



## **eSolution Evolution**

### **Developing ERP interface for downstream processors**

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**Tiivistelmä**

Opinnäytetyön tavoitteena oli tutkia ja edistää case-yrityksen jälkikäsittelijöille suunnatun eSolution-käyttöliittymän jatkokehitystä, joka on rakennettu yrityksen nykyiseen toiminnanohjausjärjestelmään. Tämän päämäärän saavuttamiseksi työssä keskityttiin kahteen keskeiseen tutkimusobjektiin. Ensimmäisenä tavoitteena oli tunnistaa eSolutionin mahdolliset rajoitukset ja keinot sen parantamiseksi. Toisena tavoitteena oli arvioida eSolutionin siirtämisen toteutettavuutta pilvipohjaiselle alustalle yrityksen digitalisointitavoitteiden mukaisesti.

Tutkimuksessa käytettiin laadullista tutkimusmenetelmää. Tietoa hankittiin sekä kattavan kirjallisuuskatsauksen että useiden haastattelujen avulla. Kirjallisuuskatsaus kattoi kaksi pääaluetta, yksityiskohtainen tarkastelu toiminnanohjausjärjestelmistä, niiden elinkaaresta ja integrointivaatimuksista sekä toiminnanohjausjärjestelmien käyttöönottomallien vertailu. Kerättyjen tietojen analysoinnissa käytettiin laadullista sisällönanalyysia.

Kerätyn aineiston analyysi paljasti kolme keskeistä kehitysteemaa. Ensimmäinen teema oli käyttöliittymän vuorovaikutus ja tehokkuus, mikä korostaa käyttäjäkeskeisen suunnittelun merkitystä. Toinen teema korosti yhteentoimivuuden ja tietojen eheyden tarvetta järjestelmän saumattoman toiminnan varmistamiseksi. Kolmannessa teemassa korostettiin vaatimusta mukautua eri maantieteellisille markkinoille, korostaen järjestelmän joustavuutta.

Keskusteluissa eSolutionin tulevasta siirtymisestä ilmeni monitahoisia haasteita. Vaihtoehtoisista Salesforceen vankkaa toiminnallisuutta verrattiin räätälöityyn Azure-ratkaisuun. Tuloksissa korostui, että vaikka Salesforce tarjosi laajan valikoiman työkaluja, Azure-keskeisen ratkaisun mahdollisuudet näyttivät vastaavan paremmin yrityksen pitkän aikavälin tavoitteita erityisesti kustannustehokkuuden ja mukautuvuuden osalta. Huolimatta joistakin haasteista, jotka liittyivät lähinnä taloudellisiin sitoumuksiin, Azure-keskeinen kehityskaari osoittautui lupaavammaksi ja strategisten tavoitteiden mukaiseksi.

**Avainsanat (asiasanat)**

ERP, toiminnanohjausjärjestelmät, tietojärjestelmät, digitalisaatio, strategia, pilvipalvelut, teknologinen kehitys, käyttöliittymät

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### **Abstract**

The aim of the thesis was to study and develop further the user interface referred as eSolution, built into the case company's current ERP system, which is tailored to manufacturing service providers called converters. To achieve this goal, the thesis focused on two main research objectives. The first objective was to identify the potential limitations of eSolution and ways to improve it. The second objective was to assess the feasibility of migrating eSolution to a cloud-based platform, in line with the company's digitalisation ambitions.

A qualitative research approach was adopted for the study. Insights were gained from both a comprehensive review of relevant literature and a series of interviews. The literature review covered two main areas, a detailed examination of ERP systems, their lifecycle and integration requirements, followed by a comparison of ERP system deployment models. The analysis of the collected data was carried out using qualitative content analysis.

Analysis of the collected data revealed three key development themes. The first theme was user interaction and efficiency, highlighting the importance of user-centered design. The second theme stressed the need for interoperability and data integrity to ensure seamless system operation. The third theme emphasized the requirement for eSolution to adapt to different markets, demonstrating its flexibility.

Discussions on the future migration of eSolution revealed complex challenges. The robust functionality of Salesforce was compared to a customized solution on Azure. The findings highlighted that while Salesforce offered a wide range of tools, the potential of creating an Azure-centric solution seemed more aligned with the company's long-term goals, particularly in the areas of cost efficiency and adaptability. Despite some challenges, mainly related to financial commitments, the Azure-centric trajectory proved to be a more promising path in line with strategic imperatives.

### **Keywords/tags (subjects)**

ERP, enterprise resource planning systems, data systems, digitalisation, strategy, cloud services, technological development, user interfaces

### **Miscellaneous (Confidential information)**

None

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## Abbreviations

API	Application Programming Interface
BI	Business Intelligence
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
JSON	JavaScript Object Notation
SaaS	Software-as-a-Service
SUG	Segment User Group
PaaS	Platform-as-a-Service
UI	User Interface
UIB	Unit Identification Barcode
XML	eXtensible Markup Language

# 1 Introduction

This chapter provides an introduction to the study, outlining its background, objectives, and research questions. It concludes with an overview of the study's scope and structure.

## 1.1 Background of the study

The case company is a major player in the global bioeconomy, focusing on the sustainable use of renewable resources. Employing over 20,000 people, its portfolio includes renewable products ranging from packaging materials to wooden construction. While the company is predominantly based in Europe with production facilities across 11 European countries, its reach extends through sales offices from North America to the Middle East and Asia. In the fiscal year 2022, the company recorded a turnover of 11.7 billion euros.

The case company has identified the need to further develop the user interface (UI) built into the current Enterprise Resource Planning (ERP) system. ERP systems centralize and integrate diverse organizational functions, using integrated software modules and a central database to automate processes, provide real-time data access, and optimize organizational performance (Azhar et al., 2022). This improvement is primarily aimed at meeting the needs of downstream processors. The solution, henceforth referred to as 'eSolution', which is tailored for manufacturing service providers, specifically converters that perform tasks such as sheet cutting, rewinding, barrier coating, or laminating for case company mills, provides a versatile platform.

Beyond its production-centric features, eSolution extends its capabilities to logistics. It eases the entry and visibility of bills of lading, ensuring that transportation documents are not only accurately recorded, but also easily accessible for review. This visibility is important for making informed decisions in logistics operations. The eSolution also provides users with a comprehensive understanding of various operational sides, from detailed inventory overviews to critical production reports that compare items produced to raw materials used. In addition, the system's ability to break down production lots based on individual cycles provides a granular perspective on production processes.

However, the development of eSolution has received limited attention. The company recognizes the importance of this service and is actively exploring the strategic direction for its continued development. A key decision lies ahead, should the company continue to develop the service in its current environment, or should it transition to the cloud environment. While moving to the cloud environment offers a modern infrastructure with potential benefits in agility, scalability, and integration capabilities, it also comes with its own set of costs. These costs, both financial and workforce, must be carefully weighed against the expected benefits. This decision will be important in determining the future course of the eSolution solution and ensuring that it remains aligned with the company's evolving technology landscape and business objectives.

## **1.2 Research objectives and questions**

The ERP system of the case company, rooted in the 1990s, remains a foundational pillar for many of its core operations. While the ERP continues to be the backbone of the company's operations, there has been a strategic shift in recent times. Recognizing the advantages of cloud-based platforms, the company has begun migrating some of its supporting functions to the cloud. This move is not merely a technological upgrade but a strategic realignment, aimed at enhancing agility, scalability, and responsiveness to the evolving needs of their customers. However, eSolution, despite its potential significance, has not been part of this initial cloud transition. Its development has historically been somewhat overlooked, leaving it operating within the boundaries of the legacy ERP system. Given the strategic importance of eSolution and the company's broader shift towards cloud-based solutions, there is a need for a pre-study. This study focusses on two research objectives.

**RO1:** Understanding Development Needs. An analysis of the current state of eSolution, its limitations, and potential areas for improvement to better serve its users.

