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ERP implementation into the e-commerce platform

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Abstract

Enterprise Resource Planning (ERP) is software that supports businesses to manage, unify, and utilize organizational processes. Accordingly, the ERP implementation trend has been critical for any company's exponential development. Along with global digitalization, e-commerce platform is an essential tool for trading activities. Implementing an ERP system to an e-commerce platform is seen as a strategic approach to optimize benefits and discover further opportunities. However, the limitation is that a small research range focuses on ERP implementation towards e-commerce platforms.

Company A, an e-commerce small-and-medium business, planned to integrate an ERP system for its procurement module. Thus, the case company wanted to understand the integration process and find a suitable ERP system. The academic objective was comprehending the relationship between ERP systems and e-commerce platforms as a fundamental background. As a result, the business case study of the commissioner and ERP selection process were analyzed to find the right ERP solution.

The qualitative and quantitative methods are mixed to evaluate and examine the case study. Interviews with the IT manager and ERP consultant investigated the ERP selection criteria and limitations. At the same time, a survey of company A's users explored system requirements and expectations. The challenges while obtaining implementation methods were a narrow range for research, non-responsive respondents, and a lack of ERP experiences from objects.

The result contained a requirement analysis for company A's ERP selection process. The ERP requirements were related to the user interface, price, modules, company size, and additional factors from future analysis. Two shortlisted ERP products, SAP Ariba and Coupa, were chosen for further examination. By evaluating two products with specific selection criteria, Coupa was the final decision for the case study. Company A could enhance the decision by requesting quotations and discussing with ERP vendors. As ERP implementation was a long-term investment, company A needed careful consideration and in-depth analysis to find the best solution.

Keywords/tags (subjects)

Enterprise Resource Planning, ERP, ERP implementation, Electronic Commerce, E-commerce, ERP selection criteria, SAP Ariba, Coupa

Miscellaneous (Confidential information)

No

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Abbreviation

AM	Advanced Materials
API	Application Programming Interface
B2B	Business-to-business
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
E-commerce	Electronic Commerce
HCM	Human Capital Management
HRM	Human Resource Management
IT	Information Technology
OS	Operating System
OAuth	Open Authorization
PO	Purchase Order
RQ	Research Questions
REST	Representational State Transfer
SAAS	Service-as-a-software
SCM	Supply Chain Management
SME	Small-and-medium business
TCO	Total Cost of Ownership
TO	Thesis Objectives
UI	User Interface
WAN	Wide Area Network

1 Introduction

The introduction chapter provides the thesis background, objectives, research questions, scopes, and limitations. The introduction targets to clarify the contents and subjects of the thesis.

1.1 Background

Enterprise Resource Planning (ERP) is an organization's systematic management software that centralizes all departments, areas, and functions of the e-commerce platform by integration. Different departments have separate personal customer information and operating systems to optimize the service. ERP systems connect different functions and activities and integrate departments' system schemes. ERP provides cloud or on-premise services to store and transfer original data. The activities of an ERP system cover operational fields such as financial planning, manufacturing, marketing, supply chain management, and transport activities. The collaborative approach improves the company's business insight, usage of internal resources, and time efficiency. (Wailgum, 2017.)

The case study is based on company A, a business-to-business (B2B) e-commerce marketplace for advanced materials (AM) in Finland. The target of company A is connecting suppliers and buyers to bring the best experience in electronic commerce. The company enhances the services for suppliers and buyers in discovering, communicating, and paying for AM products. The users on the platform have different sizes, and the range of products is extensive. The current problem of the company is that the data flow within the platform needs to be fully connected. Some users already have their implementation of ERP systems, while others do not. Company A's target is its own ERP system to connect the data for internal use and external connection for the users. As a third party in the transaction, company A aims to bring the utmost convenience for both suppliers and consumers by integrating a suitable ERP system.

According to Farzaneh (2014, p. 4171), the integration allowed the transfer of inventory, orders, items, customers, and other sales data between independent systems. The e-commerce platform without connection to ERP features such as accounting, financial systems, and other functions is expensive. The reasons for the high budget are manual data entry management, sales data administration, and human errors. The consequences are decreasing sales, lost shipments, delivery delays, reduced customer satisfaction, increasing hidden costs, and declining cash flow. (Farzaneh,

2014, p. 4171.) Integrating ERP and E-commerce connects automatically with platform users by interchanging information. The integration improves the efficiency of procurement and customer relationship management. The benefits of the implementation are reducing costs, bringing competitive advantages, increasing the accuracy of data, secure transactions. The implementation process is a long-term plan and expensive budget. (Jiang, 2009, p. 3.)

The ERP selection process is also a long-term and thorough procedure. The selection process includes planning stages and several numbers of analyses before the shortlisting step. The selection criteria are conducted on the business situation, the company's requirements, and discussion with the company's partners. The thesis aims to give practical and academic recommendations for the most practical ERP solution for the company.

The ERP market has been significantly developing with increased numbers, revenues, and market shares (See figure 1). ERP is a considerable investment for an organization for better internal and external unification of information. The thesis contributes the background theory for organizations interested in implementing ERP systems and E-commerce platform-related companies specifically. Moreover, the topic of integrating ERP systems and E-commerce platforms has yet to be developed enormously in the period of recent five years. The thesis brings up-to-date information with a selective literature review to find a suitable solution for nowadays ERP systems. The thesis's contribution is applicable not only to the company case study but also to the E-commerce industry and the enterprise resource management field.

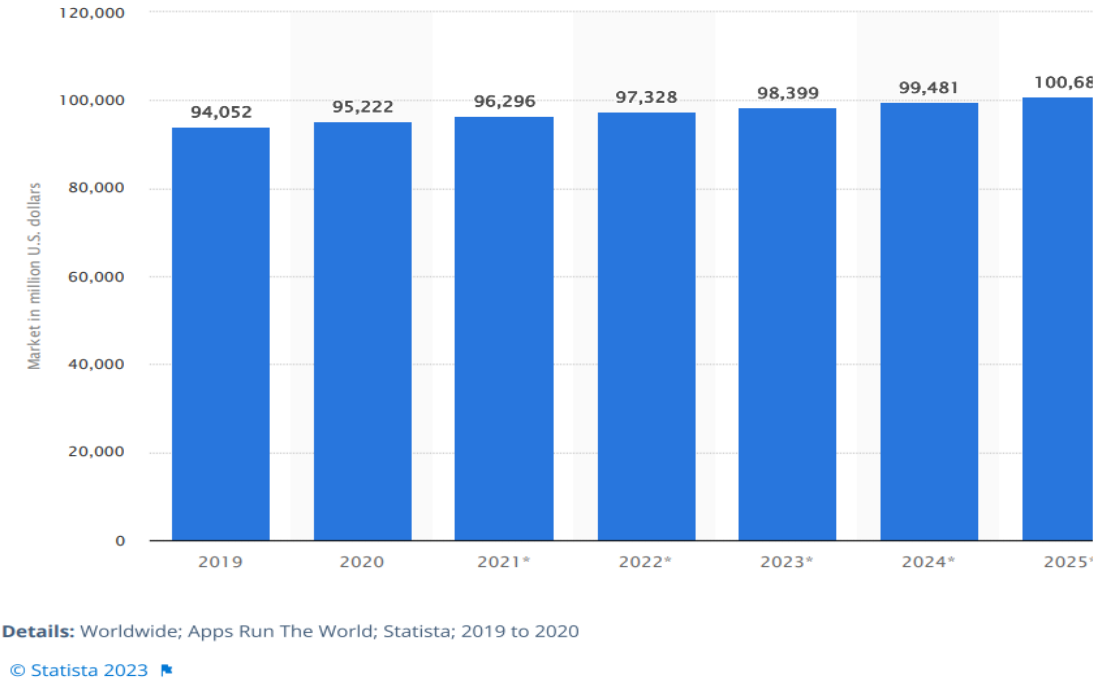

Figure 1 Enterprise resource planning (ERP) software market revenues worldwide from 2019 to 2025(in million U.S. dollars) (Statista, 2021)

1.2 Research objectives

The thesis is a commission from company A about ERP implementation. The primary objectives of the thesis are to find the ERP selection criteria and the most suitable ERP system for the company. In order to achieve the primary objectives, theoretical targets are set to understand the roots of the problems. Other objectives of the thesis are understanding the relationship between ERP and E-commerce, integrating the ERP system into the E-commerce platform, and studying company A's business case. The relationship between ERP and E-commerce is the theoretical background because company A is an electronic commerce company working in the advanced materials industry. The company can understand how ERP systems integrate into its platform. The criteria selection for ERP is a long-term and complicated process. Therefore, the integrating stage helps the company understand the requirements and expectations for the new system. The systematic list of the thesis objectives (TO) is described as follows:

TO1. Understand the relationship between ERP and E-commerce

TO2. How ERP can be integrated into the e-commerce platform

TO3. Study about ERP selection process

TO4. Introduction to company A business case

TO5. Find the most suitable ERP system for the company A case study

1.3 Research questions

According to Alvesson and Sandburg (2013, p. 10), research questions provide the starting point for all forms of scientific research development. The primary direction and path of the research questions are developed to research design and methodology (Alvesson & Sandburg, 2013, p. 10). The research objectives are researching the relationship between ERP and E-commerce and finding the suitable ERP system for the case study company A. The research questions (RQ) can be listed as follows:

RQ1. What is the connection between ERP systems and E-commerce platform?

