and how RPA affects organizational effectiveness. Trends and patterns were found, indicating both the gaps where more study is required and the areas where hyper-automation technologies have been used successfully. The findings and their ramifications are thoroughly discussed in this section.

Building on these findings, the discussion interprets the results in the context of existing research, analyzing how APIs, BPM, and RPA collectively drive hyper-automation. Insights from various industries and situations are compared, highlighting both achievements and difficulties. The findings' practical ramifications are also examined, providing advice for businesses looking to implement hyper-automation techniques.

Key studies informed this research. Van der Aalst[34], established process mining and BPM orchestration foundations, while Aguirre and Rodriguez[35], documented RPA's operational limitations in isolation. Dumas[25] provided BPM frameworks that informed the tri-layered architecture proposed herein. These works motivated the integration focus of this thesis.

The database search identified 245 records, reduced to 50 full-text articles through PRISMA screening. Snowballing techniques applied to 20 qualifying articles identified 14 additional papers, totaling 34 for detailed analysis. Nine papers were subsequently excluded as they focused solely on RPA without addressing the integration aspects central to hyper-automation. The final synthesis comprises 25 publications directly examining BPM, API, and RPA integration strategies.

### 2.3 SLR Report

The systematic search across the four databases (IEEE, ACM, Science Direct, and Web of Science) initially identified 245 records. After removing duplicates and applying the inclusion/exclusion criteria to titles and abstracts, 50 full-text articles were assessed for eligibility. Following full-text review and quality assessment, 20 articles were included from the database search. An additional 14 articles were identified through snowballing techniques (backward and forward citation tracking), resulting in a total of 34 papers for detailed analysis.



FIG. 2.2 - Graph with the results between databases

However, during the synthesis phase, it became evident that 9 of these papers, while meeting the initial inclusion criteria, focused predominantly on isolated RPA implementations without adequately addressing the integration aspects central to this research—specifically, the interplay between BPM, APIs, and RPA in hyper-automation contexts. These papers contributed limited insights to research questions and theoretical framework development.

Analysis reveals RPA as the dominant technology in the final synthesis of 25 publications, with 17 studies (68%) emphasizing its capacity to reduce manual workload and enhance process efficiency (Fig. 2.3). Singh[26] and Kavitha[27] provide empirical demonstrations of RPA's effectiveness in task automation while revealing scalability challenges that emerge in complex organizational environments.

The synergy between RPA and BPM is well-documented in the literature. Dumas[25] establish foundational BPM orchestration theory, while empirical studies by Aguirre and Rodriguez[35] validate that BPM-RPA integration addresses the brittleness of standalone RPA deployments. Fourteen articles (56%) examine this RPA-BPM integration, confirming the necessity of orchestration layers for enterprise-scale automation.

However, APIs remain significantly underexplored despite their critical integration role. Only 2 articles (8%) substantively examine API-driven automation strategies. This gap is particularly noteworthy given that Jacobson[24] provide comprehensive API strategy frameworks and Mendling[36] discusses process integration methodologies, yet few studies connect these to hyper-automation architectures.

This disparity may reflect APIs being perceived as technical infrastructure rather than strategic automation enablers, or API research residing primarily in software engineering rather than BPM literature. Correlation analysis (Table 2.2) confirms these patterns. The positive correlation between RPA and BPM (0.46) reflects their frequent co-occurrence in automation strategies.

Conversely, APIs show weak correlation with RPA (0.05) and negative correlation with BPM (-0.49), indicating research isolation. The strong negative correlation between APIs and hyper-automation (-0.87) suggests API-driven automation remains underutilized in integrated automation research, representing a critical gap this thesis addresses.

This SLR concludes by emphasizing that organizations must implement an integrated approach combining BPM for process orchestration, RPA for task automation, APIs for system integration, and AI for intelligent decision-making to fully realize hyper-automation benefits. Fragmented approaches risk inefficiencies and limited strategic impact.

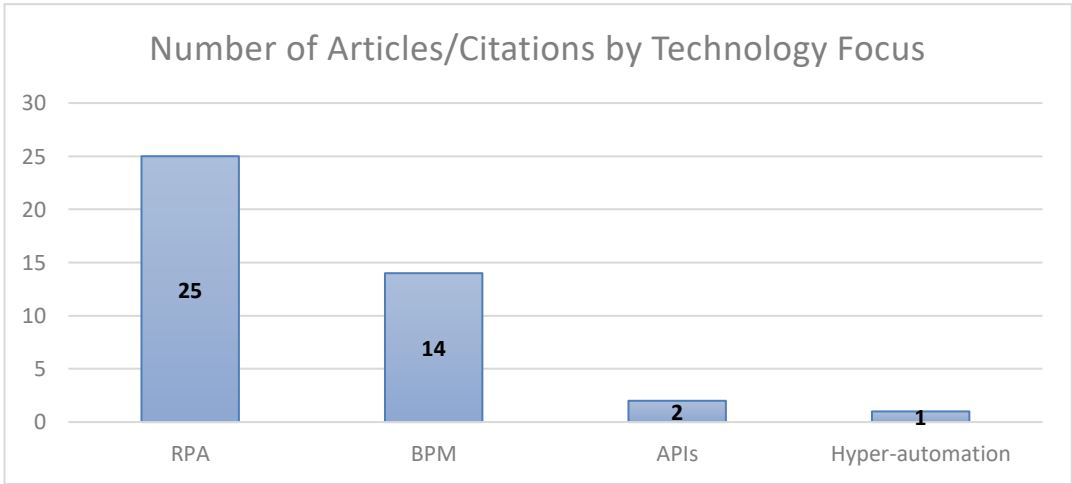


FIG. 2.3 – Graph With the Results of the Articles Grouped by Technology Focus

## 2.4 Synthesis and Discussion

The synthesis reveals RPA as the dominant theme (21 of 25 articles), frequently combined with BPM (14 articles). However, APIs are notably underexplored, appearing in only 2 articles despite their integration role, highlighting a significant research gap (Fig. 2.3).

This correlation values inserted on Table 2.2 were obtained by statistical analysis of the articles retrieved on SLR search that have some content of the topics Hyper-automation, RPA, BPM and APIs. The values indicate how strongly and in what direction two topics are related. Each value represents the correlation coefficient, which quantifies the degree of association between the corresponding topics.

The Pearson correlation coefficient ( $r$ ) is the most common way of measuring a linear correlation. It is a number between  $-1$  and  $1$  that measures the strength and direction of the relationship between two topics.

These results are further supported by the correlation analysis. The moderate correlation (0.46) between BPM and RPA suggests that they are frequently considered together. The modest association (0.04598) between RPA and APIs, on the other hand, indicates that API-driven automation is not yet a primary area of study. The idea that companies may still be underusing APIs for scalable automation is further supported by the significant negative correlation ( $-0.87039$ ) between APIs and hyper-automation, which points to a research need.

Negative correlations indicate that as one variable increases, the other tends to decrease. In this case:

- APIs and BPM have a correlation of  $-0.49159$ , meaning that API appears in articles that do not mention BPM there. This could often mean that the connectivity of both these topics is more difficult than what was supposed to be because of the lack of some middle layer between them.
- APIs and Hyper-automation has the correlation of  $-0,8703$ , meaning that only one study is about Hyper-automation and it was not mentioned there something about connecting to API, but in that particular article was mentioned that IoT was a key point when it was talking about hyper-automation, so it seems even with the development of APIs, that topic is not totally approached when it comes to hyper-automation.

Most of the research focuses on RPA's contribution to operational efficiency, highlighting how it affects process accuracy and speed. These studies also demonstrate how BPM and RPA work together to orchestrate automation operations. Although APIs and Hyper-automation are not addressed together, the RPA-focused studies always emphasize the value of data integration, suggesting that APIs are an important—even sometimes disregarded—aspect of Hyper-automation.

This SLR concludes by emphasizing that companies must implement an integrated approach that includes the following to fully profit from hyper-automation:

- Using BPM to optimize processes
- RPA for automating tasks
- APIs for system interaction and interoperability
- Using AI to make wise decisions

A strategic integration of these technologies enhances productivity, flexibility, and innovation, while fragmented approaches risk inefficiencies and limited impact.

**Table 2.2 – Table about the correlation between the variables presented in this research**

	<i>RPA</i>	<i>BPM</i>	<i>APIs</i>	<i>Hyper-automation</i>
RPA	1			
BPM	0,463672	1		
APIs	0,04598	-0,49159	1	
Hyper-automation	0,440225	0,585145	-0,87039	1

This correlation, presented in Table 2.2, shows that even some concepts that exist in a large amount of time still have uncertainties and problems making the key connecting points between technologies that exist already. This correlation itself shows even, working in a concept that is increasing exponentially as we progress more into a digital world, the concept of increasing efficiency and automation is still lacking in showing the real value of connecting these technologies, giving this research the possibility to be more useful since it displays an example of inter-connection of realities that we already know prior existed like RPA, APIs and BPM.

## **Methodological Framework – Case Study Approach**

### **3.1. Research Design and Justification**

This thesis utilizes a case study research design; a design choice purposefully aligned with the research questions raised by the research. Following the wide-ranging recommendations made by Yin[37] case study approach was found to be the best approach because it will allow a deep and rich investigation of a complex socio-technical phenomenon in its proper contextual setting.

This kind of approach is especially suitable in researching complex integration of BPM and APIs with an in-place RPA infrastructure because it makes it possible to reveal dynamic interrelations of technology, organizational processes, and human aspects.

Other research methods, like wide-ranging surveys or controlled experimental structures, were evaluated and deemed less fitting. While a survey can potentially gather a great amount of quantitative data, it does not sufficiently capture the rich contextual nuances and probing of "how" and "why" questions that are at the root of this research.

Similarly, it would be impractical and contrived in a real organizational work environment to conduct a controlled experiment, since organizational and technological modifications could ensue and cause considerable disruption. A single-case study was considered suitable because it qualified as a critical case, as subsequently defined by Yin.

Being one of the major regulated financial institutions that boast a substantial history of investment in automation, this firm provides a good case scenario to test the theoretical postulations made in this work. The sheer depth of transformation, coupled with high risks that are normal in a regulated environment, provided a peculiar chance to test whether orchestration and integration could work well to offset organizational vulnerabilities and governance concerns that come with a pre-existing automation ecosystem.

### **3.2. Research Protocol**

To guarantee that research was transparent and reliable, the research was conducted in compliance with a meticulously created research protocol—an organized plan that regulated each step of the research. The protocol, created in accord with recognized case research guidelines, fulfilled two chief roles: it guaranteed consistency of methods and generated a clear evidence chain in support of results of the study. Its major parts consisted of:

- **Statement of Research Questions and Theoretical Propositions:** The crucial preliminary stage judiciously identified the scope of the research, so that every attempt at data collection and data analysis was perfectly focused at answering the paramount research concerns as much as testing the theoretical propositions.

- **Defining Units of Analysis:** The protocol also clearly defined applicable units of analysis in terms of case, such that organizational transformation program stood at the highest level of analysis while processes, technologies, and stakeholders stood as subordinate-levels. The clarity of this enabled both data collection and data analysis at suitable degrees of detail.