**RO2:** Cloud Migration Assessment. Evaluating the feasibility of migrating the eSolution to the cloud platform, aligning it with the company's digitalisation strategy.

After establishing the research objectives, a central question emerges that captures the essence of this study. While the objectives outline the research steps, the primary question focuses on the future of eSolution.



**RQ:** In line with the company's strategic vision, how can eSolution be developed to better meet the needs of the downstream processors, while improving its efficiency and usability?

### **1.3 Structure of the thesis**

This thesis is structured into five chapters, each with a specific focus and purpose. The first chapter begins with a background discussion on the strategic importance of ERP UI development. It then expands on the objectives and purpose of the study and presents the central research question that guides the study. Finally, the chapter provides an outline of the thesis structure.

The second chapter offers a more in-depth exploration of the theoretical foundations, starting with an examination of how ERP systems have revolutionized modern business. This is followed by an analysis of the development characteristics and demands of ERP systems. The chapter also provides an overview of various deployment models, highlighting their key differences.

The third chapter outlines the methodology of the study, detailing the data collection and analysis processes and providing reasoning for the chosen research methods. The fourth chapter presents the results of the empirical study, complete with a comprehensive analysis of the data collected.

In the fifth chapter, the thesis concludes with a summary of the main discoveries and insights, alongside practical and theoretical implications of these findings, and reflections on the study's objectives and research questions. The chapter closes with an evaluation of the research, recognizing its limitations, and proposing potential directions for future research.

## **2 Theoretical background**

This chapter provides the theoretical foundation for the study and is organized into three main sections. The first section reviews the literature on ERP systems, including their lifecycles, development, and integration demands. The second section discusses various strategies for implementing ERP systems. Lastly, the third section summarizes the key concepts identified in the literature review and sets the foundation for the empirical part of the study.

## 2.1 ERP-system

ERP is a software system that integrates various functions, including finance, human resources, and manufacturing, into a unified platform. This centralizes data from various process points. These systems consist of integrated software modules and a central database, which streamline administrative processes and enhance cross-functional operations. By automating business processes and providing real-time access to data, ERP systems promote efficient resource management and optimize overall organizational performance. (Azhar et al., 2022.) This integration not only streamlines business needs but also enhances organizational efficiency and coordination.

Implementing an ERP system is primarily a business-focused initiative rather than just a technological one, and it demands attention from a wide range of stakeholders. This process involves not only adapting the software to fit specific business needs but also adjusting business operations to align with the best practices embedded in the ERP system (Jiang & Wang, 2022). Azhar et al. (2022) highlights the significance of ERP in enhancing business outcomes, particularly in areas like inventory management and order processing and emphasize its ability to promptly resolve queries and improve communication.

Additionally, ERP is described as a comprehensive system essential for accessing transaction data on both local and global levels. By connecting various business processes and allowing for continuous data flow, ERP eliminates duplicate data and ensures data accuracy. This establishes ERP as a reliable data repository and a collaborative hub for engaging with third-party businesses (Azhar et al., 2022).

This section examines the ERP system lifecycle, emphasizing the importance of aligning post-implementation strategies with business objectives, understanding the differences between technical and functional updates, and addressing the challenges and considerations associated with system customizations and upgrades.

### 2.1.1 ERP lifecycle

The ERP lifecycle framework, as shown in Figure 1, offers a comprehensive perspective on the evolution of an ERP system.

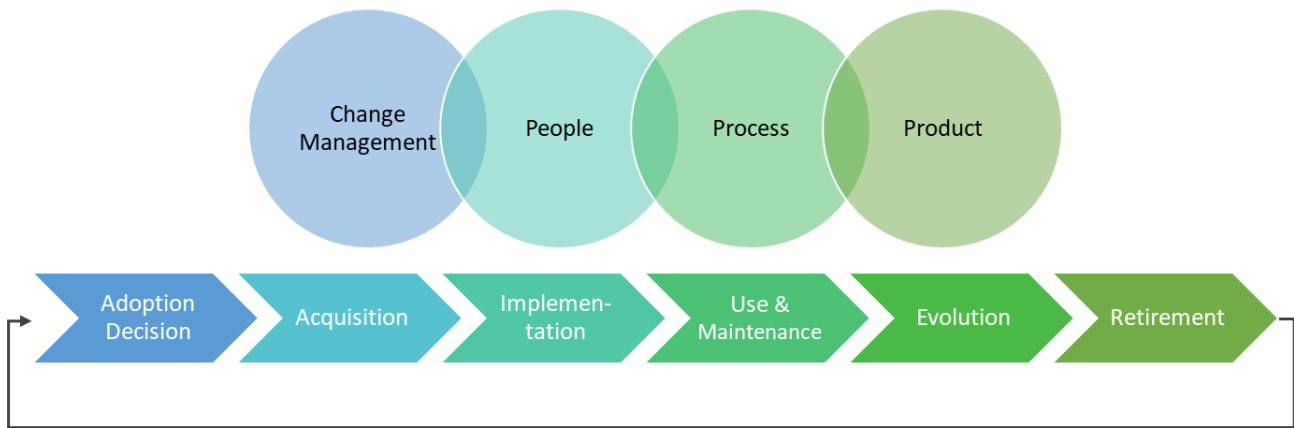


Figure 1: ERP lifecycle framework (Bjelland & Haddara, 2018).

Bjelland & Haddara (2018) framework comprises of six essential stages. The process begins with the Decision to Adopt stage, where organizations conduct a thorough assessment of their needs, weigh the benefits and disadvantages, and determine the viability of implementing an ERP system. Next comes the Acquisition stage, wherein organizations participate in the selection and acquisition of an ERP system that best fits their operational priorities. Once acquired, the Implementation phase begins, characterized by configuring, customizing, and deploying the system. This stage requires thorough planning, testing, and training to ensure a seamless transition. Following successful implementation, the system enters the Utilization and Maintenance phase, where it is actively used and regularly maintained through patches, updates, and troubleshooting to ensure optimal performance. As organizations grow and their needs change, the ERP system must adapt, leading to the Evolution stage. During this stage, the system undergoes enhancements by integrating additional features or modules. When the ERP system no longer aligns with the organization's evolving requirements or becomes outdated, it reaches the Retirement stage, indicating its phase-out and potential replacement. (Bjelland & Haddara, 2018.)

Bjelland & Haddara (2018) emphasize the importance of four key dimensions in understanding the lifecycle in question. Change Management underscores the strategies employed to oversee transi-

tions, ensuring minimal disruptions, and fostering user adoption. The People dimension acknowledges the pivotal role of human factors, emphasizing training, user experience and ensuring the system resonates with the workforce's needs. Processes, the third dimension, focus the importance of streamlined workflows, automations, and operational procedures that are inseparably linked to the ERP system's success. Lastly, the Product dimension pertains to the ERP software itself, its features, capabilities, and alignment with organizational objectives. (Bjelland & Haddara, 2018.)

### **2.1.2 ERP post-implementation development**

If an ERP post-implementation plan fails to align with the overall business strategy, it can lead to significant challenges for the organization. Regular review and upgrading of the adopted ERP system during the post-deployment phase are essential. A well-crafted ERP implementation strategy is vital for long-term success. Without alignment between the ERP post-deployment plan and the business strategy, the organization may struggle to navigate towards its developmental goals. (Singh et al., 2023.) This misalignment can cause the ERP system to struggle in supporting the company's objectives and aspirations.

Implementing business software often requires customization. While technological advances have made customization more affordable, it remains an important consideration, especially for systems such as ERP, and organizations face a dilemma when implementing ERP systems, how much to customize. Nestell & Olson (2018) argue that, ideally, extensive in-house reengineering and modification of ERP software would be required to perfectly align with organizational needs. However, this approach is often impractical due to time and cost constraints. A more efficient alternative is to use the vendor's software directly, but this rarely meets all of an organization's unique needs. As a result, many companies choose a middle ground, customizing a vendor's software product. This approach balances the flexibility of custom software while retaining some of the built-in efficiencies of the vendor's system. It allows organizations to maintain their unique processes and core competencies, with minimal disruption to employees. However, this flexibility comes at a price, as it places a greater burden on the IT team and can be more expensive. (Nestell & Olson, 2018.)