RQ2. What are the criteria for choosing a suitable ERP system for the case study?

RQ3. What is the recommended ERP system for company A?

The table below determines each research question's research methods and results from the chapters. The research methods analyze how the solutions and steps for the research questions, while the result chapters direct readers to the corresponding location.

Table 1 Development plan for the research questions

Research questions	Research methods	Result chapter	Corresponding objectives
RQ1. What is the connection between ERP systems and E-commerce platform?	The literature review explains perspectives of ERP systems and E-commerce terms. The theoretical chapter elaborates on the relationship by demand, strategies, technical solutions, benefits, and limitations.	3	TO1, TO2
RQ2. What are the criteria for choosing a suitable ERP system for the case study?	The question contains theoretical answers and practical applications with the company. The literature review elaborates on the terms from the ERP selection process, which include ERP selection criteria. After that, an interview with the case company is conducted to summarize the main criteria.	3, 5	TO3, TO4
RQ3. What is the recommended ERP system for company A?	This question needs practical application from the selected criteria from RQ2. Two suitable ERP systems will be selected from the chosen criteria. The selected systems are analyzed in the result part. Moreover, a survey will be conducted with the current partners and customers vendor of company A about the new system.	3,5,6	TO5

1.4 Scope and limitations

The scope of the thesis defines the parameter of the research, such as problems to be solved, related matters, and possible domains (Simon & Goes, 2013). The thesis is about implementing ERP into the E-commerce platform with the application to company A case study. The study field contains two significant issues: the relationship between ERP and E-commerce and the ERP selection for the case company. The research field covers the theoretical background of ERP systems, E-commerce, and E-commerce platform. The background includes definitions, advantages, disadvantages, system structures, and particular types of objects. The thesis analyzes the current demand, benefits, challenges, strategies, and technical solutions regarding integration. The second issue is the selection process of the ERP which contains the steps within the process and the selected criteria for the case study. The selection process background covers detailed descriptions of each step with corresponding documents, data, and resources. The selection criteria are collected by researching about critical features of around 20 ERP vendors and discussing them with company A's representative. The scope of the thesis is the application to the case study, academic research, ERP industry, and E-commerce business.

The limitation occurs in the thesis; however, out of research knowledge and impossible to find accurate information (Simon & Goes, 2013). Regarding ERP and E-commerce integration, the number of related peer-review and updated sources is limited. Moreover, ERP vendors are developing their systems quarterly or annually to new versions. Different ERP vendors establish new versions which are customizable for specific industries. Therefore, the method and strategy for the integration are only partially accurate. Another limitation depends on the quotation of different vendors for selection criteria. The features from ERP vendors are collected based on online resources and demo requests. However, because of confidentiality, some ERP vendors cannot give a complete list of features and functions. The case company can only fully understand the system if further discussion of purchasing is conducted. The limitation leaves space for innovation and a realistic perspective when the company starts implementing. The thesis only consults in the planning stage of researching, shortlisting a list of ERP vendors, and negotiating with the company's management board and partners. The company takes time to conduct further stages and several adjustments, in which the thesis cannot include accurate risk management.

2 Literature review

2.1 Enterprise Resource Planning

Enterprise Resource Planning (ERP) is an integrated software program incorporating company departments and corresponding functions. The concepts of an ERP system are transparency in sharing information and communication within the company, practical usage of management resources, and the efficiency of an enterprise. The initial market for ERP was the manufacturing industry, with essential functions for core business management and planning. ERP has become more diverse and is processing on a global scale. ERP system unifies business processes with transactional data and digitalizes the process to meet organizational goals. (Parthasarathy, 2007, pp. 1-2.) ERP characteristic is cross-functional because the system supports the information requirements for several functional areas. Moreover, the ERP system centralizes processes developed based on business strategies. The most common business processes ERP supports are order management and procurement. (Bradford, 2020, p. 2.)

2.1.1 ERP structure

According to Búrca et al. (2005, p. 428), ERP management concepts outline the development of internal resources and improving customer services. ERP system automatically records real-time data on humans, cash flow, material resources, etc., from different modules such as production, inventory, warehouse, and finance. (Jiang, 2009, p. 2) ERP solutions are customizable to fit various software infrastructures and support external business processes. However, there are five critical traits involved based on ERP application: scalability, vendor management, functionality, integrated modules, and reliable customer services. (Parthasarathy, 2007, p. 4.)

According to Bradford (2020, p. 3.), companies apply core ERP or extended ERP based on business strategies. Core ERP comprises financial, logistics, and human capital management (HCM) modules. These general modules contain other related sub-modules. For example, applications in the finance department are accounts receivable and accounts payable, while the HCM suite includes personnel and talent management. Extended ERP is the broader version of core ERP with supply chain management (SCM) and customer relationship management (CRM) (Bradford, 2020, p. 4). ERP systems typically include logistics, distribution, inventory, shipping, accounting, production, invoicing, etc., for an organization. These functions are involved in back-office activities,

which mainly control business processes. Full integration for ERP covers features that reduce complexity in business processes, successfully deliver requirements, smooth transactions, achieve financial standards with product coding, and integrate all procedures across the organization. (Parthasarathy, 2007, pp. 5-6.)

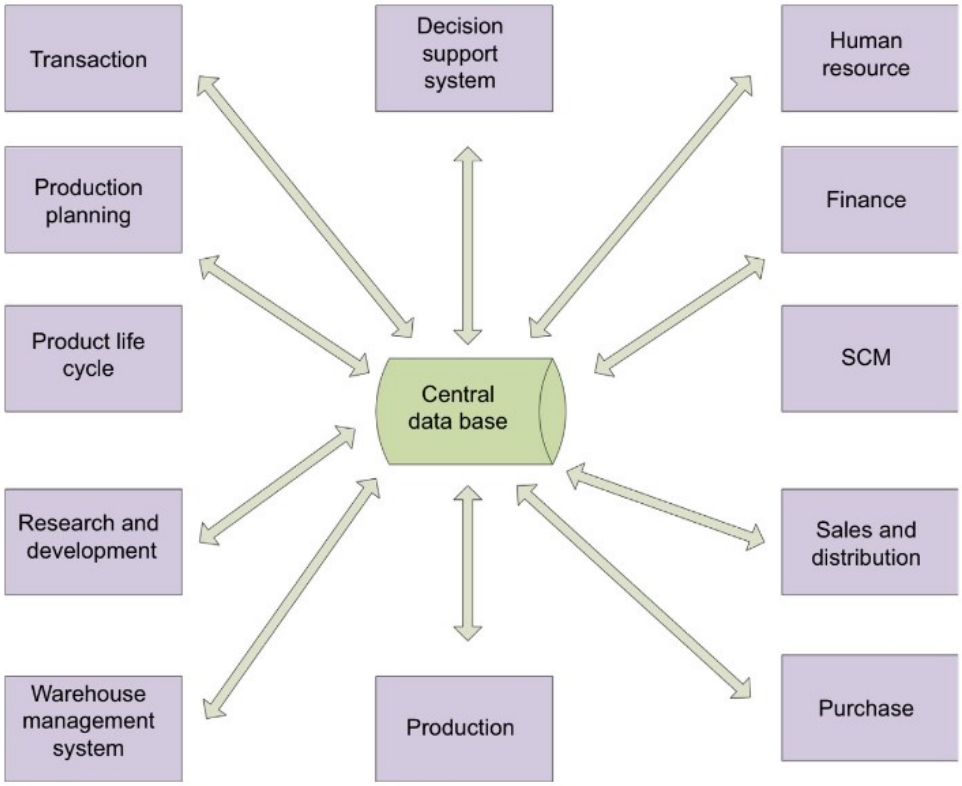

Figure 2 ERP system with all modules linked with a single database (Thomassey 2007, p. 238)

2.1.2 Types of ERP platforms

Enterprise resources planning platforms are on-premise, cloud-based/Software-as-a-service/Saas, and hybrid. The company's computers and servers specifically implement for the on-premise platform. The client may install on-premise software with customized components, functions, and features. On the other hand, cloud-based platforms do not require the physical on-premise system. A vendor provides technological resources and technically supports the implementation based on contracts. The technical resources include an online ERP system, cloud storage, cybersecurity, and other requested elements. A hybrid platform is a mixed implementation of on-premise and cloud-based in which private organizational servers host cloud software. The infrastructure of this

platform depends on the quality of the third-party provider and the effectiveness of WAN connectivity between two environments. (Hayek & Odeh, 2020, p. 2.)

2.1.3 Benefits and challenges

Implementing ERP systems improves the data integration in the business flow. When employees enter or update the data, the information changes are shared and updated across the enterprise. The data's accuracy and completeness help companies improve business strategies and visions. Moreover, ERP systems allow real-time access to information to minimize waiting time for managing documents. Different departments can track data immediately, centralize the systematic process, and create risk management. The standardization of business end-to-end operation and ERP systems improves coordination and relationship of internal and external stakeholders. (Bradford, 2020, p. 6.) ERP provides decision support systems and simulation functions, which enable companies to enhance planning management. Based on better calculations, companies can reduce lead time, decrease cycle time, earn on-time shipment, increase customer satisfaction, improve suppliers' performance, and utilize resources. (Parthasarathy, 2007, p. 3.)