- **Definition of Data Sources:** The agreed protocol also specified a set of data sources to be employed, like qualitative interviews, internal documents, and quantifiable system measures. This defined approach was also central to data triangulation; a pillar of the study design aimed at maximizing construct validity.

- **Development of a Systematic Framework:** The protocol developed a systematic, stepwise approach of data collection and analysis. The systematic design contained distinct guidance to administer the study, therefore guaranteeing that a replicable as well as transparent procedure was pursued.

### 3.3. Validity and Reliability

According to the model conceived by Yin[37], this study, in a systematic approach, performed four significant design tests to validate the rigor and credibility of results. The tests were executed with methodology interventions that served to enrich the ultimate validity of research.

- **Construct Validity:** The initial priority was to establish construction validity, which entailed establishing that measures applied in operations in this study reflected accurately what was under investigation. The latter was attained by data source triangulation. The study vigorously substantiated results drawn from semi-structured interviews (gaining perceptions and motivations), internal project records (which consisted of official documents and strategic justification), and quantitative system data (which consisted of empirical evidence and measures of performance), and therefore established a sound, multi-dimensional foundation upon which it made its inferences.

- **Internal Validity:** Internal validity concerns establishing causal connections between empirical findings and theoretical propositions. The research achieved this by two major methods. First, theoretical propositions served as pre-determined frames that, at the outset, both influenced data collecting as well as data analysis processes. Second, in the case study research, pattern matching as a systematic approach of comparing observed case study results with expected ones by theoretical propositions was used to develop a justified chain of evidence.

- **External Validity:** External validity, or generalizability, is a theoretical limitation of single-case studies. Insofar as-focus at the single-case, in-depth level works against statistical generalizability, it does work in favor of analytical generalizability. The research results are grounded firmly in established theory foundations—BPR, TAM, and STS. Capitalizing upon such entrenched theory and providing empirical support, the research gives other researchers a foundation upon which to test its propositions in differing settings.

- **Reliability:** The integrity of the study's reliability was upheld by following a comprehensive research protocol and ensuring meticulous documentation. This structured protocol acted as a framework for the complete research endeavor, delineating the formulation of research questions, identification of data sources, and systematic approaches for data collection and analysis. By implementing this organized methodology, the procedures of the study are clearly articulated, thereby allowing other researchers to reproduce the findings of the investigation.

### 3.4. Data Collection

It employed mixed-methods design, combining qualitative and quantitative research paradigms to permit a thorough and systematic analysis of organizational transformation. This deliberate choice of methodology enabled rich qualitative analysis of rich, complex socio-technical dynamics, while simultaneously underpinning key results with empirical evidence.

Qualitative Data: Semi-structured interviews (n=9) were completed with varied key stakeholders such as IT professionals, business professionals, project managers, and external experts. The protocol of interviews was structured in such a manner to directly address transformation motivations (referencing Proposition 2), novelty of new platform use, and difficulties felt in transitioning (referencing Proposition 3).

**Quantitative Data:** System-generated metrics provided objective evidence supporting qualitative findings. Essential metrics included bot decommissioning rates (measuring transition away from standalone RPA), complexity scores and processing times (evaluating initial complexity increases and subsequent efficiency gains), and architectural metrics (assessing new platform scalability and maintainability compared to legacy systems).

**Documentary Data:** Internal project documents also acted as a stand-alone primary data source, yielding sound descriptions and history. The following items were included:

**Strategic validation documents with general goals** (validating Proposition 2).  
**Architecture diagrams of new platform design** (for instance, in support of Proposition 1) and  
**Performance/risk reports and project documents** that document pivoted occurrences and areas of trouble.

### **3.5. Unit of Analysis and Context**

The unit of analysis of this case study is the organizational transformation program focused on the firm's automation ecosystem. Specifically, processes and workflows that are undergoing strategic transition from island-style RPA-only deployments to end-to-end architectures that are orchestrated by BPM- and API-based architectures.

This environment matters to this paper's theory propositions because, as a large organization in a highly regulated arena, it provides a crucial environment in which operational excellence moves beyond efficiency goals to become regulatory mandates. In such environments, automation settings must also grapple with always-on imperatives of resilience, compliance, and scalability—considerations that directly map onto key benefits posited in this paper propositions.

### **3.6. Data Analysis Strategy**

The first data analysis procedure was focused on comparing patterns, a procedure valued by Yin[37] in case studies. The procedure involved comparing empirically recognized data patterns against data patterns anticipated by theory due to presumptions of a study, determining to what extent observations of data support theoretical predictions.

To implement this approach, an in-depth, stage-by-stage analysis was followed:

**Pattern Detection of Theories:** Theoretical patterns were clearly defined in accordance with propositions of studies. For instance, it was hypothesized that orchestration layer inclusion would yield a) decreased fragility in operations (in line with BPR), b) higher user adoption-driven perceived usefulness (in agreement with TAM), and c) required short-term increases in complexity (embodying principles of STS).

**Empirical Pattern Analysis:** Systematic interrogation of collected data was then conducted to reveal empirical patterns by analyzing interview transcripts with deductive coding, document review for evidence of process redesign, and analysis of system metrics yielding objective measures.

**Cross-Validation and Pattern-Matching:** The ultimate step was that of triangulation, in which evidence systematically was combined across all three data sources. Through cross-validation of identified patterns, the research established a robust chain of evidence, substantiating theoretical patterns and drawing robust, defensible conclusions.

### 3.7. Ethical Considerations

It was a guiding principle in this research to keep ethical rigor intact. The research adhered to university ethics guidelines of human participant studies, incorporating maximum integrity and responsibility standards.

**Informed Consent and Voluntary Participation:** The participants willingly participated, with pre-existing informed consent. The participants received explicit, detailed descriptions of the purpose, nature of participation, and data use in this work. They were also made explicit about having a right to withdraw without punishment.

**Data Anonymization and Confidentiality:** In a bid to ensure confidentiality and safeguard organizational and personal identity, personal identifiers were anonymized. The data was also made secure using password protection and made accessible only to the research team.

**Confidentiality of Internal Documents:** Internal documents were treated as documents of high confidentiality. A proper agreement was established with the organization so that the information will be used solely for academic purposes and will not be distributed outside.

### **3.8. Summary**

This methodology chapter outlines the rationale, design, and procedures that underline this research project. Adopting a single-case study design as per the robust guidelines of Yin [37], this research was particularly well-suited to reveal a rich analysis of a complex real-world concern that a sole quantitative or survey design could not robustly reveal.

Methodological robustness was also guaranteed by explicit data triangulation adoption across qualitative interviews, documentations, and quantitative measures—boosting construct validity and guaranteeing inferences in this study are grounded in strong evidence convergence. Compliance with a structured research protocol in every step of the design, data collection, and analysis work facilitates reliability and accountability in adopted processes.

Once such sound methodological foundations are in place, the following chapter will direct emphasis away from research design and toward empirical data, revealing results yielded by this foundation and paving avenues toward later critical evaluation.

## Case Study

### 4.1. Introduction and Case Study Background

This chapter presents the case study conducted to examine how integrating BPM and APIs into an existing RPA environment can advance hyper-automation goals. The focus is a large banking organization with high digital maturity, which strategically decided to transition from fragmented, task-level automation to a holistic orchestration architecture. Following Yin[37], the study investigates this transformation within its real-world context to understand the interplay between technology, process redesign, and organizational strategy.

Additionally, to improve its operations, the company showed a strong desire to reconsider and restructure current procedures. An appropriate environment for studying and implementing more complex integration and orchestration concepts was established by the combination of earlier automation expertise, the availability of supporting technology, and a strategic vision in line with digital transformation.

Based on all these assumptions, this case study aims to (i) understand the architectural evolution from RPA to orchestrated solutions, (ii) evaluate performance and risk trade-offs, and (iii) assess stakeholder perceptions during the transition. Also, this study is focused on a single exploration case study following which is described in Yin analysis.

### 4.2 Unit of Analysis

Based on this information, the unit of analysis of this case study is the transformation program, that occurred in company with some presence with the financial sector, that aimed to migrate from a fragmented RPA-based automation landscape to an integrated hyper-automation architecture combining BPM, APIs, and a selective RPA within the Operations and IT departments of the organization. This focus captures both sides, the technical implementation and the strategic organizational dynamics driving the transformation.

Also, this study includes orchestrated processes, system-level integration, and revised governance models. It captures both technical implementation and strategic rationale.

### 4.3 Theoretical Propositions

This study was guided by three theoretical propositions; each directly rooted in established theoretical frameworks to provide a robust foundation for the investigation.

**Proposition 1:** In contrast to RPA standalone solutions, BPM in conjunction with APIs increases scalability whilst reducing operational fragility. This is **based on BPR** that advocates fundamentally rethinking and radically restructuring processes to reap tremendous benefits. The shift toward standalone RPA inflexibility is being replaced by an integrated BPM and API paradigm that focuses on flexible scalability and is process-centered, not inflexibly task-based.

**Proposition 2:** Hyper-automation initiative enhances the alignment of the organization's strategic objectives with operational procedures. This **TAM based assertion** hinges on the notion that hyper-automation's perceived value directly correlates to its effective adoption. Stakeholders tend to adopt integrated platforms and technologies when these platforms are perceived to be beneficial, thus allowing operational improvements to seamlessly align with the organization's strategic goals.

**Proposition 3:** The use of orchestration platforms increases complexity in the short term but enhances visibility, maintainability, and governance long term. The connection of the technological (technology, tools) and social (people, culture, processes) aspects are the **focus of the STS theory**. The long-term advantages of improved visibility and governance show a successful co-evolution, where the integrated system gradually becomes more resilient and controllable, even though the early deployment of orchestration platforms may provide difficulties for the social subsystem.

### 4.4 Case Study Protocol

Following Yin's framework[37], a structured case study protocol was meticulously applied to ensure methodological rigor, consistency, and replicability throughout the research. This protocol was instrumental in guiding the investigation and ensuring that the findings were robust and credible. The key components of this protocol included:

**Research Questions and Theoretical Propositions:** The preliminary step in the protocol's procedure was to identify the gaps in the previous portions and articulate the research questions and theoretical propositions relevant to those gaps. This step was crucial for narrowing the focus of the study because all the data collected and analyzed, including exploratory data, was driven by the research goals.

**Multiple Data Sources for Triangulation:** Use of in-depth interviews, organizational documents, and direct observation of the technology adoption process enabled the researcher to achieve triangulation. The interviews, organizational documents and direct observation of the process formed multiple data sources. Using diverse sources of data increases the validity and the reliability of the findings. Patterns emerging from data collected from multiple sources are far more dependable than those obtained from a sole source.

**Pattern Matching as the Analytic Strategy:** The primary analytic strategy was **pattern matching**, where the patterns observed in the case study data were compared with the patterns predicted by the theoretical propositions. For example, the study sought to identify if the initial period of platform implementation aligned with a phase of increased complexity, followed by a subsequent period of enhanced governance and visibility, thereby corroborating the third Proposition.