Upgrades in ERP systems can be technical or functional. Domagała et al. (2021) describe those technical upgrades, provided by vendors, ensure the system remains supported and up to date. They transition the existing system to a newer version and are essential when the current version nears its end. Businesses seek these upgrades for consistent legal and technical support, while the IT department aims to stay updated with the latest technology. On the other hand, functional upgrades enhance business operations. Unlike technical upgrades, which are IT-driven, functional ones are usually initiated by the business side. (Domagała et al., 2021.)

Functional upgrades often follow technical ones, aiming for significant technical and business improvements. These enhancements in the ERP system can come in the form of add-ons or upgrades, offering added business features. The process of upgrading involves integrating customizations and transferring data across ERP versions. In contrast, reimplementation introduces the latest ERP version as if it is brand-new software, necessitating the reconfiguration of systems and databases. This approach is a blend of replacing an old system and a technical upgrade, demanding extensive business process re-engineering and data conversion. (Domagała et al., 2021.)

### **2.1.3 ERP Integration demands**

For modern companies, the role of ERP systems goes beyond centralization. They serve as a hub, integrating applications at both the information and operational levels (Azhar et al., 2022). Nevertheless, the ERP system landscape is presently undergoing a major transformation. While traditional on-premises ERP systems are robust, they are facing competition from cloud-based ERP systems. The advantage of cloud-based systems is their cost-effectiveness and rapid deployment capabilities. As businesses undergo digital transformation, migrating to cloud technology presents both opportunities and challenges. One of the notable challenges, as highlighted by Rahme et al. (2022), is the presentation of the ERP module as a "black-box" application. This means that while the system comes with built-in services and modules, it may not guarantee efficient integration among these applications.

Even with the progression in ERP technology, Rahme et al. (2022) argue that issues of interconnectivity and interoperability continue to exist between functions. Such barriers can hinder communication across different functions. When one function faces these communication challenges, it can

ripple through the organization, impacting overall efficiency. Thus, selecting a system and environment that addresses and mitigates these interoperability issues is crucial for optimizing the entire company and enhancing its operational efficiency.

The Web Application Programming Interface (API) serves as a bridge, allowing different systems to communicate seamlessly, surpassing the constraints of traditional integration methods. By simplifying complex processes, APIs offer an efficient approach to connecting different software components. This seamless data exchange is not limited to an organization's boundaries. Companies can extend their reach through APIs, sharing data insights with partners, stakeholders, and the wider user community. Moreover, a well-designed API is not only about data exchange, but it is also about functionality. APIs provide programmatic capabilities, enabling developers to leverage specific functionalities from one system and integrate them into another, without requiring an understanding of the complex details of the underlying system. (Geewax & Skeet, 2021.)

One of the key data formats that can be used via APIs is XML (eXtensible Markup Language). XML serves as a meta-language designed to standardize the representation and exchange of data across various platforms and applications. Unlike fixed-tag markup languages, XML allows for the creation of user-defined tags, making it a flexible framework for both structured and loosely structured data. The extensibility of XML makes it a suitable choice for complex integrations where data structures may vary or evolve over time. (Banzal, 2020.) JSON (JavaScript Object Notation) is another popular data interchange format like XML. JSON is primarily used in web-based APIs and is compatible with various programming languages, making it highly efficient for fast data exchange. Although XML offers more complex and flexible data representation, JSON's simplicity and speed make it a preferable choice for web applications. (Carter, 2018.)

On the other hand, EDI (Electronic Data Interchange) provides a more rigid but highly efficient method of data exchange. Unlike XML and JSON, EDI uses predefined message formats and codes, ensuring quick and secure data transmission. This standardization is particularly useful for routine transactions that do not require frequent changes in data structure. (Klapita, 2021.)

## 2.2 Deployment models

The effectiveness of an ERP system is not solely determined by its features or capabilities, but also by its configuration and implementation. The selection of deployment methods, whether SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), or on-premise, is significant to this discussion. These options for deployment can influence the flexibility of the ERP system, its cost, maintenance requirements, integration with other systems, and alignment with a company's objectives. In this section, different approaches to implementing ERP systems are examined, highlighting the advantages, possible challenges, and ideal situations for each approach.

### 2.2.1 On-Premise

The conventional method that software companies use to deliver enterprise software is known as the on-premise licensing model. In this approach, organizations purchase the right to use the products and install them on their local systems (Wang et al., 2023). Licensing is a key component of this model, but it is only part of the total cost of ownership. Beyond the initial license fees, which are one-time charges, customers must account for additional expenses. These include ongoing annual maintenance charges and according to Link & Back (2015), they often range 15-25% of the initial license fee, as well as the costs associated with infrastructure like servers and databases. Additionally, each on-premise ERP instance demands individual maintenance and backups, requiring IT expertise and incurring further costs. Organizations must manage these backups themselves and establish their own reliability and safety standards, although some may opt for trusted providers to maintain superior backup standards. (Link & Back, 2015.)

Predicting costs is a challenge with on-premise ERPs due to possible hardware issues, installation challenges and unexpected maintenance needs. However, businesses with IT expertise and a preference for customized systems could find on-premise ERPs more strategic, particularly when customization gives a competitive advantage. These systems can become valuable assets due to their rare alignment with business processes. Essentially, on-premise ERPs are optimal for businesses looking for a tailored solution or those with industry-specific needs. On the other hand, businesses lacking IT proficiency or those who perceive ERP as a regular tool could gain an advantage by outsourcing their ERP operations. (Link & Back, 2015.)

### **2.2.2 SaaS (Software-as-a-Service)**

ERP systems have evolved to be accessible via cloud technology, where vendors provide both the software and essential infrastructure. This approach simplifies the user experience by eliminating the need for in-depth system and hardware management. The SaaS model allows customers to rent software resources from vendors, offering standardized functionalities without significant up-front costs. This model shifts from a one-time purchase to a subscription-based approach, offering cost predictability and reduced initial expenses. (Wang et al., 2023.)

With SaaS, there is no requirement for on-site server applications or backend infrastructure, leading to more efficient maintenance and support. The responsibility for system updates, server up-keep, maintenance, and data backup rests with the vendor, ensuring the system's security and consistent performance. The implementation of SaaS-ERP is generally quicker, given the absence of hardware provisioning and software installation. (Bjelland & Haddara, 2018.) However, although the system is pre-configured, it often needs to be customized to match specific business processes, particularly when its configuration mechanisms are complicated (Link & Back, 2015).

SaaS offers flexibility, allowing businesses to scale resources based on their needs. Companies with fluctuating demands, such as seasonal businesses, can particularly benefit from this model. However, customization in SaaS-ERP is limited to predefined configurations and interfaces, making it essential for businesses to weigh the benefits of system specialization against standardization. (Link & Back, 2015.)

### **2.2.3 PaaS (Platform-as-a-Service)**

PaaS builds upon the concept of platforms in the software industry, offering an extensible code-base that provides core functionality shared by interoperable modules. Platforms such as Salesforce allow independent software vendors to develop extensions for the software business's core application. The core application must be considered an integral part of the platform, as any third-party software operating on this platform functions solely as an extension or add-on to the core application, rather than as independent or stand-alone software. (Giessmann & Legner, 2016.) However, users are restricted to deploying applications developed using a specific version



of a programming language dictated by the PaaS provider. These restrictions may require users to modify and rewrite existing applications to run on a PaaS cloud. (Jiang & Wang, 2022.)