The challenges when adopting ERP systems lay in different factors of the implementation stage. According to Bradford (2020, p. 8), the problems are people-related and technical issues from software or hardware. The people-related issues come from the managers and employees. When the managers fail to prioritize the implementation of ERP to the management board, the lack of resources leads to a delay in ERP development. Employees must be encouraged enough to change from the original platform to the new system. Another issue is that the education to use ERP systems is delivered late or complicated. The employees' daily workload may cause errors and delays because they must familiarize themselves with the system. The lack of user acceptance leads to consequences of quitting or resistance to work from employees of the operation. (Bradford, 2020, p. 9.)

2.1.4 ERP market

The ERP market is a developing and exponentially growing industry. ERP vendors are categorized into three tiers based on four criteria. The criteria are functionality, the total cost of ownership, solutions based on industry, target customers, and geographic functionality. Tier 1 vendors

provide services for a large corporation with 1000+ employees and more than one billion dollars in enterprise space. Because of the variety in capabilities and ability to handle the operation, tier 1 products are expensive. As the ERP market is becoming competitive in the offers and prices, tier 1 vendors release reasonably priced products for different companies' sizes. Tier 1 and tier 2 offer solutions and implementation strategies for mid-market ranges. The experts suggested that small-and-medium companies (SMEs) were suitable with ERP products in tier 2 and tier 3. Small companies with few locations, earning revenues less than 50 million dollars per year, and fewer than 250 employees are recommended to use tier 3 ERP vendors. The table below describes the differences in functions between the three types of vendors. (Bradford, 2020, p. 11.)

Table 2 Characteristics of ERP Vendor Tiers (Adapted from Bradford, 2020, p. 11)

Tier 1	**Tier 2**	**Tier 3**
High complexity	Medium complexity	Limited complexity
Higher cost of ownership	Medium cost of ownership	Lowest cost of ownership
Many industry solutions	Fewer industry solutions	Fewer industry solutions
Large companies	Mid-market companies	Small to mid-sized companies
Global functionality	Global functionality	Few locations

2.2 Electronic commerce platform

According to Organization for Economic Cooperation and Development, electronic commerce (E-commerce) are the transactions which are made by transmitting digitized data such as voice, images, and written text from open or closed networks by individuals and institution (Kalayci, 2008, p. 140). The e-commerce platform operates a transactional cycle of products, services, and

information through computer sciences (Mourya & Gupta, 2015, p. 23). According to Sadowski (2002, p. 78), three elements in the strategic e-commerce framework are the communication requirements of people, economic and social life demands, and competition policies of enterprises. The global market requires flexibility and adaptation due to the incline of new products, customers, resources, and operations. E-commerce platform benefits consumers by having contactless transactions, creating price comparisons, tracking delivery processes, and other elements. Moreover, organizations or suppliers can join the international marketplace, cut costs, and digitalize purchasing process. Therefore, the e-commerce platform is critical for connecting buyers and suppliers. (Mourya & Gupta, 2015, pp. 28-33.)

2.2.1 Technical architecture

The targets for developing electronic commerce platforms are the requirements to build features. In order to earn a good customer experience, the platform has to connect with strong-powered hosting networks. The seamless flow during platform usage depends on integrating different access gateways. When users make requests on the platform, the modules should be easy to follow and add value to appliances. The user interface is specifically designed and able to communicate with customers. The system management infrastructure controls the information technology functions from a technical perspective. Moreover, the platform connects to public portals and external internet providers for hosting systems. The middleman payment network supports payment activities and cycles. Security technologies such as firewalls are recommended to protect confidential information. Legal authorization of the web is essential to operate electronic commerce. (Rajput, 2000.)

The electronic commerce server contains three main applications as user tier, server tier, and database tier. The user tier obtains requests from the users by information appliances. The users can be business partners, personal users, organizations, and other types of customers. The information appliances or physical layer are technical devices with a browser to request e-commerce services. The information is transferred to the server tier. The server tier contains several programs to process the request from the user tier. Electronic computing networks, which are internet and commerce server applications, reduce the delay in operating the workload. The database tier contains a logical layer, an application layer, and an intermediary service layer. The database tier can access master data to transfer information with the server tier. The logical layer includes

external sources for security and authorities. The application layer is the primary enterprise computing service. The layer contains programs to support different features on the e-commerce platform. The payment process operates in the intermediary service layer. Third-party partners are corporate with the platform for the payment process. (Mourya & Gupta, 2015, p. 41.)

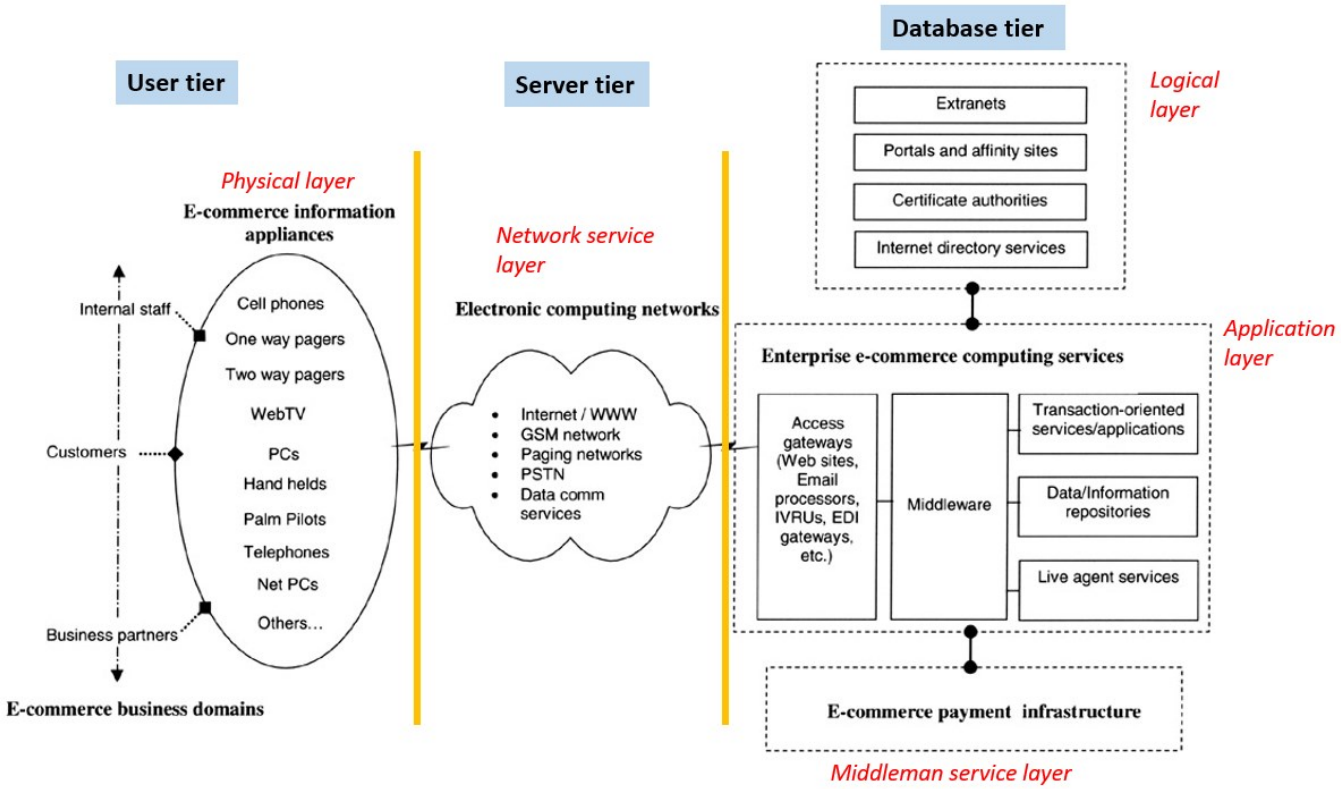

Figure 3 Technical architecture of E-commerce (Adapted from Mourya & Gupta, 2015, p. 41 and Rajput, 2000)

2.2.2 B2B E-commerce

E-commerce has different concepts and is constantly developing based on global changes. E-commerce trade can be seen in different ways, national and international. (Kalayci, 2008, p. 142.) B2B or business-to-business is one of the most common categories of e-commerce. (Laudon & Traver, 2010, p. 17). B2B e-commerce operates transactions between businesses to others via electronic websites. Different companies can exchange communication at the same time in one transaction. B2B e-commerce platform allows users to conduct various activities. The activities include requesting quotations, managing orders, purchasing, and other business-related tasks. The data distribution within companies is changeable before completing the transactions. The B2B electronic

commerce business model concentrates on organizational operation. The operation generates long-term forecasts and development. The business strategies optimize profits, efficiency, and competitiveness. The transaction includes complex contract terms and transparency during the process. The average order size is a bulk amount based on different policies. The customer relationship within B2B e-commerce is essential and complicated due to the beneficial collaboration. (Samtani et al., 2002, pp. 5-8.)