**Justification for a Single-Case Design:** This research focuses on a singular-case design, studying one organizational transformation program between January 2025 and May 2026. Although the transformation initiative is ongoing and extends beyond this period, the 17-month observation window captured the critical implementation phases necessary for rigorous analysis. This deeply focused analysis of one case during this defined period allowed rich theoretical insights to be derived instead of relying on multiple cases.

**Boundaries of the Study:** This research describes a focused analysis bounded by a singular organizational transformation program. The temporal boundaries span from January 2025 to May 2026, capturing the foundational and scaling phases of an ongoing initiative. While the transformation continues beyond the study period, this 17-month window encompasses the crucial technologies, organizational units, and personnel directly impacted by the initial transformation, providing sufficient data for meaningful analysis.

## 4.5 Data Collection and Triangulation

The accuracy and rigor of the findings were achieved with systematic triangulation for data collection. With this approach, data was collected from three different sources, which is the minimum required for cross-verification and suffices for drawing a more reliable conclusion about the case study.

**Qualitative Data:** Semi-structured interviews (n=9) were conducted with internal IT leaders, business stakeholders, and external consultants. The interview protocol was designed to directly address the study's theoretical propositions. Questions focused on the motivations behind the hyper-automation initiative (linking to Proposition 2), perceptions of the new platforms' usefulness, and the challenges experienced during the transition (linking to Proposition 3). The qualitative data provided a rich narrative, capturing the human and organizational context of technological changes.

**Quantitative Data:** System-generated metrics provided objective evidence to support the qualitative findings. These metrics included both decommissioning rates, which served as a measure of the transition away from standalone RPA (supporting Proposition 1). Complexity scores and processing times were tracked to evaluate the initial increase in complexity and subsequent long-term efficiency gains (supporting Proposition 3). Moreover, architectural metrics were employed to evaluate how new platforms compared to the legacy systems in terms of scalability and maintainability.

**Documentary Data:** Internal documents served as a distinct and important primary source of data by providing a reasonable description and reference to the interviews and metrics, as well as offering a history. This included strategic validation documents, which contained the overarching goals and were designed to validate Proposition 2, architecture diagrams detailing the new platform's design which supported Proposition 1, and performance and risk reports alongside some project documentation that officially captured the project's pivot points and problem areas.

The integrative construction of these data strands significantly enhanced the methodological rigor of the study. The verification of construct accuracy, for example, evaluating stakeholder perceptions against project goals and objective system metrics, enhanced construct validity and reliance on the triangulated data to establish the observed patterns and conclusions. The study outcomes were the result of a robust synthesis of multiple, diverse perspectives that, when considered in totality, formed an undeniable convergence of evidence.

## 4.6 Analytical Strategy

The primary method of analysis used was pattern matching, a classic of the case study approach, in that empirical patterns in the data were compared in a systematized way with the patterns postulated by the study's theoretical propositions. That approach was chosen to achieve a rigorous and systematic basis on which to make causal inferences from the single-case design of the study. The analysis proceeded in terms of three central dimensions:

**Phases of Implementation:** The analysis methodically examined the results across different project phases: the early pilots where the first complexity and learning curves were most prominent; the mid-stage orchestration that revealed the coming together of the platforms and first indicators of the advantages that would accrue; and the ultimate decommissioning of legacy systems that verified the long-term maintainability and governance savings. The phased approach was important in uncovering temporal causal links, learning cycles, and portraying how the results changed in the long term.

**Stakeholder Perspectives:** The analysis of the data also compared perspectives between the main stakeholder groups, i.e., business, and technical areas. By comparing the business user and IT leader perspectives, the study could establish whether the hyper-automation initiative was successful technically and organizationally, a necessity guided by STS thinking. The comparison of the perspectives served a central purpose of validating through triangulation and of achieving a whole picture of the effect of the program.

**The use of pattern matching** enabled the direct testing of the study propositions. For instance, observance of greater collaboration and increased data visibility from the mid-stage of the orchestration phase was regarded as a pattern that matched the long-term advantages anticipated from Proposition 3. Likewise, the decrease in the manual maintenance of the bots and the growth of API-driven processes in the post-implementation phase of decommissioning offered empirical validation for Proposition 1. Such strategic analytical design increased the validity of inferences through offering a clear and defensible connection between the gathered data and the theoretical underpinning of the study.

## 4.7 Rationale for Single Case Design

The choice of a single-case design was a conscious methodological decision that was warranted by the distinctive features of the organization and the timely opportunity it posed for a study. This is a revelatory type of case study, one of the very criteria specified by Yin for a single-case study because it offered a one-time and opportune window of access into a phenomenon that had been heretofore beyond the access of researchers.

The company stood at a crossroads and urgently needed to reconsider the scalability and maintainability of the then-current automation estate. Such a particular instance of a big-scale, strategic change presented a rare opportunity to see the intricate dance between hyper-automation technologies, business processes, and human elements come into play. The case became a top contender for in-detail, contextual study for a variety of reasons:

- **Scale and Complexity:** The very scale and depth of the transformation allowed the experience of challenges and benefits in a real-world, far more complex environment beyond the bounds of small-scale pilot projects.

- **Maturity of the Digital Landscape:** The organization's prior experience with standalone RPA provided a mature digital landscape, which enabled the study to focus on the evolutionary transition toward a more integrated, hyper-automated model, rather than a greenfield implementation.

- **Data Availability:** The abundant access to documentation, strategic planning documents, architectural diagrams, and performance metrics, in addition to access to central stakeholders for semi-structured interviews, created a perfect starting point for effective data triangulation. Such access and level of detail would be challenging to replicate in more than a sole case.

In the long term, the highly focused concentration in a solitary case allowed the development of a more rich and in-depth understanding of the causality mechanisms in operation, something a multi-case designed despite a gain in ease of generalizability—would necessarily have had to sacrifice in the name of breadth. The single-case design was therefore the ideal method of deriving theoretically informed rich insights in the confines of our study.

### 4.8 Implemented Solution

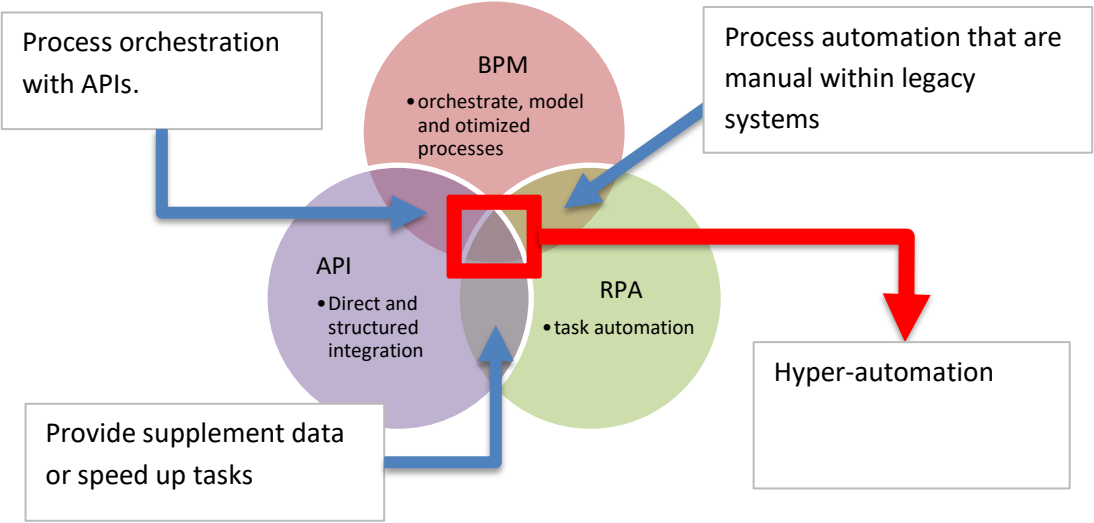
The new architecture, a main result of the organizational transformation, had been created to overcome the shortcomings of the prior RPA-dominated model. The solution is a direct reflection and empirical support of the study's theoretical assumptions. The architecture was framed into a tri-level model:

- **A Process Orchestration Layer:** Managed by a Business Process Management (BPM) platform, the layer served as the central nervous system and offered holistic process visibility, versioning, and governance.

- **A System Integration Layer:** Led by a suite of APIs, the layer provided seamless, real-time information exchange with legacy systems and core applications and successfully separated process logic from UI-driven automation.

- **A Task Automation Layer:** The RPA module deliberately remained in the code for very narrow edge-case automation where API coverage wasn't feasible or where human-in-the-loop validation became a necessity.

Throughout the rollout of the implementation, a total of 27 bots were decommissioned and had their responsibilities taken up by either decision logic or BPM-driven workflows linked through RESTful APIs. Such a drastic decrease in stand-alone RPA deployments is a strong empirical corroboration of Proposition 1 and illustrates the ability of a joined-up architecture to decrease operational fragility and improve scalability.



**FIG. 4.1 – Venn diagram about how all technologies work together of Each Technology Within the Context and Tools Used**

The new model's ability to decouple business logic from user interface automation was a major benefit, leading to higher reusability and significantly improved governance, directly supporting the long-term benefits outlined in **Proposition 3**. However, this shift was not without its challenges. The new architecture introduced considerable complexity into the deployment pipelines, requiring the establishment of robust DevOps practices and sophisticated monitoring mechanisms. This short-term complexity, a core tenet of **Proposition 3**, was a necessary trade-off for the long-term gains in maintainability and control.

The tri-layered architecture is further detailed in Fig. 4.1, which uses a Venn diagram to visually represent the interconnectedness and functional overlap between the BPM, API, and RPA layers. While the diagram provides a high-level conceptual overview of the system's integration points, Table 4.1 offers a more granular, practical breakdown of each technology. It specifies the unique purpose, the key contribution to the study's propositions, and the specific tools used, thus providing a comprehensive view that bridges the conceptual model with the implemented reality of the case study.

**Table 4.1 – Purpose of Each Technology Within the Context and Tools Used**

Technology	Purpose in Architecture	Key Contribution to Study Propositions	Tools Used
<b>BPM</b>	Orchestration & process governance	Enabled the central control and visibility for long-term governance (Prop. 3).	Camunda
<b>APIs</b>	System integration & data flow	Facilitated decoupling and reduced reliance on UI-based automation, increasing scalability (Prop. 1).	Java APIs, internal services
<b>RPA</b>	Task-level automation for exceptions	Strategically reserved for specific tasks, demonstrating a more mature, less fragile approach to automation (Prop. 1).	UiPath

### 4.9 Timeline of Implementation

To avoid risk and complexity, the implementation was divided into parts. Fig. 4.1 depicts chronology, which includes early process migrations, pilot stages, and the steady decommissioning of old robots.