The cloud computing model, known for its scalability and cost savings, has significantly transformed the IT sector. However, challenges like security concerns and vendor lock-in, often due to interoperability and portability issues, have limited its widespread adoption. In this cloud structure, PaaS is central, with user-oriented SaaS positioned above. Designed for software developers, PaaS provides the necessary services for application development, with the provider overseeing the underlying infrastructure and network operations. Yet, a significant challenge at the PaaS level is application portability. Applications crafted for one PaaS environment often face difficulties when transitioning to another, leading to vendor lock-in. (Bharany et al. 2022.) This problem is even more pronounced in the PaaS domain compared to other layers of cloud computing. Bharany et al. (2022) highlight how this vendor lock-in scenario, resulting from a lack of seamless interaction between cloud providers, limits the smooth migration of application components and their associated tasks from one cloud provider to another. It is important to address this issue, as unresolved vendor lock-in could potentially negate the very benefits and cost savings promised by cloud computing.

While on-premise focuses on the traditional method of software deployment with direct control over infrastructure, and SaaS emphasizes cloud-based software delivery with reduced infrastructure management, PaaS introduces a platform-centric approach. This approach not only facilitates software development and deployment but also promotes collaboration, innovation, and value co-creation. The PaaS model offers a balance between the customization capabilities of on-premise systems and the standardized functionalities of SaaS solutions. By providing a platform for developers to build, test, and deploy applications, PaaS solutions can provide specific business needs while also benefiting from cloud-based efficiencies.

### 2.2.4 Comparison overview

Table 1 provides a comparative analysis of three deployment models discussed above.

Table 1. Comparison between different deployment models (Wang et al., 2023; Link & Back, 2015; Bjelland & Haddara, 2018; Giessmann & Legner, 2016; Jiang & Wang, 2022; Bharany et al., 2022).

Deployment Model	Benefits	Risks
On-Premise	Highly customizable	High initial & ongoing costs
On-Premise	Direct control over data	Need for IT expertise
On-Premise	Specialized for industry needs	Unpredictable costs due to hardware and maintenance
On-Premise	Rare alignment with business processes	Requires local backups
On-Premise	Total control over security protocols	Risk of obsolescence
SaaS	Lower initial costs	Limited customization
SaaS	Quick implementation	Adaptation may be needed for specific business processes
SaaS	Vendor-managed security	Reliance on vendor for uptime and data security
SaaS	No need for on-site servers	Potential data sovereignty issues
SaaS	Cost predictability	Possible latency and performance issues
PaaS	Balance between customization and standardization	Vendor lock-in
PaaS	Scalable	Specific language and framework limitations
PaaS	Facilitates collaboration and innovation	Portability challenges
PaaS	Reduces time and cost of application development	Unresolved vendor lock-in could negate cost savings
PaaS	Quick testing and deployment capabilities	Complexity can overwhelm teams without cloud expertise

These models address different organizational needs and capabilities. For example, on-premise systems are often best suited for large organizations with complex operational requirements and the IT expertise to manage them. In contrast, SaaS models are typically preferred by small and midsize businesses, or any organization looking to deploy solutions quickly with minimal up-front costs. Designed with a developer in mind, PaaS is ideal for organizations looking to deploy unique

applications quickly and offers a balanced approach that combines some of the benefits of both. The table evaluates each model based on its advantages and disadvantages to assist organizations in making the decision that best aligns with their business goals and operational needs.

## 2.3 Summary

ERP-systems have emerged as transformative tools in the modern business landscape, centralizing and streamlining various organizational processes. By integrating functions such as finance, human resources, and manufacturing, ERPs provide a unified platform that enhances cross-functional operations, ensuring efficient resource management and improved organizational performance (Azhar et al., 2022). The importance of ERPs goes beyond mere process integration, they serve as collaboration hubs, fostering innovation and facilitating third-party business engagements. The evolution of an ERP system within an organization is best understood through Bjelland & Haddara (2018) ERP lifecycle, which spans from the initial decision to adopt it to its eventual retirement. This lifecycle highlights the importance of strategic planning, acquisition, implementation, and continuous adaptation to changing business needs. Four key dimensions - change management, people, process, and product - emerge as critical to successfully navigating this lifecycle (Bjelland & Haddara, 2018).

Post-implementation, the alignment of ERP strategy with overarching business goals becomes paramount. A misaligned strategy can pose significant challenges, highlighting the need for regular system reviews and upgrades (Singh et al., 2023). Customization, a common requirement, presents organizations with the dilemma of how much to change their ERP systems. Finding a balance between customization and standardization is essential, especially in the context of technological and financial constraints (Nestell & Olson, 2018).

As the ERP landscape evolves, traditional on-premise systems are being challenged by cloud-based ERPs. Although these cloud solutions are cost-effective and quick to deploy, they can sometimes function as "black-box" applications, presenting integration challenges. Persistent interconnectivity and interoperability issues can interfere with communication between functions, which can adversely affect overall efficiency (Rahme et al., 2022). However, modern APIs ensure smooth communication between diverse systems, simplifying complex processes for more efficient software integration (Geewax & Skeet, 2021). Key data formats like XML and JSON provide flexibility and

extensibility for complex integrations (Banzal, 2020; Carter, 2018), whereas EDI offers a standardized, efficient method for routine data exchanges (Klapita, 2021).

The deployment model chosen for an ERP system plays a critical role in its effectiveness and alignment with organizational goals. Traditional on-premise models provide control at the expense of higher costs and maintenance responsibilities (Wang et al., 2023; Link & Back, 2015). In contrast, cloud-based models, such as SaaS, simplify the user experience and reduce upfront costs, although they may limit customization (Bjelland & Haddara, 2018; Link & Back, 2015). PaaS, which combines the strengths of both models, introduces a platform-centric approach that encourages collaboration and innovation (Giessmann & Legner, 2016).

When making a strategic choice between these deployment models, organizations must weigh their priorities. Those that value specialization and have IT expertise may lean toward on-premise solutions. On the other hand, companies that lack such expertise or view ERP as a mainstream tool may find greater value in the streamlined experience offered by SaaS. Meanwhile, PaaS stands as a bridge, blending the strengths of both models and introducing a platform-centric approach that promotes both customization and collaboration. The decision between SaaS, on-premises, and PaaS depends on an organization's operational priorities, IT capabilities, and long-term strategic goals. Each model comes with its own set of benefits, challenges, and considerations, so it is important for organizations to assess their unique needs and goals before committing to a specific deployment approach.

### **3 Methodology**

The chapter explains the research methodology and its underlying justification, divided into three primary subsections: literature review, research approach, and data collection and analysis. The literature review examines current theoretical literature, thereby setting the foundation for the study. The research approach section outlines the organizational structure and methods utilized in the study. Lastly, the data collection and analysis section explain the techniques used to gather the necessary information for this study and describes the processes used to examine the collected data.

### 3.1 Literature review

Understanding the current knowledge of a field requires a careful literature review that evaluates both theoretical frameworks and empirical studies conducted by peer researchers. According to Eriksson & Kovalainen (2016), the purpose of such a review is to examine, synthesize, compare, and critically evaluate the contributions of other researchers on the research topic. This process not only provides a basis for formulating research hypotheses, but also sets the stage for later analysis and interpretation of findings (Eriksson & Kovalainen, 2016).

The data collection process was conducted systematically to gather relevant and credible sources using the JAMK Janet Finna database. This approach ensured the accuracy and reliability of the information, which was considered essential for the study. To maintain source relevance and recency, a period of 2015 to 2023 was chosen. This eight-year duration provided a comprehensive view of recent developments and ensured that the data remained up to date. Search criteria were also narrowed to peer-reviewed articles and publications. The review was guided by specific keywords using Boolean commands, including "ERP"; and combinations such as "ERP AND post-implementation"; "ERP AND customization"; "ERP AND lifecycle"; "ERP AND on-premises AND SaaS"; "SaaS AND PaaS"; and "API".