2.2.3 Success factors for e-commerce

The strategic success factors are determined to improve the company's competitive position. The success factors of e-commerce businesses are strongly related to customers' experiences. (Colla & Lapoule, 2012, p. 844.) Users seek convenience by reducing physical attachment and time to consume products. The first factor of e-commerce is to understand and identify consumers' motivations. Moreover, e-commerce offers deliveries which is a beneficial advantage to consumers. (Schenk et al., 2007, pp. 894-903.) The website's user interface should include high-quality design, user-friendly, and ergonomics. Yen et al. (2007, pp. 159-170.) stated that even though the web design is flexible for different purposes, the website should help consumers save time navigating and finding suitable offers. The coupons motivate consumers to make the buying decision easier and faster. The search term is systematic and includes fundamental elements. (Dholakia & Zhao, 2009, pp. 821-838.) After receiving an order, an efficient logistics flow allows the products to deliver to the consumers quickly. Customer satisfaction means in-time delivery and good quality products. The problems occur in warehouse management and distribution. (Urban et al., 2000, p. 39.) The modules for e-commerce are collected from stores or pick-up points and delivered directly to customers. Depending on the modules, solutions for the problem are generated. The critical ideas are analyzing the characteristics of the products and showing customers various options. Moreover, fulfillment centers in supermarkets or convenience stores allow consumers to see the availability and pick up orders. (Fernie et al., 2003, pp. 161-174.) The competitiveness in the e-commerce market is not only about the prices but also about the diverse range of products, advertisements, payment methods, and other interactive activities. The consumers can decide whether to pay extra fees for the home delivery service. (Tanskanen et al., 2002, pp. 169-178.)

2.3 The relationship between ERP and E-commerce platform

Integrating ERP into an e-commerce platform requires in-depth information from different perspectives to create the most suitable plan. The relationship between ERP and e-commerce comes from the demand, advantages, limitations, business strategies, and technical solutions.

2.3.1 The demand for the integration

Digitalization is a critical driver for exponential development and benefit growth. Many companies focus on growing IT functions to scale up the business. (Kujala & Halonen, 2020, p. 1.) Development in digitalization is a competitive factor for businesses (Goundar et al., 2021, p. 163). The trend of integrating e-commerce and ERP has been steadily inclined but promising in recent years (Krithika et al., 2020, p. 7). The connection between Enterprise Resource Planning and E-commerce is externally and internally related. Subtle changes in one department directly affect other related links (Galante, 2015, pp. 173-176.) Several risks from the operation of the electronic market need the implementation and support of ERP. Within an e-commerce platform, the quality of the products cannot be informed or expertized online. Data security is another concern according to the non-enacted ideal trade regulations. The management could better verify the trader's identity, credit card private information, payment issues, quality assurance, and other problems. (Kaya & Aydin, 2019, p. 214.) Critical data information in the e-commerce platform stands independently without using an ERP system. The data inconsistency and incompleteness affect the logistics and the enterprise information flow. Therefore, implementing ERP implies unifying business features, cost efficiency, and data accuracy. The integration encourages business transparency in data sharing and resource connection. (Goundar et al., 2021, pp. 158-164.)

2.3.2 Benefits and limitations

According to Robert et al. (1999, p. 5), integrating ERP and E-commerce allows transaction data to transmit effortlessly and bidirectional among independent platforms. According to Kujala and Halonen (2020, p. 3), without the data unification of the ERP system, the company can suffer from wrong inventory numbers, shipping addresses, product information, and other essential data. The solution is cost-efficient because the e-commerce platform can cut costs on manual management. An E-commerce platform with ERP systems reduces human errors and automatically implies data into a shared information base. The company can save operational costs and manage the business

better. Moreover, the accuracy of data is reliable, which gains customer satisfaction. (Kujala & Halonen, 2020, p .3.) The customization of ERP can suit the current e-commerce platform, which helps employees to adapt more quickly. For retailers, ERP creates overview analysis on sales, delivery status, cash flow, and other business perspectives. The system's flexibility, accuracy, and transparency significantly support business growth. (Farzaneh, 2014, p. 4172.) Lastly, the business landscape has become globally expanded with high competitiveness and strict rules. An implementation is a tool for businesses to earn new opportunities and communicate with more stakeholders and customers. (Kujala & Halonen, 2020, p. 2.)

According to Krithika et al. (2020, p. 6), the challenges in the integration are the communication terms and testing structure. The integration requires enormous resources and time to become a commercial enterprise network. The testing structure is the hard core of the implementation stage. The importance of fitting the ERP system with the e-commerce network depends on the list of standards. The company faces challenges when the standards need to be qualitative enough. The qualitative standards help the company to target the expectation and further steps for development. Moreover, the communication terms occur between the company, the ERP vendor, internal employees, and partners. The mismatch in communication with ERP vendors leads to extra costs, delays in implementation, and time-consuming. The internal employees may take a long time to adapt to the new system without frequent consults. The company's partners may run through errors while using the platform. The errors happen when the company does not analyze and develop the testing phase. (Krithika et al., 2020, pp. 6-7.)

Wallace and Kremzar (2002) state that the limitations of the ERP implementation may come from the planning and selection stage. The new ERP systems require user guides, and it takes time for employees to adapt thoroughly. Moreover, the new system does not fit the company processes and lacks user requirements. In that case, the company cannot optimize the ERP profits (Finlay & Servant, 1987). Another area for improvement is understanding available ERP packages in the marketplace. According to Alanbay (2005), approximately 90% of ERP implementations cost more than expected or are delayed. The mismatch in importing the new ERP system and the company's data caused the delay and requests for more resources. Therefore, objective professional consultancy without affiliation with ERP vendors is recommended. (Alanbay, 2005) Moreover, the limitation comes from the extra costs in the long-term usage of ERP. The system can cost expensive

annual maintenance fees or development costs with the growth of the business. The company may lack the resources to invest in and manage the ERP system. (Kujala & Halonen, 2020, p. 3.)

2.3.3 Strategies for the implementation

The integration strategies are organic implementation, reorganization of departments, and renovation of updates (Wang & Shi, 2017, p. 3). ERP perspectives prioritize modules such as production plan, marketing, sales, procurement, finance, and inventory. These modules are directly connected to critical logistics and asset management activities. In an e-commerce environment, payment, purchasing, sales, and website management modules are prioritized. (Chang, 2010, p. 82.) The organic implementation combines essential modules to create functional solutions. The design and construction stage creates background principles for the implementation. A metric evaluation helps the design and construction stage fit with the company's requirements. The factors are based on functions, user interface, efficiency, and other aspects of the design. The evaluation stage is essential in the implementation stage. (Kujala & Halonen, 2020, p. 9.)

Secondly, the ERP continues to improve and adjust to the existing business models, while e-commerce is flexible to changes. The reconstruction of business models allows a development cycle between ERP and e-commerce. The benefit of reconstruction is saving costs by adjusting implemented factors. For example, the strategies from enterprises are more expensive and not necessary for small businesses. Small companies may use free platforms or low-cost options such as WordPress or Google Analytics for the implementation. (Kujala & Halonen, 2020, p. 10.)

Lastly, the integration causes various changes to the current management ideas, systems, and methods. The company should promote leaders, managers, and employees and adopt advanced management concepts. The dynamic changes in the market should follow by the responsive attitude of the enterprises. (Wang & Shi, 2017, p. 3.)

2.3.4 Technical solution for integration

ERP suites are different from e-commerce systems because of the purposes of development and users. ERP system is more related to the back-office system where only employees can manage the status of products. However, customers and suppliers demand to view the platform's real-time

status. Therefore, integrating ERP and e-commerce should separate different layers and maintain potential communication. (Krithika et al. 2020, 3.)

According to Kaya and Aydin (2019, p. 219), the solution contains three layers: the primary system, the intermediate database, and the e-commerce system layers (see Figure 4). The difficulties in synchronization are the reasons for the separation of layers. The intermediate layer includes data from the ERP system, VPN server, and Firewall. The independent intermediate database is because the uncontrolled connection from clients may cause performance errors in the system. Moreover, because the data cannot be transferred directly from customers to the ERP system, the intermediate database stores and manages that information and then delivers it to the system for accurate redesign. Another reason is that financial records should not be inserted directly into the system. If the new records do not match existing accounting records, there would be incorrectness and conflict for the finance department. ERP system has an open structure, so the security issues are pretty concerning. (Kaya & Aydin, 2019, pp. 219-220.)