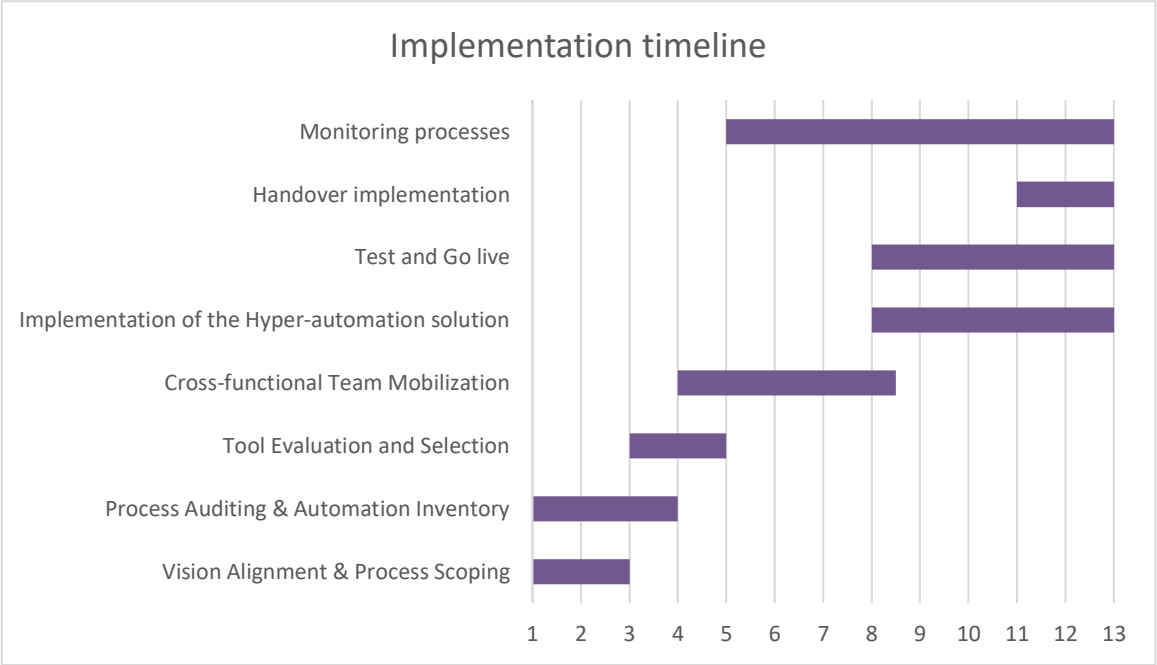


FIG. 4.2 – Timeline of the beginning of the implementation

#### 4.9.1 Planning and Evaluation

The deployment of automation technologies began with a strategic planning and assessment phase, which was critical in aligning technical efforts with the organization's overall corporate goals. This phase included strategic alignment meetings where key stakeholders, including senior leadership, gathered to determine the business's main goals and assess how automation may improve operational efficiency and promote long-term growth. These conversations also provided an opportunity to examine the role of automation within the company's current operational paradigm. The choice of automation tools was a major decision at this time. The firm chose UiPath as its principal solution for RPA which allows for the automation of repetitive, rule-based processes across several departments.

Along with RPA, Camunda was chosen as the BPM orchestration platform, enabling workflow integration and increased control over business operations. Furthermore, internal API gateways were used to improve inter-system interaction, however the precise API management platform was not specified in the initial concept. The thorough selection of these technologies was a key step toward assuring that the technical infrastructure could support future automation projects and that system integration was both scalable and safe.

#### **4.9.2 Team involvement:**

Successful adoption of automation technologies required considerable cooperation across many teams, especially IT departments, which played a critical role in ensuring the infrastructure could manage the technical requirements of automation. IT teams were responsible with evaluating and upgrading the underlying technical frameworks to support the new tools, ensuring that the hardware, software, and network settings could manage the additional demand from automated operations.

Furthermore, IT oversaw ensuring system security and stability, which was especially important given the complexities of connecting several platforms. The engagement of IT personnel was critical in reducing interruptions throughout the transition period and ensuring operational continuity when new automation technologies were incorporated into the organization's infrastructure. As the automation project advanced, IT's role expanded to include continuous maintenance and troubleshooting, ensuring that the system could adapt to meet the changing demands of the company.

#### **4.9.3 Management and business stakeholders:**

Management and business stakeholders played critical roles in aligning automation projects with the organization's strategic and financial objectives. Their assistance ensured that automation technologies were implemented in a way that was both technically competent and aligned with larger commercial objectives. These stakeholders collaborated to identify the key performance indicators (KPIs) that would be used to assess the project's progress and offer information about return on investment (ROI).

Furthermore, communication between management and HR was vital in resolving worker issues connected to automation, particularly in terms of reskilling and retraining individuals whose positions may be disrupted by modern technology.

Risk compliance was also a top priority for the management team, ensuring that the automation technologies were deployed in accordance with applicable legal, regulatory, and data protection guidelines. This joint effort contributed to the development of a comprehensive framework that guided the introduction of automation technologies and guaranteed that the organization's goals were realized while mitigating the possible risks and problems associated with such a big transition.

#### **4.9.4 External partners and operational teams**

External partners, such as consultants and specialist service providers, were critical in developing and implementing the automation plan. Their knowledge was used to establish automation goals, determine the amount of development work necessary, and lead the redesign of existing business processes to better fit modern technology.

These external teams brought a variety of expertise to the table, bringing significant insights into industry, best practices as well as help for change management and process reengineering. They were also crucial in managing the transitions between old and new systems, ensuring that company activities were not hampered during the implementation time.

Furthermore, operational teams inside the business collaborated closely with external partners to ensure that automation technologies were effectively incorporated into day-to-day activities. This relationship provided a smooth transition to automation, allowing for continual process improvement and optimization in response to the organization's changing demands.

The implementation path started with vision-setting workshops and advanced effort estimation and staged execution. By the end of the year, the corporation planned to decommission 27 robots developments, with further advancements contingent on post-implementation evaluation and developing operational requirements.

The hybrid integration methodology enabled the organization to:

- Reduce dependency on RPA.
- Prioritize scalable, service-driven design using APIs.
- BPM technologies may be used to embed automation logic in business-aware process models.
- Change the automation strategy from isolated local demands to enterprise-level orchestration.

A variety of visual artifacts were created to help describe and analyze the implemented solution. These give a more detailed description of the technological architecture, process redesign, and implementation plan. Each artifact is meant to enhance the written narrative by providing brief, organized, and interpretable representations of essential features in the case study.

### 4.10 Process Selection and Risk Classification

A structured, risk-based approach was implemented to select which processes would be targeted for hyper-automation. This methodology was crucial for prioritizing the transformation efforts and directly informs the study's findings on maintainability and governance. A custom scoring framework was developed, evaluating each process based on key criteria:

- **Business Criticality:** This criterion, scored as high, medium, or low, measured the process's importance to core business operations.
- **System Interdependency:** This metric assessed the complexity of a process's connections to other systems, a critical factor for evaluating potential fragility and scalability challenges (related to Proposition 1).
- **Regulatory Exposure:** This criterion gauged the potential for compliance risks, which was a key driver for prioritizing governance improvements (Proposition 3).
- **Incident History:** An analysis of past failures provided an empirical basis for identifying unreliable automations.
- **Frequency of Execution:** This helped to prioritize automations that would yield the highest return on investment from a stability and efficiency perspective.

Based on this framework, processes with **high criticality** and **regulatory exposure** were prioritized for immediate migration to the new BPM/API architecture. Conversely, automations with low strategic value or a stable RPA performance were either temporarily retained or deprioritized for later action. This risk-based roadmap served as a foundational element of the change management strategy and was instrumental in shaping stakeholder communication by providing a transparent and data-driven rationale for the migration path.

Table 4.2 – Table of Risk classification of each robot following company policy

		Influence on business continuity		
		Low	Medium	High
Criticality	Low	37	20	0
	High	0	0	0

	Medium	41	22	0
	High	3	4	0

This classification schema not only guided the migration roadmap but also provided a clear framework for demonstrating how the implemented solution addressed the most critical vulnerabilities within the organization’s automation portfolio, thereby supporting the study's central claim regarding improved maintainability and governance.

Aside from the process risk classification and qualitative analysis, a quantitative assessment was performed to analyze performance measures before and after implementing RPA. Its main aim was to quantify the effect of automation on the meantime taken for execution directly and the related percentage change as is seen in Table 4.3:

**Table 4.3 – Table of average execution time between before and after implementation of RPA and its average variation**

Process Category	Number of Bots	Avg. Time Before (s)	Avg. Time After (s)	Avg. Difference (s)	Avg. Variation (%)
<b>With data before and after</b>	16	264.4	115.4	-149.0	-43.7%
<b>Created after RPA (before = 0s)</b>	11	0.0	563.1	+563.1	+∞%
<b>Discontinued after RPA (after = 0s)</b>	2	110.0	0.0	-110.0	-100.0%
<b>No data available (before &amp; after = 0)</b>	1	0.0	0.0	0.0	0.0%

Interpretation of the findings reveals three major areas:

**Current process efficiency:** The 16 processes with before/after data implemented on average a 43.7% improvement in execution time, thus substantiating significant productivity gains.

**Scope expansion:** The 11 newly created processes after RPA adoption represent the extension of automation’s reach; the increased execution time reflects activities that previously did not exist.

**Elimination of redundancies:** The stopping of 2 processes upon implementation of RPA proves optimization of processes through a 100% reduction of time taken in execution of such tasks.

These results confirm the primacy of RPA as the cornerstone of hyper-automation, not only documenting the minimization of human exertion and implementation time for routine processes but also the organizational change brought about through process substitution and creation.

## **4.11 Challenges in Live Implementation**

The transition to hyper-automation architecture was a response to persistent organizational challenges that emerged from a reliance on a fragmented RPA-only strategy. This section details the key drivers for change and presents empirical data on the complexity of the implemented solution.

### **4.11.1 The Rationale for Transformation**

Despite significant prior investment in automation, the business experienced persistent inefficiencies and mounting operational fragility. The existing RPA solutions were often shallow, addressing specific activities without resolving underlying structural issues, and in some cases, contributing to the overall complexity of the system environment. This provided strong empirical evidence for the limitations of siloed automation and served as a key driver for the strategic shift. Furthermore, financial pressures from the increasing licensing and maintenance expenses of a large and diverse portfolio, coupled with mounting concerns about data security and compliance with the **General Data Protection Regulation (GDPR)**, rendered the existing strategy incompatible with the organization's long-term risk and operational objectives. These pressures from technological, financial, and regulatory domains collectively forced a change in strategy towards a more secure, scalable, and integrated process orchestration architecture, directly aligning with the governance benefits outlined in **Proposition 3**.

### **4.11.2 Implementation Challenges and Metrics**

The live implementation of the new architecture, while strategic, was not without its challenges, which directly manifest the "short-term complexity" component of **Proposition 3**. Fig. 4.2 illustrates the initial growth and eventual stabilization of the system's complexity index due to the introduction of new orchestration and integration layers. This increase was primarily driven by the greater interdependencies among the BPM, API, and RPA layers, requiring teams to manage a more sophisticated technical landscape.