To ensure article relevance, titles were initially assessed, and only relevant articles advanced to the abstract review stage. The abstracts were then examined to identify valuable information related to the thesis topic and its concepts. Articles meeting the established criteria were then selected. As the research progressed and the connections between topics became clearer, search terms were adjusted to enable a more comprehensive examination of the subject, ensuring a thorough analysis. Through the literature review, a systematic foundation has been established, highlighting the complexities and implications of the primary issues. By utilizing a methodical approach and prioritizing current, relevant sources, the research will be comprehensive and up to date, setting the stage for subsequent phases of the study.

## **3.2 Research approach**

While quantitative research typically tests specific hypotheses, qualitative research is broader, drawing from multiple information sources to gain a holistic understanding of a subject. Quantitative methods validate predefined ideas, while qualitative methods go deeper to uncover new insights and perspectives. (Eriksson & Kovalainen, 2016.) Due to these characteristics, qualitative research is considered the most suitable approach for this study.

### **3.2.1 Interviews**

Interviews, as a qualitative research tool, can vary from unstructured to structured, depending on specific research needs. Unstructured interviews are designed to provide a casual, conversational approach, ideal for deep dives into subjective experiences. Semi-structured interviews combine structure with flexibility. They maintain a conversational tone but are intentionally directed by the interviewer to gather specific data. While they demand an informed interviewer, the depth of expertise is not as critical as in unstructured interviews. They are a preferred choice when precise responses are desired without the high expenses of unstructured interviews. Structured interviews are similar to surveys and are characterized by their formal protocols. They aim for precision by limiting respondent freedom, often resulting in quantitative data. Their structured nature allows for less specialized interviewers, making them more cost-effective. They are ideal when specific, quantifiable information is needed. The choice of interview type depends on the research objectives and the desired depth of information. (Walle, 2015.)

The main aim of this study is to examine the developmental requirements and potential improvements of the eSolution for downstream processors. To achieve this, an unstructured interview approach was chosen as it allows for a free exploration of the topic from many stakeholder groups without restricting questions to a structured format.

### **3.2.2 Case company**

Focused on the sustainable use of renewable resources, the company is a major player in the global bioeconomy. With more than 20,000 employees, it specializes in renewable products, including packaging materials and solutions, biomaterials, and wooden construction. Customers are global business-to-business companies, such as packaging converters, brand owners, industrial

component manufacturers, construction companies and publishers. The company holds a dominant position in Europe with production sites in 11 European countries and most of its sales and production activities are concentrated in this region. The company's operations also extend to South America, where they source raw material locally. In China, the company manages three corrugated packaging facilities, representing their strategic expansion in the Asian market. Globally, the company has established sales offices in North America, Africa, the Middle East, and Australia, ensuring their products are available to a diverse businesses worldwide. In 2022, the company reported sales of 11.7 billion euros.

### **3.3 Data collection and analysis**

The aim of the data collection in this study is to gain a detailed understanding of the limitations of the existing eSolution, as well as the feasibility and desirability of moving to a cloud-based environment. Data will be collected from system key users, business lead, and members of the IT department. Key users are selected for their daily interactions with the ERP system and provide critical insight into its user interface, efficiency, and overall usability. Their feedback directly feeds into RO1, which focuses on understanding development needs. The participation of the IT department and business lead provides a technical perspective on the feasibility of cloud migration. Their input is also vital for assessing whether the existing system meets customer expectations and for considering the potential benefits and options of a cloud-based migration, which aligns with RO2 on evaluating cloud migration.

The data was collected through individual interviews via Microsoft Teams 23.08-15.09.2023, with participants located remotely. The interviews were conducted in Finnish and English lasted an average of 80 minutes. Table 2 shows the details of the participants and the length of the interviews.

Table 2. List of Interviewees.

<b>Title of interviewees</b>	<b>Interview length</b>
Director eBusiness	45 minutes
Senior Service Specialist	105 minutes
Manager eBusiness	135 minutes
Data Architect	60 minutes
Product Owner	55 minutes

Conversations from the Teams interviews were recorded and transcribed. The interview data was then analyzed, starting with the transcription process. The analysis of the collected data was conducted using qualitative content analysis, a method widely used in business research and applicable in certain technical contexts due to its exploratory nature. This approach involves a systematic review and interpretation of the data using various methods such as coding, categorizing, and identifying recurring themes and patterns, as well as formulating narratives and explanations to highlight the inherent meaning of the data. (Eriksson & Kovalainen, 2016.) Codes were introduced for relevant items and, when necessary, new ones were created. These codes were categorized and condensed into six predominant themes.

## 4 Findings

The aim of this chapter is to present empirical findings that resolve the study's research question on improving the eSolution in alignment with the company's strategy. To this end, a content analysis identified six key themes closely related to the research objectives, assessing the eSolution present condition and development directions, and the feasibility of cloud migration.

### 4.1 The current state of eSolution

This section evaluates the current state of eSolution, thereby meeting the RO1 of identifying development areas. The concept of eSolution dates to the 1990s, when the company's custom-built on-premise ERP was introduced. Initially, eSolution was designed with a focus on two main functionalities, raw material usage and production registration. It was officially piloted with a downstream processors, commonly referred to as converters, in 2002, marking its formal entry into



operational use. The system is based on the company's ERP database, ensuring that all data is consistent and reliable. Over time, eSolution has been expanded to include functions that support logistics, such as loading agreements and bill of ladings.

#### 4.1.1 User interaction and efficiency

Since the early 2000s, the development of eSolution has received limited attention. The UI for eSolution has remained largely unchanged since it was first introduced in 2002 and it does not align with the updated design guidelines adopted by the company for all of its digital services. Improving the UI is not simply a matter of enhancing its appearance. It is vital to the company as it supports broader objectives, such as increasing customer satisfaction and improving operational efficiency.

In the system, converters manually input order-related information into the system one at a time. To facilitate the handling of multiple orders, an Excel spreadsheet-template has been developed and integrated into the system and nowadays converters predominantly use this method for inputting data. The Excel file, as illustrated in Figure 2, contains a macro-enabled script that converts the entered data, such as raw material usage, into an XML format compatible with the eSolution system. The XML created is then uploaded back to eSolution.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	
	Export to XML	Fill all MillOrderNumbers and UnitIDs				Create RawMaterialSet names			Mandatory column, see Mandatory columns for details.				Reel production mandatory columns.				Sheet production mandatory columns.						
1	RawMaterialSet	Raw material usage				Production																	
2		MillOrderNumber	OrderLineNumber	Width	UnitID	UsedNetKg	MillOrderNumber	OrderLineNumber	Width	Length	ProdLot	UnitID	UIB	SSCC	CustUnitID	ParcelType	GrossHeight	GrossKg	TareKg	Diameter	Core	Set	
3	xxxxxx000001	xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
4		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
5		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
6								xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
7								xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
8								xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
9	xxxxxx000002	xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
10		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
11		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
12		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
13		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
14	xxxxxx000003	xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
15		xxxxxx000001	xxxx	9999	xxxxxx	99999	99	xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
16								xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999
17								xxxxxx000001	xxxx	9999	99999	99	xxxxxx	xxxxxx	ABC999	ABC666	xxxxxx	99999	99999	99	99999	99999	999

Figure 2. Preview of excel template.

eSolution's reporting tool is used for inventory management among converters. Utilizing user-selected attributes, the system generates Excel-based reports that give an overview of stock levels, product types, and other key metrics. While functional, the Excel format has its limitations, particularly in terms of real-time data analytics and visualization capabilities.

#### 4.1.2 Interoperability and data integrity

PapiNet is a global initiative aimed at facilitating e-business within the paper, forest products, and bioproducts industries. The organization has developed a set of XML-based standard electronic documents designed to streamline the flow of information among various stakeholders involved in the buying, selling, and distribution of paper, forest, and bio-related products. This feature allows the standard to be compatible with any messaging service that facilitates the electronic exchange of business documents, making it a universally interoperable standard. (papiNet, 2023.) Although the current papiNet standard includes nearly 50 different XML schemas for various purposes, there is no standardized solution for communication between raw material manufacturers, such as the case company, and converters. Therefore, a custom-made XML solution has been built for eSolution.