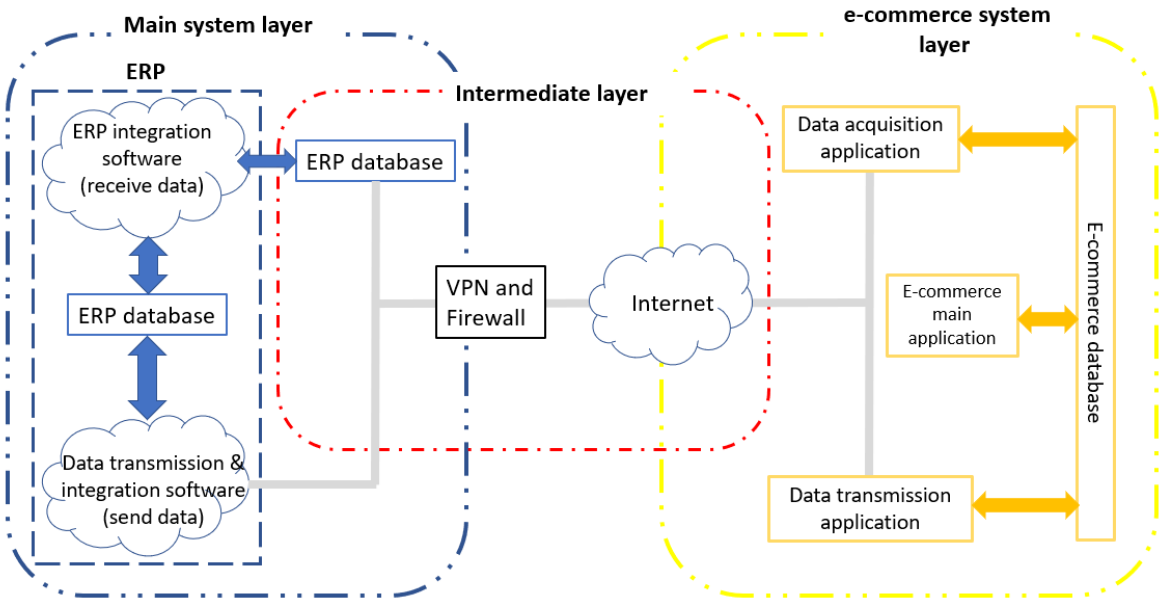

Figure 4 System technical view (adapted from Kaya & Aydin 2019, 220)

The main application layer contains several database management systems and databases. Different databases can cooperate with ERP systems (Kaya & Aydin 2019, p. 220). For example, the SAP ERP system supports databases such as Oracle, Windows, SAP live Cache Technology, and other applications (“SAP Help Portal,” n.d.). The ERP system consists of a presentation layer (graphic

user interface), a database layer, and an application layer. Users are able to access the presentation layer then the data is transmitted to the application layer. The application layer acts as a sub-layer and processes the incoming transaction codes. The database layer stores the digitalized data in the system. (Kaya & Aydin, 2019, p. 221.)

The intermediate layer contains the copy-supported database and transfers the information to the ERP system. The records from e-commerce transactions are maintained in the support database platform. The central server preserves the core database of the electronic commerce platform. The database in the e-commerce system keeps the master data, such as transactions, documents, product information, and other information, then delivers it to ERP software. (Kaya & Aydin, 2019, p. 221.) The intermediate layer was known as Web Application Programming Interface (API). API is a third-party platform that supports the connection from different systems without traditional implementation. API simplifies the integration development of existing components of the business with new software. The platform allows the company to share internal data with business partners and users. A good API has requested programmatical functionalities. Investing in API assists in increasing the development rate and competitive factor. (Geewax & Skeet, 2021.)

The e-commerce layer allows e-commerce information to be delivered to the central system. The layer contains data transmission systems, reception, electronic commerce software, and a database. The actions made to the ERP system reflect directly on the working platform. For instance, changes can be deleting changes, document updates, registration, and other possible actions. The layer connects directly to the ERP system without going through the intermediate layer. The ERP system allows using data by several methods and external access. Therefore, the user can access remotely with permission from the system. Further upgrades on user classes or specific connecting requirements can be integrated by applying additional packages. The data structure of this layer is managed by the IT department and adjusted by companies' policies. (Kaya & Aydin, 2019, p. 221.)

2.4 ERP selection process

Implementing an ERP system is an expensive and time-consuming investment for any company. The costs for implementing ERP include licensing, hardware, IT infrastructure, system implementation, and maintenance. The size of the investment depends on the demand and strategies of the business. Therefore, proper planning and associated risk management are essential from the initial

stage. Lack of proper planning affects business opportunities, budgets, and time management. This part highlights the outline steps during the implementation and criteria in ERP selection. (Bradford, 2020, p. 68.)

The selection of an ERP system might be complex due to the unclarity of customers' requirements and complex business processes. Furthermore, the difficulties lay in the meager planning stage and resistance to change due to the company's culture. Moreover, the ERP market is expanding with an increasing number of ERP vendors, making the decisions harder. Consultants ensure the ERP system will meet the customers' and vendors' demands and challenges. (Parthasarathy, 2007, p. 31.)

2.4.1 ERP implementation planning

Organizational readiness

The company has the business analysis of the current situation about assets and issues to prepare for the application of ERP. The organizational readiness for ERP is crucial because the company has the target and direct expectation of the types and functions of ERP. The question during this stage can be whether the time is suitable to change. If the company has been facing significant fluctuation in recent years, such as management changes and staff layoffs, the answer should be no. The second question is about the level of standardization from different departments of the company. The standardization includes business processes, procedures, and structure. The third issue concerns executive leadership and human resource management about prioritizing the implementation. The company culture and stakeholders should be open to integrating the new ERP project. (Bradford, 2020, pp. 68-69.)

Project team

After implementing ERP, the company forms a project team with executive leaders, key process owners, managers, end users, and IT engineers. The target is to decide based on required functions, software structures, boundaries, company size, and organizational levels. The project team can invite specialists or consultants to advise on technical problems. Moreover, the team is in charge of training and accompanying other employees to use the new system. In order to fulfill the tasks, the group should understand business domains, express strong motivation in changing

procedures, have a significant influence on other colleagues, have teamwork skills, and willingness to learn. The size and commitment of the team significantly depend on the scope of the project and the company's demand. (Bradford 2020, p. 69.)

Project manager and executive sponsor

The project manager oversees the functional and operational aspects of all ERP projects. The manager is essential because his responsibility is transferring the business requirements to IT solutions and understanding business metrics. The executive sponsor manages the project managers and distribution of resources with delegate management. A steering committee is founded to authorize the ultimate decisions. The committee includes top management, project managers, and senior consultants. The committees' responsibilities are to set project objectives, and time scope, approve selection methodology, shortlist, and prioritize critical success factors (Bradford 2020, p. 70.)

Project Charter and scope statement

The project charter is a confidential document with the objective of persuading the executive sponsor and top management. The description in the project charter consists of objectives, business cases, and involved stakeholders. The charter is approved and authorized by the sponsor with the agreement of the steering committee. The scope statement provides specific information from the project charter with excluded factors from the project. The objective of scope management is to define all related factors and possible situations of the project. (Bradford, 2020, pp. 70-71.)

Cost of ownership

The total cost of ownership (TCO) is a significant factor in making decisions for the implementation and software strategies. Even though there are different metrics in evaluating TCO, vendors and end users are discussing the strategy to lower the price. The costs are identified before and after the implementation. The TCO model provides an evaluation tool for suppliers by comparing their performances. Moreover, the company can evaluate the cost structures and establish priorities to create benefits. Thformie cost structure supports long-term procurement direction to understand the meaning of the cost factors. (Ellram, 1995, pp. 4-23.) TCO cost of implementing ERP system can be listed as follows:

- Obvious cost: the license cost of the software. The ERP license is perpetual and owned originally by the ERP vendors. The license is sold by modules or the whole system products of the ERP company.

- System integration: The cost is the primary factor in deciding the long-term cost. The customization and additional interfaces are the reasons for the expensive charge of implementation. Examples of additional interfaces are the CRM system, HRM system, and modification for the entry system.

- Implementation: The software is implemented into the company system at this stage. The cost varies with the selection of applications such as movement services, training, consulting, process engineering, and other applications.

- Customization: Companies may customize the system based on different situations after the system integration stage. As customization directly affects the system, changes are considered a high cost.

- Platform: Software requires a computer platform or cloud-based environment. Therefore, in order to use or expand the platform, companies have to procure the platform.

- Safeguarding: The maintenance for the system is counted as an annual expense. ERP sellers charge around 20 percent of the selling price per year.

- Training costs: The training stage is critical for employees to use the software smoothly. The training programs cannot guarantee quality outcomes because employees have different paces of studying. Therefore, this cost is related to the technical support costs.

Implementing ERP is a long-term plan since several unpredicted factors require adaptation. (Nestell et al., 2017, pp. 63-64.)

2.4.2 Selection criteria

The ERP selection criteria of companies are different due to size and demand. The criteria factors are increasing transparency and enhancing information flow. The new ERP function should reduce lead time, cycle time, and the developing process. The maintenance is well-processed, and the adaptability with company is high. The features of the ERP software are modular architecture, high reliability, ergonomics, and user friendly. The tier of the ERP vendors is defined based on the ERP market. The new ERP should match customers' demands and operate the process independently. Technical support can improve e-commerce functions and internet services. The customization stage should be reduced since the budget for the customization is high. (Parthasarathy, 2007, p. 31.) User interface (UI) is the technical interaction of humans and computers to communicate in a machine. (Miraz et al., 2016, p. 432) The perspective-based User Interface (UI) contains inspection from evaluating different perspectives. The objectives of perspective-based UI are generating the requirement range and exploring different solutions at a moderately low budget. The evaluating factors might be page elements, the size of clickable items, web terminology, and the scanning possibilities. The UI could be improved by designing the perspective-based evaluation. The evaluation team set a characteristic list and evaluated based on the objective users' opinions. (Wilson, 2014.) According to Parthasarathy (2007, p. 31), the general selection criteria are achieving customer satisfaction and improving innovation capabilities.