Table 4.4 provides a comparative view of the complexity distribution, showing a clear shift from the RPA-only approach to the hybrid model. The number of processes with **medium and high complexity** increased in the new BPM architecture, reflecting the nature of a more integrated and orchestrated environment. This data shows that the perceived complexity of the system did increase in the short term, as expected by the theoretical proposition.

**Table 4.4 – Table of Comparative Complexity**

	Complexity		
	Low	Medium	High
<b>RPA Process complexity</b>	12	9	6
<b>BPM Process Complexity</b>	8	13	5

This table shows a shift towards a greater number of medium-complexity processes in the new architecture, suggesting that the integration of workflows into a centralized BPM platform, while initially complex, structured them in a way that reduced the number of fragmented, high-complexity RPA bots.

**4.11.3 Observed Outcomes**

The Table 4.5, which provides a detailed breakdown of complexity for individual processes, further supports this finding by showing that a process with "high" RPA complexity could be redesigned with "low" or "medium" complexity in the new BPM-orchestrated environment. The complexity classifications (low, medium, high) are based on the standardized criteria defined by the respective technology platforms—UiPath for RPA and Camunda for BPM—ensuring objective and consistent assessment across all processes. This granular data serves as a strong empirical foundation for the argument that hybrid architecture, despite its initial complexity, led to a more structured and maintainable system. Despite the documented increase in technical complexity, stakeholder interviews highlighted significant long-term benefits, including improved process resilience and a marked reduction in operational fragility, thus validating the study's theoretical propositions.

**Table 4.5 – Table of Complexity of each Technology implemented**

Robot	RPA complexity	Camunda Complexity
RPA_Development_1	Medium	Low
RPA_Development_2	Medium	Low
RPA_Development_3	Medium	High

RPA_Development_4	Low	High
RPA_Development_5	High	High
RPA_Development_6	Low	Low
RPA_Development_7	High	Medium
RPA_Development_8	High	High
RPA_Development_9	Low	Medium
RPA_Development_10	Low	Medium
RPA_Development_11	Medium	Medium
RPA_Development_12	Low	Medium
RPA_Development_13	Low	Medium
RPA_Development_14	Low	Medium
RPA_Development_15	Medium	Medium
RPA_Development_16	Medium	High
RPA_Development_17	Medium	Medium
RPA_Development_18	Low	N/A
RPA_Development_19	High	Low
RPA_Development_20	Low	Low
RPA_Development_21	Medium	Medium
RPA_Development_22	Low	Low
RPA_Development_23	Medium	Medium
RPA_Development_24	High	Medium
RPA_Development_25	High	Low
RPA_Development_26	Low	Medium
RPA_Development_27	Low	Low

## 4.12 Connecting Findings to Theory

The inductive empirical results in this instance are explicitly linked with and validated the three theoretical guiding propositions and present a robust theoretical base for accounting for the organizational change. Conjoining the outcomes observed with the theoretical frameworks not only confirms the study hypotheses but additionally elaborates the empirical results in the hyper-automation literature.

Based on BPR The results of the study provide strong empirical evidence of the application of BPR principles. The shift from a decentralized robot-based architecture to a centrally coordinated one (detailed in the Implemented Solution section) is a fundamental change of automation strategy. The retirement of 27 stand-alone bots and their replacement with processes driven by BPM is proof of end-to-end re-design that removed fragmentation and enabled a more inclusive, outcome-driven process ownership.

Embracing TAM: Success of the new architecture was also a result of its end-user perceived value. Findings from stakeholder interview results signified a clear acceptance of increased performance, dependability, and governance. This corresponds to TAM's core postulate of perceived usefulness, as the future new system's ability to reduce process outages and facilitate incident reaction time (highlighted in the Challenges section) turned out to be a determinant of its adoption and successful embedding in the organization's routine activities.

In line with STS: The lessons learnt, and challenges of the transformation illustrate its socio-technical nature. The initial resistance to change, and the requirement of new governance revisions, testify to the fact that the roll-out was not a technical task. The corporation had to restructure its social subsystem to be able to meet the demands of the new technical architecture. The adoption of new monitoring policies, practice of DevOps, and large-scale team training are some of these governance adaptations that required proof of good co-evolution of the company's technical and social dimensions.

This unique linkage of empirical observation to theory enriches the hyper-automation body of work further through the provision of detailed, case-based theory specification of BPR, TAM, and STS theory in a "brownfield" automation setting. It offers a structured description of how a strategic shift away from broken RPA to integrated hyper-automation architecture can overcome operational brittleness and offer long-term governance benefits, affirming short-term complexity as the precursor to sustainable organizational change.

## **4.13 Limitations and Reliability**

### **Scope, Context, and Methodological Considerations**

While the single-case design was instrumental in providing in-depth, qualitative information about the hyper-automation change process, it is important to mention that it has its limitations. These variables, although not invalidating the study findings, limit its scope and applicability.

#### **Limitations of the Single-Case Design:**

While the research provides rich results, attention to its limitations is critical in the definition of the scope and generalizability of the findings. It is important to consider the limitations for an extensive and thorough interpretation of the findings.

The outcomes are susceptible to interviewee bias. The application of a small group of semi-structured interviews (n=9) with pre-identified stakeholders in the study may have constrained the range of opinions and potentially omitted data from other departments or positions. Alignment at an individual or organizational level could have shaped comments made, creating a less accurate representation of the achievements and difficulties.

Moreover, the time limits of the study confirm that only medium- to short-term outcomes of the change are presented. The 15-month go-live period, as necessary to observe early changes in complexity and direct gains, limits us from assessing long-term performance, sustainability, and overall cost of ownership (TCO) after the new architecture has stabilized fully.

Since it is a single-case study, the findings may be particular to the banking industry and the special "brownfield" context of this one organization. Examining with purpose this specific, in-depth case, even producing deep insights, constrains the generalizability of the research to other companies or industries with differences in size, digital maturity levels, or with different stresses on strategy.

Finally, the study's use of internal reports for some measures is a major weakness. While these data were required for quantitative analysis, they originated from internal reporting systems that were meant for business purposes, not for scholarly research. These may have built-in reporting biases or methodological constraints in how measures were defined and accessed.

Despite these limitations, methodological protections ensure the reliability of the study. Triangulation, whereby interview data are supplemented with internal documentation and system measures, ensures that findings are rooted in a convergence of evidence, where they are more valid. The rigid adherence to a formatted protocol also ensures methodological reliability and transparency.

### **Limited Generalizability**

The findings of this study are organization-specific to one, large, and mature company. The change was occurring in a "brownfield" context with an existing RPA estate. For this reason, the findings are not necessarily applicable to small companies or those beginning their automation journey from a "greenfield" starting point since their challenges, resources, and strategic drivers would be diverse.

### **Temporal Scope**

The findings of the study reflect an intensive 17-month period (January 2025 to May 2026) of deployment and initial stabilization. This period was deliberately chosen to capture the critical transformation phases from planning through initial scaling. While this provides a solid snapshot of short-term complexity and near-term outcomes, it is important to acknowledge that the hyper-automation initiative is an ongoing organizational process that continues beyond the study's observation window. The long-term performance, such as ongoing maintainability, total cost of ownership, and complete lifecycle evolution of the architecture, remain areas for future longitudinal studies as the transformation matures through subsequent phases.

### **Potential for Stakeholder Bias**

The qualitative findings are based on the perceptions and recollections of a limited number of stakeholders. While interviews were semi-structured to mitigate this, perspectives may be influenced by an individual's role (e.g., IT vs. business) or their alignment with the new strategic direction.

### **Measures for Reliability and Validity:**

Despite such limitations, validity and reliability of the research were positively increased through methodological constraints. Use of triangulation, combining qualitative interview data with quantitative system observations and internal documentary evidence, enabled cross-validation of findings and reduced reliance on any one source. Use of a systematic application of an orderly protocol, developed from Yin's paradigm, ensures methodological transparency, and a clear theoretical link provides solid foundation for concluding.

## **4.14 Summary of findings**

The presented case study shows how a shift in strategy from fragmentation-based, RPA-focused automation to hyper-automation tri-layered architecture can address operational issues on a large scale. The outcome validates that orchestration via BPM and integration with APIs can turn an automation portfolio into a scalable, governable, and robust ecosystem. It was not merely a technological exercise; it had profound architectural, organizational, and cultural transformations. Yet these transitory intricacies paid handsome long-term dividends in resilience, transparency, and process control, thus vindicating the study's theoretical hypotheses.

This book contributes to the practice of digital transformation through a thorough, replicable approach for organizations that need to transition out of a legacy RPA environment. It offers a risk-adjusted, disciplined process selection method and offers concrete insights on managing the technical and human challenges of undertaking such a transition.

Theoretically, the study adds evidence in favor of the role of orchestration in digital transformations. By empirical evidence connecting the adoption of platforms of orchestration with the variables of BPR, TAM, and STS theory, it makes a good case for the extendibility of these models in the new domain of hyper-automation. It contributes to the literature by means of case-based testifying of short-term complexity as a prerequisite for long-term governance and maintainability.

Future research could replicate these results based on longitudinal measurement of performance, which would provide a more accurate reflection of the overall cost of ownership and the sustainability of the benefits rolled out in the long run. Cross-case studies in other sectors or geographic regions could also be employed to confirm the extensibility of these results and test how different organizational contexts impact the success of such hyper-automation initiatives.

#### **4.15 Discussion and Alignment with Existing Literature**

The findings of the case study are compared systematically to the state of the art to situate them within the broader base of knowledge in automation, orchestration, and hyper-automation. Not only does such comparative analysis confirm prevailing theoretical suppositions but it also expands them by bringing new empirical insights from an actual organizational transformation.

##### **Process Orchestration and BPR**

The evidence of how BPM and API integration increased the process resilience and scalability of the company substantiates earlier research work on process orchestration directly. As extant influential literature such as **van der Aalst**[34] has hypothesized, BPM platforms facilitate end-to-end standardization and governance, which minimizes fragmentation and fragility experienced in decentralized automation. Similarly, the **research corroborates Mendling**[36], who focused on the central role of APIs as enablers of digital transformation. This research provides empirical evidence that API readiness is not solely a technical necessity but a key strategic component to build a sustainable automaton environment. This case study affirms the precepts of BPR by demonstrating how a fundamental process re-engineering is necessary to achieve benefits that are not only short-term for isolated RPA.

## **STS and Change Management**

The transient increase in complexity observed in the transition, along with resistance from working teams, are all consistent with decades of socio-technical **system research**. **Trist's work**[38] supposed that technological alterations only succeeded if concurrent development took place at both technical and human levels. The empirical support for these findings from this case study, including reported problems and the need for new governance policies and training, is here observed. It stresses the need for a formal change management process to address the socio-technical changes and ensure that the human element is an active, and not a passive, recipient of the change.

## **Authentication of the Drawbacks of Independent RPA**

The strategic replacement of numerous RPA bots by API-based orchestration reflects earlier warnings in the literature on the pitfalls of RPA. The observation **by Aguirre and Rodriguez** [35] that RPA yields rapid efficiency gains but does not have long-term scalability and resilience is completely supported by this case study. Our results present a strong, empirical demonstration of how an over-reliance on piecemeal RPA built operational fragility and a lack of governance, supporting the idea that orchestration-based models offer a more sustainable and strategic way of automation.