Apart from the ERP system, there are no other existing integrations in the solution. Some large converters do directly integrate with the company's ERP system via EDI messages, thereby bypassing the main eSolution interface. Despite this, they still use eSolution for tracking order statuses through its reporting tool. A significant limitation is the lack of an API, requiring data to be converted into XML format via Excel. Converters often copy data from their own systems and paste it into Excel and this manual process is prone to errors. For instance, if an extra character is inadvertently included during copying, it can result in erroneous data, leading to incomplete data transfer between systems. Consequently, the use of Excel becomes time-consuming as manual oversight is required to ensure data validity. This lack of seamless integration and reliance on manual data entry not only increases the risk of errors but also makes the system less efficient. The absence of an API and the need for manual validation of data underscore the urgent need for system improvements to enhance data integrity and operational efficiency.

Another challenge involves the complexity of the 14-digit Unit Identification Barcode (UIB) codes and the differences in mandatory fields required for production registration across different mills and systems. UIB codes include information about the manufacturing unit, country code, and current year, and in some cases have been customized at the plant level to include unique plant identifiers. In addition, these codes must remain unique for 10 years, be unique and should not overlap with existing identifiers. This is particularly critical as a single identifier could influence multiple systems and reports. The multitude of unique identifiers and the requirement for long-term

uniqueness make interoperability across multiple systems and domains a challenging task, resulting in potential errors and inefficiencies.

#### **4.1.3 Adaptability to different markets**

The current system is designed for the European market and operates on the metric system. This poses challenges as the company expands into the United States, where the imperial system of units is prevalent. Consequently, there is a necessity for the local U.S. sales office to perform unit conversions from the metric to the imperial system. While a separate conversion table has been developed for this purpose, the unit transformations are manual and time-consuming. This manual conversion process is not merely labor-intensive but also increases the potential for errors, thereby reducing operational efficiency.

Manual intervention may lead to measurement inaccuracies that could critically impact business operations and customer satisfaction. This situation underscores the need for system modifications or upgrades that would enable automatic unit conversions, enhancing both operational efficiency and data reliability. Such an integrated solution would reduce the need for manual work while simultaneously minimizing the risk of errors, thereby improving the company's competitiveness in global markets.

### **4.2 Feasibility of cloud migration for eSolution**

Building on the insights gained from the analysis of eSolution's current state, this section focuses on the research objective of the feasibility of migrating eSolution to a cloud-based platform. The following analysis examines a range of factors involved in such a migration, including technical challenges, financial implications, and alignment with the organization's broader digitalization strategy. These assessments aim to provide a comprehensive understanding of whether cloud migration would be a viable and beneficial option for eSolution, thereby addressing the RO2.

#### **4.2.1 Organizational impacts**

It is vital to understand the impact of technological decisions on the operations of an organization. The interviews revealed that moving to a new system is not just about the technical stages. It is

also important to think about the existing technology setup, the expected benefits of the new system, and the potential challenges involved in the transition. However, the impact of technology is only part of the solution, the people within the organization are equally important. While the technological architecture defines the system's functionalities and capabilities, it is the human interactions, perceptions, and adaptabilities that often determine its practical success. Migration decisions often involve a complex balancing act between desired functionalities, ease of integration, cost implications, and potential future scalability.

Selecting a platform is not merely about its functionality, it is also about ensuring its compatibility with the broader technological and strategic goals of an organization. Insights from an interviewee about Salesforce's Manufacturing Cloud elements highlight an important dimension in the decision-making process, the trade-off between ready-made solutions and the allure of customization. In the field of IT decisions, this balance between 'out-of-the-box' functionalities and tailored solutions is a recurrent theme. While standardized solutions can provide immediate advantages, tailored solutions cater to specific organizational requirements. However, custom solutions can introduce challenges, especially concerning costs and potential future complexities.

While platforms such as Salesforce may appear convincing based on their features, making the right decision depends on comprehending how they align with the organization's particular needs, both in the immediate future and in the long term. Moreover, as emphasized by one interviewee, the focus on cost underscores the need for a comprehensive approach to decisions. When evaluating this approach, it is essential to look beyond the immediate expenses of licensing and development, while also considering ongoing and potential future costs. This broader financial perspective should encompass long-term support, potential disruptions during migration, training expenses, and the often-overlooked costs associated with adaptability challenges.

#### **4.2.2 Build or buy**

The discussions with the interviewees explored into the contrasting perspectives on the choice between the company's in-house eBusiness solution, built on Microsoft's Azure cloud platform and already integrated with the ERP offering services to customers, and the recently adopted Salesforce platform, which has been chosen for several strategic initiatives within the company. A significant advantage attributed to current eBusiness solution is its in-house development coupled

with hosting on Azure. This structure offers a distinct edge in terms of potential customization. Control over the solution when kept in-house might provide increased flexibility. Furthermore, migrating eSolution to an Azure could be beneficial for IT operations. Some interviewees highlighted that, although this might not offer direct business advantages, the operational benefits are undeniable.

There was also an emphasis on the alignment of eBusiness solution with the functionalities of previous systems, indicating that many of these functions can be replicated both swiftly and efficiently. On the topic of future development and funding, the general sentiment among the interviewees was that funding for immediate development might be limited in the upcoming financial period. However, they also underscored the importance of a strategic roadmap to ensure that any investments made would propel the project in the desired direction.

On the other hand, when discussing Salesforce, some interviewees pointed out that while it might present a compelling case through its functionalities, the true essence of the decision lies in understanding how these functionalities merge with the organization's unique needs, both immediate and long-term. Therefore, integrating custom functionalities might not be as straightforward. Such customizations could increase both the cost and complexity of the platform. Notably, the 'out-of-the-box' functions that Salesforce offers might necessitate changes to existing business and operational practices. Moreover, the financial implications of implementing Salesforce could encompass aspects such as licensing, customization, required adjustments, and comprehensive IT support.

The necessity for an in-depth cost analysis regarding this transition was stressed by the interviewees. Moreover, the challenges are not solely of a technological nature. Feedback from interviewees emphasizes the need to adjust business strategies to better harmonize with Salesforce's capabilities, pointing to a broader need for organizational transformation. This debate illustrates the recurring dilemma of whether to adapt technology to existing business processes or to redesign business processes to fit technology. Although implementing technology can offer instant convenience, redesigning business procedures, despite obstacles, has the potential to produce enduring efficiencies and a more streamlined operational environment.

In conclusion, the decision between eBusiness solution and Salesforce is not just a comparison of functionality. It requires a holistic approach and comprehensive evaluation. Salesforce, with its wide range of tools and established functionality, requires complex customization, which comes with its own costs and challenges. In contrast, eBusiness option, as an in-house solution, offers greater control with potential cost benefits, although there are uncertainties about its future development and financial support. One interviewee emphasized the prevailing sentiment, noting that while the idea of consolidating everything under Salesforce is compelling, it is crucial to weigh the diverse options thoroughly. The final decision should ideally balance immediate operational needs with a long-term strategic vision.

#### **4.2.3 Dependencies and roadmaps**

Having addressed the technical and strategic aspects of migrating eSolution to the cloud, it is important to address two key issues that emerged from the interviews: the impact of knowledge dependency and vendor reliance, and the importance of roadmap review and goal alignment.

The interviews underscored the potential risks associated with heavy reliance on a single vendor. Such dependencies can expose the organization to vulnerabilities. Centralizing knowledge around a particular system can lead to operational challenges, particularly when personnel turnovers occur or when transitioning between vendors. It is clear from the discussions that diversifying knowledge and vendor relationships is not only recommended, but a strategic imperative to ensure operational continuity and resilience.