Figure 5 ERP selection criteria overview

2.4.3 The selection stages

The ERP selection stages conduct several analyses and detailed information on ERP products. Bradford (2020, p. 89) stated that the company took three to six months to make the final decision. The steps below support finding the most suitable system based on functionality, budget, and other requirements.

Figure 6 The steps in ERP selection stages (Adapted from Bradford, 2020, pp. 89-98.)

Requirement analysis

Requirement analysis analyzes the company's demands which are operational and technical functionalities. Technical functionalities include the Graphic User Interface, security, and customization with the operation of the database. Operational requirements rely on the business processes in different scopes. Additional functionalities are advanced planning, scheduling, governance, risk management, business insights, and other requirements. (Hass et al., 2008) Subject matter experts and process owners discuss the requirement analysis through several methods. Companies can operate workshops and brainstorming activities. The workshops focus on the current operation to seek the developing functionalities. Brainstorming and questionnaire events discover problems and solutions the new system can solve. The ideal requirement analysis captures the current business process and reasonable changes. (Bradford, 2020, p. 89.)

Market survey and shortlisting

The market survey is performed to determine possible and suitable vendors' systems. Companies select ERP vendors by discussing with business partners, consultants, and suppliers. The general selection list contains appropriate ERP vendors. The selection team can eliminate many vendors based on the requirements document, industry, financial budget, and other requirements. As a result, companies conclude a list of six to eight possible vendors to evaluate. Three to four vendors are chosen from the original list. The selection team conducts insight research for the shortlisted

vendors. The company requests proposals from ERP vendors to discuss the costs of implementation, local presence, and demo versions. The request proposals include the expected elements by different levels of importance. ERP vendors then present and demonstrate the demo version of the system to the company. The demo software is non-customized, includes basic modules, and uses direct company data to operate. Therefore, the selection team has significant visions and figures out problems or missing elements of the ERP system. ERP specialists consult the shortlisted vendors and compare the practical usage based on the demos. The underqualified ERP systems are eliminated if they cannot meet the requirements and expectations. (Bradford, 2020, pp. 89-90.)

Weighted score sheet

According to Weller (2021), a weighted score sheet is a method to select comparative values on different scales. For example, the criteria grade is from one to ten, and the numeric scale of each criterion is from low to high. The result is the total of the scaling standards grades, which are the multiplication of the numeric scale and criteria grade. The criteria selection is collective and based on the core outline of the project. (Weller, 2021.) The weight score sheet in the ERP evaluation includes technical and functional requirements for long-term assessment. The vendor that has the highest score is the most practical and suitable solution for the company. Moreover, the company can reduce a lot of expenses for platform customization. (Bradford, 2020, p. 90.)

Fit/Gap Analysis and Reviews

Fit-gap analysis is an important step in the ERP selection process because this method produces innovative proposals for the design phase (Grabis, 2019, pp. 84-92). ERP vendors, consultants, and the project team are in charge of conducting high-level fit-gap analysis. The fit in the analysis must match the company's ERP system requirements. The gap targets focus on reducing the differences between the ideal ERP system and customers' demand. High-level analysis picks out the most practical ERP product according to the company's requirements. (Imane et al., 2022, p. 393.) The first step in fit-gap analysis is to summarize requirement lists and ERP products' characteristics. Different categories and purposes select the comparing elements. Then the comparison chart is evaluated by project teams and ERP vendors. (Goodhue et al., 2000, pp. 87-101.) After the most suitable ERP system is determined, the project team conducts another detailed fit-gap analysis.

The target is to solve the gap issues through strategic implementation and gain feedback. Additional customization to the system is considered a good solution. (Blick et al. 2000, pp. 1203-1209.)

The project team researches other companies which have used the chosen ERP system. The review aims to collect experiences of ERP usage in a practical situation. Therefore, the reference company list is created based on similar perspectives of the working industry and period. The interview questions with those companies should be about current counterparts and difficulties with the ERP system. The list selection should be neutral without the intervention of ERP vendors. The period of ERP usage is at least six years, excluding the time for training employees. The selection team should know about ERP system advantages and effects on business development. The more detailed content of the interview questions, the more precise objectives are. In case the outcomes are different from each other, the selection team should focus on analyzing the particular and controversial perspectives. (Bradford, 2020, p. 97.)

Partners' discussion

According to Kobernick (2013, p. 36), the vendor proposes the initial contract with detailed regulations and policies after the negotiation. The contract includes integrated modules, license costs, maintenance fees, and other related terms. Long-term contract membership can refer to a discount on annual maintenance costs. (Kobernick, 2013, p. 36.) Bradford (2020, p. 95) suggests that the company prepare other backup options to gain more negotiation power. Moreover, the company should focus only on the main modules other than excessive products from the vendors. Lastly, the contract should cover the possible risks, such as geographic changes, size changes, and functional expansion of the company. Moreover, the company should work with the current partners to understand their management tools and business systems. The discussion aims to match the future ERP system with collaboration. The regulations and conditions are built if data is transmitted in the ERP system. (Bradford, 2020, pp. 95-96.)

2.4.4 Critical success factor

The ERP implementation is time-consuming, expensive, challenging, and contains unpredictable risks (Xue et al., 2005, p. 279). In the article of Chang et al. (2014, pp. 196-207), many reasons for

the failure of the implementation have been analyzed significantly affects the success rate. The reasons which are critical success factors (CSFs) can be evaluation guidelines for ERP implementation. According to the literature review of Reitsma and Hilletofth (2018, p. 287), there are twelve CSFs collected from the beginning era of ERP to the current time. The CSFs can be sorted into personnel-related issues, management, and software factors.

The personnel-related issues are the project team and top management (Reitsma & Hilletofth, 2018, p. 287). The project team should include the best people, such as senior managers of different departments with consultants. Top management organizes the authority of approving decisions for the project team. The personnel-related issues are important in the beginning stage of ERP implementation. (Dezdar & Sulaiman, 2009, pp. 1037-1038.)

The management subjects include decision-making, communication, project management, organizational change, training, and business process. The decision-making process is carefully prepared and strategic. The process outlines the advantages, risks, resources, and costs when the company implements an ERP system. (Yen et al., 2008, pp. 1609-1615.) The communication during the ERP implementation keeps the opinions and requirements transparent. The project management factors help the group to understand the objectives and work plan. The success of the project depends on the management of the leaders. The implementation changes the original organizational system, which requires the company to adapt. The changes can appear in working styles and software systems. Organizational changes lead to the evolution of the business process. The automation of the ERP system can cause confusion among departments. The company should align its business process with the new ERP system. The alignment can be shown as training sessions for employees to get used to the ERP system or workshops to understand employees' opinions about changes. (Singla & Goyal, 2006, pp. 59-67.)

The software factors include technical support, technological risks, customization, testing process, and performance scale. Technical support is required for maintenance, updates, and user support. The customization is limited because the expense is comparatively high. The company should minimize customization by finding the closest user interface software from the beginning. The testing process allows the company to try demos with its data to visualize how the ERP system works. Therefore, the company can use the performance scale to rate the practical usage of the ERP

system. The monthly evaluation helps the company know the hidden costs, difficulties, and software quality. (Ziemba & Oblak, 2013, pp. 1-19.)

2.5 Summary

Enterprise Resource Planning

Enterprise Resource Planning (ERP) is an integrated software program incorporating company departments and corresponding functions. ERP system unifies business processes with transactional data and digitalizes the process to meet organizational goals. (Parthasarathy, 2007, pp. 1-2.) The ERP structure depends on business requirements. Core ERP comprises financial, logistics, and human capital management (HCM) modules. (Bradford, 2020, p.4.) ERP platforms have three types: on-premise, Saas, and hybrid (Hayek & Odeh, 2020, p. 2.). ERP improves data integration and unification in the business flow. Moreover, ERP prevents errors, reduces lead time, utilizes resources, and increases customer satisfaction. (Parthasarathy, 2007, p. 3.) The challenges of ERP systems are business preparation in the implementation stage (Bradford, 2020, p. 9). There are three ERP tiers for different types of businesses. Implementing ERP is a growing trend for companies to fasten development. (Bradford, 2020, p. 11.)

E-commerce platform

The e-commerce platform operates a transactional cycle of products, services, and information through computer sciences. E-commerce platform benefits consumers by having contactless transactions, creating price comparisons, tracking delivery processes, and other elements. Moreover, organizations or suppliers can join the international marketplace, cut costs, and digitalize purchasing process. The technical architecture of an e-commerce platform has three layers: users, servers, and database tiers. (Mourya & Gupta, 2015, pp. 23-33.) B2B e-commerce which operates a transactional cycle between business and other businesses, is one of the most common categories of e-commerce (Laudon & Traver, 2010, p. 17). The critical success factors of e-commerce are customer experience-related activities. (Colla & Lapoule, 2012, p. 844)

The relationship between ERP and e-commerce platform

Many companies focus on growing IT functions to scale up the business by implementing ERP solutions (Kujala & Halonen, 2020, p. 1). The connection between ERP and E-commerce is externally and internally related. ERP helps the e-commerce platform to record the product qualities and secure data of traders and payment. (Kaya & Aydin, 2019, p. 214.) An E-commerce platform with ERP systems reduces human errors and automatically implies data into a shared information base. Other benefits are saving operational costs, increasing data accuracy, increasing client satisfaction, and managing the business better. (Kujala & Halonen, 2020, p .3.) The challenges in the integration are the communication terms and testing structure. The errors happen when the company does not analyze and develop the testing phase. (Krithika et al., 2020, pp. 6-7.) Other limitations come from the planning and selection stage without preparation (Wallace & Kremzar, 2002)

The integration strategies are organic implementation, reorganization of departments, and renovation of updates (Wang & Shi, 2017, p. 3). The organic implementation combines essential modules to create functional solutions. The design and construction stage creates background principles for the implementation. The department reorganization strategy continues to improve and adjust to the existing business models, while e-commerce is flexible to changes. The reconstruction of business models allows a development cycle between ERP and e-commerce. (Kujala & Halonen, 2020, pp. 9-10.) The renovation updates require a responsive attitude from enterprises (Wang & Shi, 2017, p. 3). The integrated structure contains three components: the main system (ERP and database), the intermediate layer (API), and the e-commerce layer. The technical integration is connected by intermediate layer API. (Kaya & Aydin, 2019, pp. 219-220.)