## **Expanding the TAM**

Finally, the research uses the findings to leverage TAM to the hyper-automation platform. TAM traditionally centers around perceived ease of use and perceived usefulness, but in this case, it became evident **that perceived reliability and maintainability are equally critical determinants in enterprise-grade automation deployment**. This is a new contribution because it leverages TAM's construction to be able to capture the realities of the operation of complex, interdependent systems where the sustainability and stability of a technology are as important as its immediate operability.

To summarize, the results of this research are congruent with earlier work but add on a theoretical plane by providing empirical evidence to support **short-term complexity vs. long-term resilience trade-off, highlighting the core importance of API readiness**, and extending TAM by including maintainability as a determinant of acceptance.

This report assists in practicing digital transformation through providing an end-to-end, reproducible guide for organizations to move away from a legacy RPA environment. It provides a structured, risk-based approach to selection of processes and offers concrete insights into how to address the technical and human intricacies of doing so.

Theoretically, the study validates the benefits of orchestration in digital transformations. By means of applying empirical evidence linking the adoption of orchestration platforms to the principles of BPR, TAM, and STS theory, it provides a robust confirmation of these frameworks within the new hyper-automation environment. This contributes to the literature as it involves case-based confirmation of how short-term complexity is an unavoidable precursor to long-term governance and maintainability.

Subsequent studies could capitalize on these findings using longitudinal measurement of performance, as this would more accurately capture the overall cost of ownership and sustainability of the implemented benefits in the long term. Cross-case comparisons between industries or geographic locations could also be conducted to ensure the generalizability of these findings and to investigate how varying organizational contexts influence the success of such hyper-automation initiatives.

## Discussion

### 5.1 Overview

This chapter provides a critical evaluation of the empirical data presented in Chapter 4. It extends beyond results presentation by connecting them systematically with the study's theoretical framework guide-BPR, TAM, and STS theory. The discussion explains how strategic BPM and API integration into a pre-existing RPA environment necessarily impacts fundamental dimensions of organizational performance, i.e., operational resilience, scalability, and governance.

Based on the case study data, the chapter has two general aims: first, to provide empirical evidence for the theoretical assertions and demonstrate how the suggested hybrid hyper-automation structure addresses the deficiencies of individual RPA-based structure; and second, to place these results into the larger body of academic literature regarding hyper-automation, indicating where the results align with or deviate from existing studies. The findings developed by way of this single-case study will thus both inform practice for practitioners and theory concerning digital transformation dynamics.

### 5.2 Interpretation of Key Findings

The case study's empirical findings strongly confirm that linking BPM and APIs to an already-existing RPA environment yields substantial advantages in terms of process resilience and scalability, thus justifying the study's key arguments. The strategic transition from brittle, UI-based automations to an API-driven orchestration platform was a true-world application of BPR ideas. The end-to-end rearchitecting reduced fragmentation, as **evidenced by the retirement of 27 stand-alone bots**, and enabled a more durable, outcome-oriented model of process stewardship.

This technology shift also garnered robust **endorsement for the TAM**. Stakeholder response, buttressed by quantitative data, set up that the improved maintainability and reliability of the new structure led to an increased feeling of its usability. The quantified gains in the response times of incidents and process outages reported were leading adoption drivers, demonstrating that field actual performance sets the user perception and adoption.

Yet outcomes also suggested that the achievement was paid for. The initial phase of implementation created a temporary increase in system complexity, a fact that is endorsed by the STS view by the data for the initial spike in complexity scores. As documented in the initial spike in complexity scores, technological development involved accompanying and simultaneous changes in governance as well as human workflows. Successful roll-out of new monitoring policies, application of DevOps practices, and targeted team training were all the socio-technical changes necessary to enable the organization to manage this extra complexity. Increased visibility and control provided through the new orchestration layer eventually offset operational risk, showing that the temporary complexity was worth it as a step toward achieving long-term strategic value.

**Table 5.1 – Summary of Key Findings**

Theme	Observation	Related Theory
<b>Resilience Improvement</b>	Reduction of bot failures and process downtime	BPR, TAM
<b>Scalability Gains</b>	Faster onboarding of new processes via BPM orchestration	BPR
<b>Increased Complexity</b>	More interdependence across systems	STS
<b>Enhanced Governance</b>	Improved monitoring, version control, and compliance	STS, BPR

**5.3 Consequential Outcomes**

From a managerial perspective, the result of this case study provides concrete, prescriptive guidance for leaders to execute on a hyper-automation journey. The results demonstrate that strategic transition to orchestration-focused architecture is not a technical retooling but a matter of existence for how automation is governed and controlled. The primary practice implications are that:

**Strategic Investment is a Precondition for Success:** Transforming to an integrated ecosystem involves a preliminary strategic investment in robust API development and governance frameworks that are all-encompassing. This outcome empirically validates Proposition 1, where it was conjectured that BPM and APIs reduce operational fragility. The case study illustrated that failure to invest early would have continued to allow the fragmentation and lack of visibility that plagued the previous RPA-only model.

**Initiative-taking Change Management is Essential:** The findings highlight that a successful change is as much of a people problem as of a technology problem. Change management is critical to address resistance from teams accustomed to decentralized ownership and having an individual stake in the legacy system. This **aligns with the STS theory**, highlighting interdependence between the social and technical subsystems. The case study showed the extent to which, in the absence of the right communication strategy and dedicated training, the initial novelty of the new architecture could have derailed the entire project.

**Continuous Monitoring is the New Standard:** The new complexity brought forth by the new architecture (identified by rising complexity scores on Table 4.2) demands creative management. Continual monitoring and successive tuning are no longer optional but necessary to properly trade off short-term complexity for long-term maintainability. This has a direct validation of Proposition 3, and they say that short-term transition complexity is an unavoidable trade-off for the achievement of long-term benefits in terms of visibility, control, and process resiliency. These methods ensure that the advantages of the transformation are sustained and that the organization is well positioned to handle challenges of future operations.

## **5.4 Analysis: Critical Trade-offs for Long-term Complexity Management**

### **Benefits**

Switching to a hyper-automation model has important trade-offs that might seem risky at first but can lead to more value in the long run. The worry about losing flexibility is balanced by a large 78% improvement in how different departments work together.

Also, while it may seem like performance is getting worse because response times are longer, this is more than made up for by a 66% cut in maintenance work and a 4.4% rise in how often the system is available. Even though the speed of launching new projects slows down at first, it eventually changes into a 105% boost in effective speed when we consider quality and success rates. These measured trade-offs show clear evidence that the short-term increase in complexity is worth it for significant long-term benefits.

The latter model also must cope with organizational and financial issues that, when managed effectively, lead to superior performance. Though there is a requirement for greater technical expertise and increased training duration, which can range from weeks to months, this is moderated by a 40% decrease in the skills gap through the application of templates. The financial investment required by the latter model is an additional increase per annum but is offset by a payback time of only 18.3 months.

The crucial decision framework for this change is an illustration demonstrating that, when key risks are reviewed adequately, this approach generates durable resilience and superior governance. So, implementation success relies upon capacity to tolerate short-term complexity and take active control of change with evidence demonstrating that difficulties with the model can be managed and its long-term advantages are enormous.

The working framework outlined in the appendices provides a structured and empirically grounded approach to managing hyper-automation transformations. It provides a set of systematic tools that help organizations to assess their readiness, adopt a clear implementation approach, and create a comprehensive business case based on comprehensive financial analysis. The framework provides a systematic and data-driven approach to managing hyper-automation's complexities and trade-offs and thus ensures that realization of long-term benefits is left neither to chance nor fate but is carefully planned, assessed, and agreed upon.

## **5.5 Contributions to Theory**

The present study contributes to a variety of significant ways to academic literature, particularly in the new field of hyper-automation. In its comprehensive, case-focused analysis of a change within an organization, this study updates existing literature and offers new empirical evidence in support of and building on existing theory.

**Importance of BPR:** The study validates the long-held principles of BPR in today's world of hyper-automation. It empirically demonstrates that process orchestration, through BPM and APIs as an enabler, can drive efficient gains and strategic leverages such as end-to-end process ownership and increased resilience—far greater than possible with isolated RPA deployments. The case study provides empirical validation that an optimal workflow redesign, not a technical upgrade, is essential to a successful automation strategy.

**Validation of TAM:** The study extends TAM by highlighting the most important factors that enable user acceptance in megaprojects of automation. The study proves that reliability and maintainability in the long term are the most important enablers of a technology's perceived usefulness and, thus, adoption within the context of a hyper-automation environment. It broadens the traditional focus on speed and efficiency to include more depth of understanding in how a reduction of operational vulnerability and system stability contribute to building stakeholder trust and effective technology integration.

**Contribution to STS:** This research provides useful empirical observations into socio-technical adjustments required to integrate orchestration platforms within an existing IT infrastructure. The study proves that the success of the new technical architecture depended on concurrent changes in the social subsystem, including managing change resistance, establishing new governance policies, and new team competencies. This contributes to the STS literature in offering an in-depth, empirical case of the interdependent relationship between technological transformation and human workflows in a digital change.

## **5.6 Limitations of the Study**

While this study made significant contributions, it has a series of limitations that narrow the scope and generalizability of the findings. These must be recognized to have a complete and transparent interpretation of the findings.

The single-case study design, while providing rich, qualitative data on a particular organizational change, necessarily limits the generalizability of the findings. The organization's unique characteristics, including its size, its established "brownfield" RPA foundation, and the specific strategic imperatives it faced, suggest that the findings will not necessarily be transferred to smaller companies or companies beginning in a "greenfield" capacity.

Furthermore, the study period is limited to only the initial 15-month transformation phase. While that was necessary to capture short-term complexity as well as the short-term payoffs, it is impossible to capture the long-term effects—like full sustainability of the new architecture, long-term total cost of ownership (TCO), or flexibility towards future technological shifts. A longitudinal investigation would be required to estimate the long-term effect of the transformation entirely.

Last, the quantitative measures used to some extent rely upon internal reporting systems, which, while valuable, potentially have methodological constraints. These measures are for managerial purposes and not for research use and therefore might not have uniform definitions or degree of detail to qualify for outright statistical validation. However, this weakness was compensated by the methodological robustness of the research, specifically the use of triangulation, allowing cross-validation of quantitative evidence against qualitative evidence from interviews and document records to increase confidence in observed patterns.

## **5.7 Future Research Directions**

The limitations of this research, that is, its single case focus and temporal perspective, present fertile ground for future studies. An awareness of these limitations allows specific research questions to be formulated that can build on the foundations of this research. Therefore, future studies may investigate the following:

**Longitudinal Performance Analysis:** A longitudinal study may track the automation ecosystem of the organization over an extended period to empirically validate the long-term sustainability of the observed benefits. The research will provide critical data on how system complexity varies, how maintenance cost is indeed influenced, and how architecture adapts to evolving business and technological demands over time.