Another key point that emerged is the dynamic nature of IT roadmaps. They are not just plans, they are essential tools for guiding an organization's strategic IT decisions. The rapid pace of technological change means these roadmaps must be reviewed and revised regularly. This adaptability ensures that the organization remains agile, with the roadmap always aligned with both current organizational objectives and broader technological developments. Discussions with interviewees highlighted the subtle balance between holding to pre-set goals and pivoting based on new insights and external changes. This dynamic interplay between strategy and adaptability is critical to remaining competitive.

In summary, while evaluating the migration to a cloud platform like Salesforce or maintaining an in-house solution like eBusiness is essential, it is equally imperative to address broader organizational issues. Dependencies, either on knowledge or vendor front, can pose significant challenges. Similarly, having a flexible yet robust roadmap is fundamental for navigating the rapidly changing IT landscape. The insights from the interviewees serve as a reminder that technological decisions are not made in isolation but are intertwined with broader organizational strategies and goals. Migration decisions are seldom black and white. They sit at the nexus of technical feasibility, financial implications, strategic alignment, and future scalability.

## **5 Discussion and conclusion**

This chapter explores the recommendations and implications arising from the analysis of the migration of the eSolution platform and its wider operational and strategic intentions. Exploration serves two main objectives. First, it identifies clear development needs, functional barriers, and opportunities for eSolution's future progression. Second, it thoroughly assesses the feasibility of moving the platform to the cloud, emphasizing the intersection of technology and strategy. The chapter concludes by evaluating the study, discussing its limitations, and suggesting potential avenues for future research.

### **5.1 Insights for future development**

This section synthesizes the study's findings to provide recommendations for the future development of eSolution, addressing RO 1: "Understanding Development Needs". Through an in-depth analysis of the current state of the eSolution, its limitations, and potential areas for improvement, this section aims to propose directions that could better align eSolution with the needs of its users as well as the broader operational goals of the organization. Each subsection focuses on a specific area of development and provides both an assessment and actionable insights.

#### **5.1.1 UI and user experience**

While the eSolution platform offers back-end functionality, such as logistics management and production reporting, the UI is a notable area for further development. The push for system improvements such as enhanced UI and user experience arises from the inherent need to ensure that the ERP system aligns with overarching business goals (Singh et al., 2023). Upgrading the UI focuses on

enhancing efficiency and user satisfaction rather than just aesthetics. Therefore, a UI update is a strategic requirement that is important for business alignment and operational improvements. The company has created design principles and a toolkit in its design system, yet the misalignment between the current UI and the company's guidelines creates inconsistencies in the user experience. These inconsistencies may cause user errors and inefficiencies, affecting not only the people who operate the system daily but also potentially the end customers. Streamlining the user interface would not only improve user satisfaction but could also significantly reduce the risk of human error.

### **5.1.2 API integration with industry standards**

The Excel template currently serves as a workaround to simplify the otherwise time-consuming task of manual data entry. While functional, relying on such a workaround underscores a significant system limitation. Automating the input of data could remove the need for manual entry altogether, thereby eliminating one of the most significant sources of potential error. The current absence of an API for data exchange and the dependence on custom-made XML solutions present challenges not only for operational efficiency but also for data integrity. By integrating an API supporting both XML and JSON formats, eSolution could offer greater flexibility to adapt to the technical requirements of its downstream processors while also standardizing communication. Emphasizing the role of modern APIs in ensuring effective communication between diverse systems (Rahme et al., 2022; Geewax & Skeet, 2021), it is worth exploring the implementation of an API to address these issues.

As the system evolves, it is becoming more important to engage actively with the papiNet organization to align the API with globally recognized standards. With the support of forest and paper companies in North America and Europe, papiNet has a long history of standardizing e-business processes across multiple industries. It is worth noting that within the papiNet standard, while all messages already exist, there is no direct XML schema tailored for this specific purpose. Therefore, collaborating with papiNet to include unique demands between manufacturers and converters in their guidelines would be a mutually beneficial endeavor. papiNet Segment User Groups (SUGs) have been effective in creating universal guidelines for trading partners, facilitating easier and more reliable data exchange. By actively collaborating with SUGs, the company has an opportunity



to influence the evolution of these standards in a direction that accommodates its unique requirements. This co-operative approach would not only improve eSolution's internal processes but also contribute to enhancing industry-wide practices.

papiNet has also recently introduced standardized APIs designed specifically for the paper and forest products industry. This API development provides the industry with an agile and efficient platform for real-time data communication, building on papiNet's already established XML standards platform. Currently, these API specifications address several use cases, including order status, shipment status, catalogue, and availability, all focused on the pulp and paper industry. papiNet's plans are underway to diversify these use cases beyond order status and into other areas such as ordering.

Concluding from the above, an optimal solution would seem to be a hybrid approach that merges the development of precise XML schemas with the establishment and implementation of the API. Given the industry-standard status of XML in data representation and the present momentum of API-led integrations, a combined solution would ensure broad compatibility, catering to diverse stakeholders and systems. By jointly focusing on XML schema development for specific purposes and extending the capabilities of APIs, eSolution can not only streamline its internal processes but also foster a data-exchange environment that is both agile and robust.

### **5.1.3 BI reporting**

When considering the advantages of transitioning from Excel to a Business Intelligence (BI) platform for reporting, two main benefits emerge that deserve detailed consideration. First, BI solutions can provide dynamic, real-time data analysis that can have a quantifiable impact on inventory management. For example, the real-time analytics provided by BI tools can enable the immediate identification of out-of-stocks, enabling faster replenishment and potentially reducing operational downtime. Second, the enhanced data visualization capabilities inherent in most BI platforms offer significant advantages over traditional Excel-based reporting. In particular, interactive graphical dashboards can provide a more detailed understanding of data trends.

#### **5.1.4 Identifier Management**

The management of UIB-codes poses several challenges, including the need for identifiers that are both unique and non-overlapping. A centralized database that can automatically manage these codes would serve as a single source of truth for real-time UIB management. This approach would streamline the process and reduce the risk of errors. In addition to a centralized database, an API interface could be developed to facilitate the reservation and verification of UIBs across various systems and stakeholders. Remote validation mechanisms could further enhance this structure, offering an additional layer of validation prior to the activation of new UIBs.

#### **5.1.5 Localization**

To meet the issues of adaptability to different markets, particularly the challenge of unit conversions between the metric and imperial systems, a well-designed improvement would be to build localization settings into eSolution. The implementation of a user-friendly settings panel would enable individual users and regional offices to choose their preferred unit of measurement, improving operations across different locations. These localization settings could support automated, immediate conversion between metric and imperial units. Automating this conversion process eliminates the need for a separate manual conversion table, thereby reducing the risk of errors and increasing operational efficiency.

### **5.2 eSolution future migration prospects**

Examining the feasibility of migrating eSolution to a cloud-based platform provided an opportunity to examine the relationship between technological advancement, strategic direction, and the human aspects of organizational change. Addressing the second research objective, RO2: 'Cloud Migration Assessment', in-depth analysis reveals pivotal areas of consideration concerning these complexities. This section synthesizes these findings into a cohesive narrative that highlights the potential benefits of migrating eSolution to an Azure-based eBusiness solution.

### 5.2.1 Reflection on the theoretical framework and findings

The theoretical framework of the study posited that the relationship between technology and organizational operations is complex, with technological choices having a profound impact on an organization's operations and overall development. This premise, established by Bjelland & Haddara (2018), was confirmed in the study's findings, highlighting the deep influence of technology choices on operational success. It was apparent that while technological systems define functionality, success or failure in practice is dictated by human interactions with these systems.

The results reveal the challenge surrounding IT decisions, deciding between off-the-shelf solutions or custom-made options. The challenge of choosing between these solutions is, in many ways, an extension of the broader dilemma faced by organizations, the balance between customization and standardization (Nestell & Olson, 2018). While this issue is often portrayed as a binary choice in theoretical discussions, there are multiple intersecting considerations involved, including cost, preferred features, possibilities for future growth, and the overarching strategic direction of the organization.