ERP selection process

The ERP selection process includes an implementation plan and selection procedures. The ERP implementation planning contains internal business preparation. The planning stage defines organization readiness and includes top management's decisions. The company forms a project team with project managers, an executive sponsor, ERP consultants, and IT employees. The company prepares the project charter and scope statement to generalize the ERP demands. (Bradford, 2020, pp. 70-71.) The TCO model enables an evaluation tool for suppliers by comparing their performances and cost structures (Nestell et al., 2017, pp. 63-64). The ERP selection criteria depend

on the company's size and requirements. The general selection criteria are achieving customer satisfaction and improving innovation capabilities. (Parthasarathy, 2007, p. 31.) The selection stage has six steps: requirements, market survey, analysis, testing, reference visits, and discussion (Bradford, 2020, pp. 89-98). The critical success factors for ERP implementation are personnel-related issues, management, and software factors (Reitsma & Hilletofth, 2018, pp. 287). Figure 7 below generalizes the ERP selection process stages overview and corresponding action description.

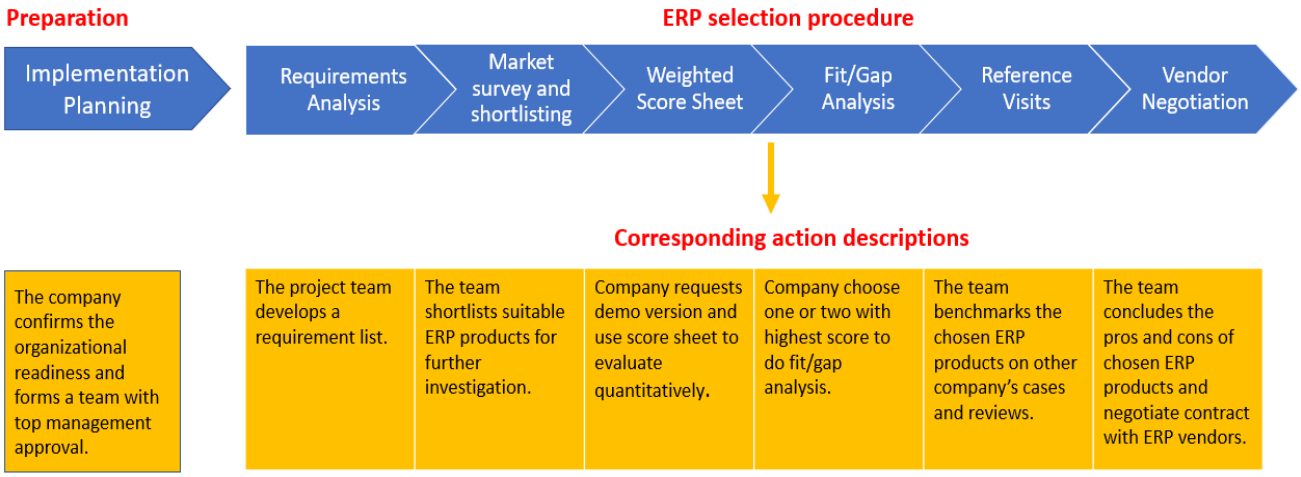

Figure 7 ERP selection process overview

3 Company A case study

This chapter introduces the case study of company A. Company A works on an e-commerce platform in Europe's advanced materials industry. The industry and company's story are elaborated to support the details of the case study. Moreover, the white papers about platform features are described for buyers and suppliers. Company A is completing the platform; however, they notice some problems regarding the purchasing process. Without implementing an ERP system, the information flow can be inaccurate and lack unification. Therefore, when selecting the most suitable ERP system, company A produces a list of ERP requirements based on the procurement module.

3.1 Company industry

Advanced materials (AM) have been specially developed to bring innovative and enhanced qualities that provide superior performance over traditional materials. Because of their distinct properties, advanced materials have a highly unknown hazard profile and may necessitate specialized testing processes and methodologies to assess the potential for adverse environmental health and safety implications. (Kennedy et al., 2019, p. 5.)

The AM industry has been developing globally with popularity in engineering, medicine, and other scientific fields. High-tech aerospace, electronics, energy, and pharmaceutical companies have been using AM materials for their core products. The market figures have different scaling metrics and growth definitions. However, the AM demand and revenues are forecast to increase rapidly in the near future. The market size of AM varies from large enterprises to small and start-up companies. The current situation lies in small and start-up companies because of the time for the materials to scale up. The development and management of the companies are expensive, discouraging, and time-consuming. (How and Where the Advanced Material Industry is Set to Grow, 2020, pp. 3-5.)

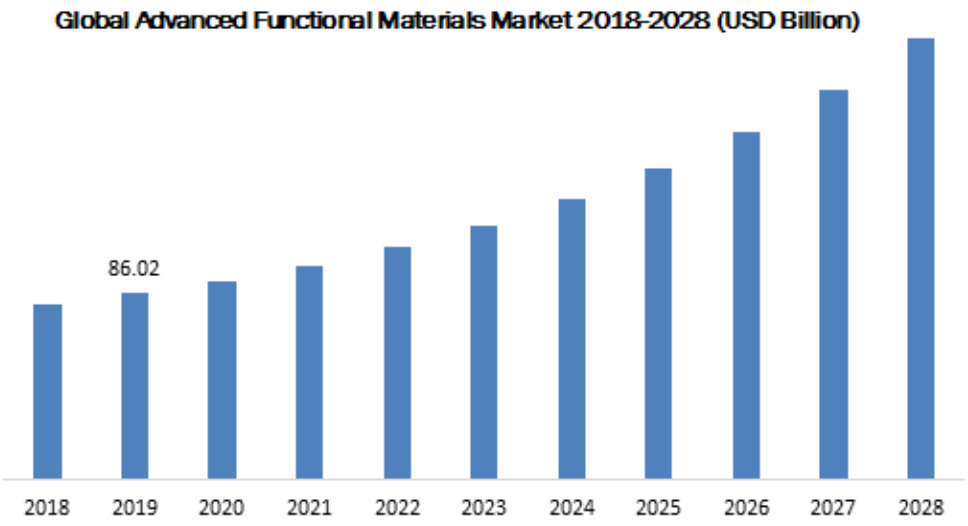

Figure 8 Global advanced functional materials market 2018-2028 (Adroit Market Research, 2020)

3.2 Company story

The current market for advanced materials includes many small and medium-sized companies with exciting and innovative products. Due to the inactive digitalization and minor scale in customer range, buyers and suppliers in the advanced materials industry need help to reach their targets and demand. Company A is the world's first B2B electronic commerce platform for advanced materials. Company A operates end-to-end solutions from sourcing, communication, and invoicing to relationship management. Moreover, company A connects suppliers to their targeted buyers and helps buyers to find their products, even if the products are not on the platform yet. Company A stated, "We see a world where barriers to create great innovations are gone, and the smartest people are given the tools they need and told to go for it instead of building obstacles at every turn for them." The company aims to tackle every problem with scientific methods and tools.

3.3 Process workflow for buyers

The buyers can sign up for free on the platform to find the most suitable products. The sorting feature in company A allows buyers to reach buyers' most specific requirements for the materials. If buyers have no options, they can leave a request on the platform, and company A will do further research. Currently, the range of advanced materials suppliers in company A is in Europe and the United Kingdom. The vision of company A is to broaden the registration of worldwide suppliers and buyers. Buyers can download safety sheets and test results of every product on the platform. Moreover, they can track the live batch of production. After finding a suitable option to purchase, buyers can leave an offer or request for the suppliers. The discussion is on-site and convenient to discuss back and forth. Company A digitalizes order management and payments for the buyers. Procurement features are included in company A so buyers can reduce their workload. Moreover, the live project manager consults on contracts and maintains relationships with potential suppliers.

3.4 Process workflow for suppliers

The features for suppliers are systematic category management, a complete invoicing cycle, and post-procurement. Categorizing material is a typical term with different methods and classifications. However, in the field of advanced materials, the diversity of the products is enormous. Some materials are produced by the specialized lab and publicized for the first time in the market.