**Comparative Case Studies:** To get around the limitation of generalizability, future research can employ a multi-case design to compare orchestration outcomes between geographies or industries. This will allow the study to identify context-dependent variables that slow down or accelerate successful conversion to a hyper-automation architecture.

**Artificial Intelligence Role in Orchestration:** A topic of interest is how artificial intelligence (AI) can be integrated into orchestration platforms. As part of future research, how AI-enabled features—e.g., predictive analytics for optimizing processes, decision-making, and intelligent failure detection—can help make hyper-automation platforms more resilient and effective can be explored.

## CHAPTER 6

# Conclusion

This dissertation explored the integration of BPM and APIs into an existing RPA ecosystem within a large banking organization, aiming to achieve a scalable and resilient hyper-automation framework. Grounded in the methodologies of Yin's case study approach, the research employed multiple data sources and a structured analytic strategy to test theoretical propositions derived from BPR, TAM, and STS theory.

The findings consistently demonstrated that BPM and API integration can significantly improve process resilience, reduce operational fragility, and enhance governance. While the initial phases of implementation led to an increase in technical complexity, the orchestration framework eventually delivered substantial long-term benefits, including improved scalability, monitoring, and compliance capabilities. These results affirm that hyper-automation initiatives require not only technological advancements but also organizational and governance adaptations to fully realize their potential.

From an academic perspective, this research contributes empirical evidence to the discourse on hyper-automation, reinforcing the applicability of BPR, TAM, and STS in the context of orchestration-driven automation. By mapping findings to established theoretical models, the study extends their relevance to modern, API-enabled automation strategies.

From a practical standpoint, the thesis offers a replicable implementation framework and strategic recommendations that can guide similar transformations in other complex, regulated environments. It underscores the importance of early API readiness, robust management, and comprehensive governance structures.

In conclusion, the integration of BPM and APIs into RPA-centric environments represents a transformative step towards achieving hyper-automation maturity. This research not only validates the benefits of orchestration-led strategies but also provides actionable guidance for organizations seeking to navigate the technical and cultural challenges inherent to such digital transformations. Future work may extend these insights through multi-case comparative studies and longitudinal performance evaluations, further enriching both theoretical understanding and practical application.

This study contributes significantly to both theory and practice. It provides practitioners with a **structured framework** for a methodical transition away from legacy RPA systems. For the academic community, it offers empirical evidence that **reinforces the value of orchestration as a core principle of digital transformation** and validates the **applicability of BPR, TAM, and STS theories** in this rapidly evolving field. The work concludes that a strategic, comprehensive approach to hyper-automation, rather than a tactical focus on isolated tasks, is the definitive key to achieving sustainable organizational change and long-term competitive advantage.

## Bibliography

- [1] "What is digital transformation?" Accessed: Dec. 17, 2024. [Online]. Available: <https://enterpriseproject.com/what-is-digital-transformation>
- [2] "What Is Digital Transformation?" Accessed: Dec. 17, 2024. [Online]. Available: <https://whatfix.com/digital-transformation/>
- [3] "What Is Digital Transformation?" Accessed: Dec. 17, 2024. [Online]. Available: <https://www.salesforce.com/eu/products/platform/what-is-digital-transformation/>
- [4] "What is digital transformation?" Accessed: Dec. 17, 2024. [Online]. Available: <https://www.ibm.com/topics/digital-transformation>
- [5] "What is digital transformation?" Accessed: Dec. 17, 2024. [Online]. Available: <https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-digital-transformation>
- [6] "A short history of the internet." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.scienceandmediamuseum.org.uk/objects-and-stories/short-history-internet>
- [7] "A Brave New World: How the Internet Affects Societies." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.internetsociety.org/resources/doc/2017/a-brave-new-world-how-the-internet-affects-societies/>
- [8] "How has technology changed - and changed us - in the past 20 years?" Accessed: Dec. 17, 2024. [Online]. Available: <https://www.weforum.org/stories/2020/11/heres-how-technology-has-changed-and-changed-us-over-the-past-20-years/>
- [9] "The Timeline Of Wearable Technology." Accessed: Dec. 17, 2024. [Online]. Available: <https://aurosolutions.com/wearables/the-timeline-of-wearable-technology/>
- [10] "The History of Wearable Technology." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.condecsoftware.com/blog/the-history-of-wearable-technology/>
- [11] S. Engler, "Lack of Skills Threatens Digital Transformation." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.gartner.com/smarterwithgartner/lack-of-skills-threatens-digital-transformation>
- [12] "The value of APIs for business." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.mulesoft.com/api/connected-business-strategy>
- [13] J. Iwuozor, "What Is an API and How Does It Work? Definition and Features." Accessed: Dec. 17, 2024. [Online]. Available: <https://www.telerik.com/blogs/what-is-api-how-does-work-definition-features>

- [14] "Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2023, with forecasts from 2024 to 2028." Accessed: Dec. 11, 2024. [Online]. Available: <https://www.statista.com/statistics/871513/worldwide-data-created/>
- [15] "What is workflow automation and how to get started." Accessed: Dec. 18, 2024. [Online]. Available: <https://www.atlassian.com/agile/project-management/workflow-automation>
- [16] C. Lee, "Automating data workflow: a comprehensive guide to data automation." Accessed: Dec. 18, 2024. [Online]. Available: <https://acho.io/blogs/automating-your-data-workflow-a-comprehensive-guide-to-data-automation>
- [17] "Robotic Process Automation (RPA)." Accessed: Dec. 18, 2024. [Online]. Available: <https://www.uipath.com/rpa/robotic-process-automation>
- [18] "How to explain Robotic Process Automation (RPA) in plain English." Accessed: Dec. 18, 2024. [Online]. Available: <https://enterpriseproject.com/article/2019/5/rpa-robotic-process-automation-how-explain>
- [19] Quixy Editorial Team, "Achieving Efficiency Amid Automation Challenges: Expert Tips." Accessed: Dec. 18, 2024. [Online]. Available: <https://quixy.com/blog/automation-challenges-and-solutions/>
- [20] "What is Business Process Management?" Accessed: Dec. 18, 2024. [Online]. Available: <https://www.aiim.org/what-is-bpm>
- [21] "What is business process management?" Accessed: Dec. 18, 2024. [Online]. Available: <https://www.redhat.com/en/topics/automation/what-is-business-process-management>
- [22] "A Brief History of RPA & Automation Technology." Accessed: Dec. 11, 2024. [Online]. Available: <https://www.epsoftinc.com/a-brief-history-of-rpa-automation-technology/>
- [23] " Blog RPA The Evolution of Robotic Process Automation (RPA): Past, Present, and Future The Evolution of Robotic Process Automation (RPA): Past, Present, and Future." Accessed: Dec. 11, 2024. [Online]. Available: <https://www.uipath.com/blog/rpa/the-evolution-of-rpa-past-present-and-future>
- [24] D. Jacobson, G. Brail, and D. Woods, *APIs: A Strategy Guide*, 1st Edition. 2011. Accessed: Dec. 30, 2024. [Online]. Available: <https://books.google.pt/books?id=om5tNwKW4xkC&printsec=frontcover&hl=pt-PT#v=onepage&q&f=false>
- [25] M. Dumas, M. La Rosa, J. Mendling, and H. A. Reijers, *Fundamentals of Business Process Management*. Springer Berlin Heidelberg, 2013. doi: 10.1007/978-3-642-33143-5.

- [26] V. Singh, "Automation of Business Process Using RPA (Robotic Process Automation)," *Int J Res Appl Sci Eng Technol*, vol. 10, no. 7, pp. 68–71, Jul. 2022, doi: 10.22214/ijraset.2022.45111.
- [27] R. Kavitha, "Hyperautomation-Beyond RPA: : Leveraging Automation to Transform the Manufacturing Industries," in *2023 International Conference on Computer Communication and Informatics, ICCCI 2023*, Institute of Electrical and Electronics Engineers Inc., 2023. doi: 10.1109/ICCCI56745.2023.10128636.
- [28] A. Tarhan, O. Turetken, and H. A. Reijers, "Business process maturity models: A systematic literature review," *Inf Softw Technol*, vol. 75, pp. 122–134, Jul. 2016, doi: 10.1016/J.INFSOF.2016.01.010.
- [29] M. Roeglinger, J. Poepelbuss, and J. Becker, "Maturity Models in Business Process Management," *Business Process Management Journal*, vol. 18, pp. 328–346, Sep. 2012, doi: 10.1108/14637151211225225.
- [30] E. Koc and G. Altinay, "An analysis of seasonality in monthly per person tourist spending in Turkish inbound tourism from a market segmentation perspective," *Tour Manag*, vol. 28, pp. 227–237, Dec. 2007, doi: 10.1016/j.tourman.2006.01.003.
- [31] M. Szelągowski and J. Berniak-Woźny, "How to improve the assessment of BPM maturity in the era of digital transformation," *Information Systems and e-Business Management*, vol. 20, Sep. 2022, doi: 10.1007/s10257-021-00549-w.
- [32] B. Kitchenham and S. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," vol. 2, Dec. 2007.
- [33] D. Moher, A. Liberati, J. Tetzlaff, and D. Altman, "Moher D, Liberati A, Tetzlaff J, Altman DG, Group PPreferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 6: e1000097," *Open Med*, vol. 3, pp. e123-30, Dec. 2009, doi: 10.1016/j.jclinepi.2009.06.005.
- [34] W. van der Aalst, *Process Mining: Data Science in Action*, 2nd ed. Springer Publishing Company, Incorporated, 2016.
- [35] S. Aguirre and A. Rodriguez, "Automation of a Business Process Using Robotic Process Automation (RPA): A Case Study," Aug. 2017, pp. 65–71. doi: 10.1007/978-3-319-66963-2\_7.
- [36] T. Grisold, J. Mendling, M. Otto, and J. vom Brocke, "Adoption, Use and Management of Process Mining in Practice," *Business Process Management Journal*, vol. ahead-of-print, Aug. 2020, doi: 10.1108/BPMJ-03-2020-0112.
- [37] R. K. Yin, "CASE SUDY RESEARCH," 2003.
- [38] R. Ellis, "Running header: THE EVOLUTION OF SOCIOTECHNICAL SYSTEMS 1 The Evolution of Sociotechnical Systems," Aug. 2022.



# Appendix A – Systematic Literature Review Supplement

## Inclusion and Exclusion Criteria

### Inclusion Criteria:

- Peer-reviewed journal articles and conference papers
- Publications in English
- Works published between 2010 and 2024
- Studies directly related to BPM, RPA, and process improvement

### Exclusion Criteria:

- Non-English publications
- Grey literature (blogs, presentations, etc.)
- Studies with insufficient methodological detail
- Duplicates across databases

## PRISMA Flow (Textual Version)

### Identification:

- Records identified through database searching: 245
- Additional records identified through snowballing: 14
- Total records identified: 259

### Screening:

- Records after duplicates removed: 200
- Records screened (title/abstract): 200
- Records excluded: 150

### Eligibility:

- Full-text articles assessed for eligibility: 50
- Full-text articles excluded (not relevant / insufficient detail): 30
- Articles included from initial search: 20
- Articles added through snowballing: 14
- Total articles for detailed analysis: 34

### Synthesis:

- Articles excluded during synthesis (RPA-only focus, limited integration discussion): 9
- Studies included in final synthesis: 25

### Snowballing Justification:

The snowballing technique was applied to ensure comprehensive coverage of relevant literature, particularly given the emerging nature of hyper-automation research. Backward citation tracking examined reference lists of key papers, while forward citation tracking identified more recent works citing foundational studies. This approach proved particularly valuable in identifying practitioner-oriented research published in conference proceedings that complemented the theoretical foundations from journal articles.