When considering the migration of eSolution, the findings highlight a multitude of complexities. The advantages of an established platform such as Salesforce, with its suite of functionality, are weighed against the flexibility of a custom eBusiness solution built on Azure. The findings suggest that this decision extends beyond mere functionality, encompassing broader organizational objectives, financial implications, and adaptability challenges.

### 5.2.2 Migrating eSolution to Azure-based eBusiness solution

The decision to migrate eSolution to an Azure-based eBusiness solution seems favorable, especially when evaluated against the organization's broader objectives. The deployment model chosen, whether it is SaaS, PaaS, or on-premises, plays a pivotal role in aligning the ERP system with organizational objectives (Bjelland & Haddara, 2018; Giessmann & Legner, 2016). Therefore, the choice to migrate eSolution to an Azure-based eBusiness solution must be assessed considering its potential to meet the company's long-term strategic goals. While Salesforce offers a robust set of tools, the need for significant customization, combined with its costs and potential disruptions—appears to be a significant challenge.

On the other hand, eSolution, being an in-house entity, not only offers familiarity but also a higher degree of control, especially when hosted on Azure. This could pave the way for more manageable integration and customization, aligning more seamlessly with the organization's operational goals. However, decisions of such magnitude must be approached holistically. As highlighted in the findings, while the migration to Azure holds a promise, it is equally crucial to address the inherent organizational challenges. Knowledge dependency and vendor reliance emerged as potential risks, emphasizing the need for a diversified knowledge base and vendor relationships. Simultaneously, the dynamic nature of IT roadmaps warrants constant revision and adaptability, ensuring alignment with organizational objectives and the broader technological landscape.

Thus, the recommendation to migrate eSolution to an Azure-based eBusiness solution is rooted not merely in its technological feasibility but in the multi-dimensional advantages it offers. These advantages include potential cost benefits, operational efficiencies, and enhanced control over customization. While challenges remain, particularly concerning future development and financial support, the strategic vision suggests a trajectory where the benefits of the Azure migration outweigh the challenges.

### **5.3 Theoretical Implications**

The study's results contribute to a deeper understanding within the existing literature of the intricacies of ERP implementation models and the complexities they introduce into organizational processes. This study emphasizes various theoretical implications that can help future research in this area. To begin with, this study reinforces and extends the foundational work of Bjelland & Had-dara (2018) on the relationship between technology choices and operational success. The study provides empirical evidence that such choices, while rooted in technology, have diverse implications that extend beyond the IT department and influence broader organizational strategies and outcomes.

Furthermore, the ongoing debate between customization and standardization, previously discussed by Nestell & Olson (2018), is enriched by our findings. The study suggests that this dichotomy is not merely a binary choice but is shaped by a confluence of factors, including an organization's developmental trajectory, internal capabilities, and future aspirations. It is a continuum where organizations position themselves based on dynamic needs and contexts.

Lastly, the migration issues that our study highlights offer scope for further research. Although the advantages of platforms such as Azure and Salesforce are apparent, the study also highlights issues like dependence on knowledge and reliance on vendors. Such discoveries can pave the way for future research that concentrates on risk reduction techniques and the most effective approaches for migrating ERP systems.

## **5.4 Practical implications**

The study's findings emphasize that the choice of a deployment model—whether SaaS, on-premises, or PaaS—is not merely a technical decision. It has profound organizational consequences. While assessing these models, businesses should not solely focus on initial investment and maintenance costs. It is crucial to examine how each model aligns with their broader goals, from operational objectives to financial aspirations, as the findings highlighted.

The study also highlighted the complex dynamic between customization and standardization. Custom solutions like eSolution, as deduced from the study, provide a sense of familiarity, and allow for significant control. However, they demand substantial in-house expertise. Conversely, standardized tools like Salesforce offer a comprehensive set of features straight out of the box, but they might not cater to every unique organizational need. Decisions here should be grounded in a company's in-house technical proficiency, adaptability requirements, and long-term growth visions.

Migration challenges are also a significant concern. Migrating to platforms like Azure brings many benefits, such as cost effectiveness, improved operational efficiency and greater control over customization. However, organizations must be aware of potential obstacles, such as knowledge dependency and vendor lock-in. Additionally, due to continuously evolving technology landscapes, the research shows that organizations must adopt an agile approach and frequently update their IT roadmaps to stay in line with evolving goals and industry trends.

## 5.5 Evaluation of the study

In evaluating the robustness and relevance of this research, it is important to consider the trustworthiness of the study, its methodological consistency, and the validity of its findings. The overall aim is to ensure that the study's findings and conclusions are grounded and can be relied upon by other researchers or practitioners in the field. The literature review forms the basis of this study, and its systematic approach over eight years ensured that the most recent and relevant academic literature on the subject was considered. By focusing on peer-reviewed articles and publications, the study aimed to use the most credible sources in the field. However, the challenge remains that in a dynamic and evolving field such as ERP systems, new literature continues to emerge, so keeping the evidence up to date is an ongoing task.

The choice of qualitative methodology, particularly unstructured interviews, sought to capture nuanced perspectives on the subject. This method provided depth and allowed unexpected insights to emerge. However, both a strength and a potential weakness can be seen in the interpretive nature of qualitative research. While it captures rich, detailed data, its subjectivity could be seen as a limitation in terms of replicability. In conducting interviews, biases, and assumptions from both the interviewer and the participants could have influenced the results. To mitigate this, reflexivity was maintained, with continual reassessment of assumptions during the process. Though the interviews were unstructured, they were approached with a clear purpose and a guiding set of topics, ensuring that the data gathered would be relevant to the study's objectives.

Qualitative content analysis as a data analysis method allowed for structured and methodical processing of the collected information. The six themes that emerged provided a focused and comprehensive lens through which the vast amount of data could be analyzed. However, as with all qualitative methods, the findings are shaped by the researcher's understanding and perspective, which must be acknowledged. In conclusion, the thoroughness and depth of this study is underlined by its detailed literature review, qualitative approach, and consistent data analysis. The findings, while deeply rooted in the unique context of the selected case company, provide invaluable insights into ERP systems, their deployment models, and evolutionary trajectories. However, as with all research, the findings should be considered within their methodological and contextual limitations.

## 5.6 Limitations

Any research study, despite its thorough design and methodology, has limitations that constrain its findings, and this study is no exception. The literature review, spanning the years 2015 to 2023, provides a comprehensive but temporally limited view of the topic. Seminal works prior to 2015 may contain valuable insights that have not been explored. In addition, the exclusive reliance on the JAMK Janet Finna database may have overlooked relevant literature available in other databases. The specific keyword approach, although systematic, carries the potential risk of missing important articles that may not include these exact terms.

In terms of the qualitative research approach, the use of unstructured interviews provides an in-depth exploration of the topic, but also introduces a degree of subjectivity. The nature of open-ended questions can influence the answers and important points may be missed. Lastly, the analytical method of qualitative content analysis, while providing a structured way of analyzing data, involves an inherent element of subjectivity. Different researchers may interpret the same dataset in slightly different ways. In conclusion, while this study's findings provide valuable insights into the subject, they should be understood in the context of these limitations.

## 5.7 Future research

As the ERP landscape continues to evolve, future research initiatives could take several directions, drawing on the findings of this study. The rapid integration of emerging technologies, such as artificial intelligence and machine learning, into ERP systems presents an interesting area for research. It would be valuable to understand the challenges of their adoption, the benefits they introduce, and their potential to revolutionize organizational processes.

Furthermore, the study's emphasis on human interactions with technological systems suggests an opportunity to examine more deeply the user experience aspect of ERP systems. Examining training requirements, change management strategies and user adaptation to evolving ERP functionality can provide deeper insights into optimizing system implementation and use.

Lastly, building upon the migration challenges highlighted in this study, a more in-depth exploration of risk management during ERP migrations might be insightful. This could encompass risk assessment methodologies, strategies for risk mitigation, and practices that organizations can adopt for smoother transitions between ERP platforms.



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