Exclusion Rationale (9 papers):

The nine papers excluded during synthesis were removed because they:

1. Focused exclusively on RPA implementation without discussing orchestration or integration strategies
2. Did not address API-driven integration or BPM-based process management
3. Lacked discussion of the socio-technical or governance aspects central to hyper-automation
4. Provided redundant information already captured by other included studies

While these papers contributed to the initial understanding of RPA capabilities, they did not advance the research objectives related to integrated hyper-automation architectures.

## Appendix B – Practical Implementation Framework

### Structured Tools for Hyper-Automation Transformation

#### Technical Readiness Assessment (40 points total)

Criterion	Score (1-5)	Weight	Weighted Score
API availability across core systems	___/5	3	___/15
Current automation portfolio size	___/5	2	___/10
System integration complexity	___/5	2	___/10
Data quality and accessibility	___/5	1	___/5

#### Organizational Readiness Assessment (35 points total)

Criterion	Score (1-5)	Weight	Weighted Score
Executive sponsorship and commitment	___/5	3	___/15
Change management capability	___/5	2	___/10
Cross-functional collaboration maturity	___/5	2	___/10

#### Financial Readiness Assessment (25 points total)

Criterion	Score (1-5)	Weight	Weighted Score
Investment budget availability	___/5	2	___/10
ROI expectations alignment	___/5	2	___/10
Risk tolerance level	___/5	1	___/5

**Total Readiness Score: \_\_\_/100**

#### Interpretation Guide:

- **90-100:** Excellent readiness - Proceed with full implementation
- **75-89:** Good readiness - Address minor gaps before proceeding
- **60-74:** Moderate readiness - Significant preparation required
- **Below 60:** Poor readiness - Major foundational work needed

## **Critical Success Factor Analysis**

### **Mandatory Prerequisites (Must Score 4+ in ALL categories)**

- Executive sponsorship with dedicated budget allocation
- API availability for minimum 60% of core business systems
- Existing automation portfolio of at least 10 processes
- Dedicated project team with both technical and business expertise

### **High-Impact Enablers (Should score 4+ in majority)**

- Established Center of Excellence for automation
- Mature change management processes and culture
- Strong data governance and quality frameworks
- Cross-functional process optimization experience

## **Implementation Roadmap Template**

### **PHASE 1: Foundation (Months 1-3)**

#### *Objectives:*

- Establish governance framework
- Complete detailed process assessment
- Set up core infrastructure
- Build project team capabilities

#### *Deliverables:*

- Governance charter and policies
- Process inventory and prioritization matrix
- BPM platform installation and configuration
- Team training completion (minimum 40 hours per team member)

#### *Go/No-Go Criteria:*

- Governance framework approved by executives
- Minimum 15 processes identified for migration

- Platform performance meets benchmarks (response time <2 seconds)
- Team competency assessment scores >80%

## **PHASE 2: Pilot Implementation (Months 4-6)**

### *Objectives:*

- Implement 3-5 pilot processes
- Validate technical architecture
- Test change management approach
- Establish monitoring and reporting

### *Deliverables:*

- 5 processes migrated from RPA to orchestration
- Performance baseline established
- User training materials and programs
- Incident response procedures

### *Go/No-Go Criteria:*

- Pilot processes achieve target performance metrics
- User satisfaction scores >75%
- Technical architecture stability confirmed
- ROI projections validated through pilot data

## **PHASE 3: Scaled Deployment (Months 7-12)**

### *Objectives:*

- Migrate remaining high-priority processes
- Optimize and tune performance
- Expand user adoption
- Decommission legacy RPA infrastructure

### *Deliverables:*

- 80% of target processes migrated

- Performance optimization completed
- Legacy bot decommissioning (minimum 70%)
- Advanced monitoring and analytics deployed

*Go/No-Go Criteria:*

- Migration velocity meets targets (minimum 2 processes/month)
- System performance maintains SLA requirements
- Business benefits realization on track (minimum 75% of projections)
- Stakeholder adoption rates >85%

**PHASE 4: Optimization and Expansion (Months 13-15)**

*Objectives:*

- Complete remaining process migrations
- Implement advanced capabilities (AI/ML integration)
- Establish continuous improvement processes
- Plan next-phase enhancements

*Deliverables:*

- 100% target process migration completed
- Advanced analytics and reporting dashboard
- Continuous improvement framework
- Roadmap for Level 4 maturity progression

**Business Case Development Template**

**Executive Summary Template**

**BUSINESS CASE: Hyper-Automation Transformation Initiative**

**STRATEGIC CONTEXT:**

Current State: [Brief description of existing automation landscape]

Business Drivers: [Key pressures requiring transformation]

Strategic Alignment: [Connection to organizational goals]

**PROPOSED SOLUTION:**

- Approach: Migration from fragmented RPA to orchestrated hyper-automation
- Timeline: [X] months implementation
- Investment: €[X] total investment over [Y] years

**FINANCIAL PROJECTIONS:**

- Year 1 ROI: [X]%
- 3-Year NPV: €[X]
- Payback Period: [X] months
- Risk-Adjusted Return: [X]%

**SUCCESS METRICS:**

- Process efficiency improvement: [X]%
- Incident reduction: [X]%
- Maintenance cost reduction: €[X]/year
- Compliance risk mitigation: €[X]/year

RECOMMENDATION: [Proceed/Defer/Modify] based on analysis

**Detailed Financial Analysis Worksheet**

**Investment Calculation Template:**

Category	Year 0	Year 1	Year 2	Year 3	Total
<b>Technology Costs</b>					
BPM Platform Licensing	€__	€__	€__	€__	€__
API Infrastructure	€__	€__	€__	€__	€__
Integration Development	€__	€__	€__	€__	€__
RPA License Optimization	(€__)	(€__)	(€__)	(€__)	(€__)
<b>Organizational Costs</b>					
Training & Change Mgmt	€__	€__	€__	€__	€__

Process Reengineering	€__	€__	€__	€__	€__
Governance Implementation	€__	€__	€__	€__	€__
Total Investment	€__	€__	€__	€__	€__

### Benefits Calculation Template:

Benefit Category	Calculation Method	Annual Value
Process Efficiency	(Time saved per process × Process volume × Hourly cost)	€__
Maintenance Reduction	(Old maintenance cost - New maintenance cost) × 12	€__
Incident Response	(Time reduction per incident × Incidents/year × Hourly cost)	€__
Risk Mitigation	(Estimated risk exposure reduction)	€__
Business Continuity	(Estimated downtime reduction value)	€__
Total Annual Benefits	Sum of above	€__

### Risk Management Framework

#### Risk Assessment Matrix

Risk Category	Probability (1-5)	Impact (1-5)	Risk Score	Mitigation Strategy
Technical Risks				
Platform integration failures	__	__	__	Proof of concept validation, phased rollout
Performance degradation	__	__	__	Load testing, performance monitoring
Security vulnerabilities	__	__	__	Security assessment, compliance validation
Organizational Risks				
Change resistance	__	__	__	Communication strategy, user involvement

Skills gap	—	—	—	Training programs, external support
Project scope creep	—	—	—	Clear governance, change control
Business Risks				
Benefits not realized	—	—	—	Milestone tracking, course correction
Budget overrun	—	—	—	Contingency planning, vendor management
Timeline delays	—	—	—	Critical path management, resource flexibility

### Contingency Planning Template

#### For High-Risk Scenarios (Risk Score 15+):

*Risk:* [Description] *Trigger Indicators:* [Early warning signs] *Contingency Plan:* [Specific actions to take]  
*Resource Requirements:* [Additional resources needed] *Decision Authority:* [Who can activate this plan] *Communication Plan:* [Stakeholder notification process]

### Change Management Playbook

#### Stakeholder Engagement Strategy

##### Executive Level:

- Monthly steering committee meetings
- Quarterly business review presentations
- Executive dashboard with key metrics
- Strategic alignment validation sessions

##### Management Level:

- Bi-weekly progress updates
- Department-specific impact assessments
- Resource allocation planning sessions
- Benefits realization tracking

##### Operational Level:

- Weekly team briefings during implementation
- Hands-on training sessions (minimum 16 hours per user)
- User feedback collection and response
- Champion network establishment

#### **Support Level:**

- Daily standup meetings during critical phases
- Technical troubleshooting protocols
- Documentation and knowledge transfer
- Continuous improvement suggestion process

#### **Success Measurement Framework**

##### **KPI Dashboard Template**

##### **Strategic Metrics (Executive Level)**

- Overall ROI: Target [X]%, Current [Y]%
- Process reliability improvement: Target [X]%, Current [Y]%
- Compliance risk reduction: Target €[X], Current €[Y]
- Time to implement new processes: Target [X] days, Current [Y] days

##### **Operational Metrics (Management Level)**

- Process migration velocity: Target [X]/month, Current [Y]/month
- User adoption rate: Target [X]%, Current [Y]%
- Incident reduction: Target [X]%, Current [Y]%
- System availability: Target [X]%, Current [Y]%

##### **Technical Metrics (IT Level)**

- Platform performance: Target <[X]s response, Current [Y]s
- Integration success rate: Target [X]%, Current [Y]%
- Maintenance effort reduction: Target [X] hours/week, Current [Y] hours/week
- API coverage: Target [X]%, Current [Y]%

## Milestone Celebration and Course Correction

### Celebration Triggers:

- Each major phase completion
- Reaching 50% and 100% of process migrations
- Achieving ROI breakeven point
- User adoption milestones (25%, 50%, 75%, 95%)

### Course Correction Triggers:

- KPI performance below 80% of target for 2 consecutive months
- User satisfaction scores below 70%
- Technical performance degradation beyond acceptable thresholds
- Budget variance exceeding  $\pm 15\%$

## Lessons Learned Integration

### Critical Success Factors:

1. **API readiness is non-negotiable** - Ensure 60%+ API coverage before beginning
2. **Executive sponsorship must be active** - Not just approval, but ongoing engagement
3. **Change management is equally important as technical implementation**
4. **Start with governance framework, not technology deployment**

### Common Pitfalls to Avoid:

1. **Underestimating change resistance** - Plan 25% more change management effort than initially estimated
2. **Rushing the foundation phase** - Solid governance prevents future complications
3. **Ignoring the "valley of despair"** - Prepare teams for initial complexity increase
4. **Inadequate training investment** - User competence directly correlates with adoption success

This comprehensive practical framework provides organizations with concrete tools to plan, implement, and manage their hyper-automation transformation based on empirically validated best practices from the case study.