Therefore, categorization might be a difficult task for an e-commerce system. However, company A's solutions break the catalog into the most fundamental properties, functions, and purposes. The solution allows suppliers to describe and create their product descriptions. The invoicing process includes payment terms, automated invoices, and shipping tracking. Sellers will sign up and upload their safety sheets and product test results. After getting an offer from the buyers, the suppliers can receive special requirements and offer negotiation. The discussion is made on the platform, and an integrated contract manager will help both sides agree. There is another party for payment, and the invoice is automatically recorded in the system. The procurement feature integrates with the ERP of the suppliers and the suppliers' company to support the procurement process. The tracking shipment is also available on the platform. The live project manager operates post-purchasing activities to reduce costs and save time.

3.5 ERP requirements and specifications

Currently, company A is focusing on finding a suitable ERP solution for procurement features. The target is the users whose Company does not acquire any ERP system. Moreover, the future ERP system can integrate with users with existing ERP systems. Using Company A's procurement feature, small and medium-sized companies can access complete purchasing suites to support their process. Company A and its users are mainly small and medium-sized business-to-business companies. Therefore, the tiers of ERP are tier two and tier three.

Moreover, the ERP system mainly focuses on procurement modules. The software should be a cloud-based solution with ease of customization. Based on the Company's background requirement, the ERP selection criteria list is created to understand the importance of different perspectives. The criteria range from buying, reporting, ordering, invoicing, and managing the procurement process. At this stage, Company A has given the list of primary and secondary criteria included in the procurement suite. The procurement modules for different functions support the uses in conducting purchasing tasks. The primary modules are marked as "must-have," while the secondary modules are marked as "good-to-have." The "must-have" elements are the priority in shortlisting ERP vendors. While "good-to-have" elements are additional factors to select depending on the different business cases. (See Table 3)

Table 3 ERP requirements from company A

Modules	**Must-have**	**Good-to-have**	**Note**
Cataloging/Categorizing	**X**		
Inventory management	**X**		
Invoice history	**X**		
Online invoicing	**X**		
Purchase Order Management	**X**		
Requisition Management		**X**	
Shipping Management	**X**		
Supplier/Buyer Management	**X**		
Discount Management		**X**	**feature added to company A recently**
Invoice Creation	**X**		
Invoice processing	**X**		
Order Management	**X**		
Accounts payable/receivable		**X**	
Returns Management		**X**	**depends on the industry**
Spend Management		**X**	
Warehouse Management		**X**	
Audit Management		**X**	
Compliance tracking		**X**	
Contract Management		**X**	
Data visualization	**X**		
Expense tracking	**X**		
Sourcing management	**X**		
Bank reconciliation		**X**	
Contract lifecycle management	**X**		
Demand forecast		**X**	
Financial report	**X**		
Quality control		**X**	

4 Methodology

In this chapter, the methods in the thesis are academically described and significantly explained. The thesis uses qualitative and quantitative methods, bringing different perspectives to support the discussion. The quantitative method is conducted by survey and other possible approaches. The qualitative method is conducted by interviews with the representative from the company's case study. The literature search section analyzes the search methodology and material selection criteria. The primary peer-reviewed materials in the literature review are highlighted and briefly paraphrased.

4.1 Literature search

Conducting a literature review includes searching and understanding peer-reviewed studies to provide academic background and identify uninvestigated areas. The process of creating a literature review includes five steps. The first step is to determine the research area in critical terms. The research area should cover the topic's elements but not be narrow or specific. The next step is evaluating prior research by scanning the title and abstract of the materials. The search method uses advanced or Boolean search tools to limit the search results. The published journals, time, languages, and other categories can sort the classification. (Oliver, 2012, pp. 7-9.) The Boolean search enables researchers to identify, narrow, and broaden the findings. The search includes "AND," "NOT," and "OR" logic with the symbols of quotation marks, slash, and brackets. (Burns, 2011.) Next, the writer scans the shortlisted research's abstract and title to emphasize the most relevant studies. The studies meet the requirements of releasing new concepts and innovative aspects of research. The strategies to collect the top research are creative and adaptable according to the scale of the topic. The top research uses prior literature reviews to see the development of chronological notions. After collecting the definition of the elements, the top research includes new and expanding expertness in the field. Lastly, the literature trend is analyzed and observed to summarize ideas and identify the research gap. (Oliver, 2012, pp. 9-20.)

According to Oliver (2012, pp. 41-43.), the literature search shortlists the top research by identifying the critical words from the topic. The topic of the thesis is ERP integration into the e-commerce platform. Therefore, the keywords can be "ERP," "Enterprise Resource Planning," "E-commerce," "Electronic commerce," "Integration," "Implementation," and other synonyms. The search tools

are JAMK online library, ScienceDirect, Google Scholar, Emerald, and other peer-reviewed web-sites. The thesis search for the materials is mainly on JAMK online library with advanced search tools and Google Scholar with Boolean search. The search's time scale is five-year, from 2018 to 2023. Oliver (2012, pp. 43-45) stated that the age for literature review should be under the last decade to keep the information up-to-date with the sources. Therefore, the scale of five years is reasonable for expanding the research numbers and narrow enough to update the data.

Different categories systematically conduct the literature search. The targets are peer-reviewed and full-text articles, conference proceedings, and books. In JAMK online library system, books, books chapters, and conference proceedings are not listed as "peer-reviewed." Therefore, before the search conditions of "peer-reviewed," the search term must go through the "books," "book chapters," and "conference proceedings" filters. The books, book chapters, and conference proceedings without "full-text" in the JAMK library cannot guarantee to be found as "pdf" versions on other academic sites. In Google Scholar, the literature search uses the "advanced search" with the condition of keywords included in the title. The term "filetype: pdf" is included to search for open-accessed materials. In the table below, there are lists of keyword variables and shortlisted articles. The results are the narrowed consequences of the "full-text" and "peer-reviewed" categories. The total results are shortlisted by scanning the abstracts and subjects of each material. For RQ1, four primary materials support the findings.

Table 4 Literature search results for RQ1

Search tools	Category	Key words	Field	Peer-reviewed	Full-texted	2018-2023	English	Total result	Shortlisted articles
JAMK online library	Library collection	ERP "AND" E-commerce "OR" Electronic Commerce	title contains					0	0
		ERP "AND" E-commerce "OR" Electronic Commerce	subject					0	0
		ERP "AND" E-commerce "OR" Electronic Commerce	description				x	1	0
	Internation search	ERP "AND" E-commerce "OR" Electronic Commerce	title		x	x	x	3	1 (Conference proceeding)
		ERP "AND" E-commerce "OR" Electronic Commerce	subject		x	x	x	10	1 (Conference proceeding)
		ERP "AND" E-commerce "OR" Electronic Commerce	abstract		x	x	x	40	1
		ERP "AND" E-commerce "OR" Electronic Commerce	abstract	x	x	x	x	9	1
Google Scholar	Advanced search (filetype: pdf)	"ERP" AND "e-commerce"	title	x	x	x	x	8	2
		"Enterprise Resource Planning" AND "e-commerce"	title					0	0
		"Enterprise Resource Planning" AND "electronic commerce"	title			x	x	1	0
		"ERP" AND "electronic commerce"	title					0	0

The main materials for RQ1 are a conference proceeding, a book chapter, and two articles. The main findings are exceeded from Kujala & Halonen (2020), Krithika et al. (2020), Kaya & Aydin (2019), and Goundar et al. (2021).

4.2 Mixing methods

The thesis uses qualitative and quantitative methods to collect data. The mixing method has analytical and observative characteristics. The quantitative approach includes defining, calculating, and analyzing variables. The variables are divided into diverse categories and put into a hypothesis or a framework. The outcome of the quantitative method is based on statistics. The qualitative approach processes the unspecified concepts and searches for relationships. Therefore, the outcome of qualitative methods is more flexible and intangible. (Brannen, 2016.) Brewer and Hunter (1989) states that the mixing method can be called the "multiple research strategy." The strategy provides multiple research objects and data collection at different times and in various ways. The results may relate to different types of social analysis. Along with objective diversity, the researcher can generate more possibilities and theories. (Brewer & Hunter, 1989.) For example, quantitative statistics may validate the results of qualitative research. The outcome becomes practical because the research may tackle advantages and disadvantages and discover new areas. The broader data collection supports the researcher in understanding more perspectives. (Brannen, 2016.)

4.3 Qualitative method

Qualitative research targets to gather in-depth information by understanding people's beliefs, concepts, and experiences. The approaches towards qualitative method try to collect an in-depth and flexible range of data. The writer uses the qualitative method, by inductive or deductive approach. The methods to conduct qualitative research are interviewing, observations, ethnographic fieldwork, textual analysis, and discourse analysis. The observation method contains hearing observation to collect data. Interviewing method involves occupational group work to discuss the topic. The ethnographic fieldwork comprises the interview and observation methods. The fieldwork method supports the researchers in observing a large target group over a long time period. Discourse analysis requires studying and transcribing the record tapes as the main activities. The researcher can use different materials, such as brochures or guides, to gather information. The benefits of qualitative research are practical values, political opinions, and learning new knowledge. A

successful qualitative outcome has the diverse reflection and data of respondents. (Travers, 2001, pp. 1-14.)

Interview

The definition of interview is a face-to-face conversation between two or more people to conduct the process. The purpose of the interview is to gather opinions and analyze the result of the information. (Maccoby & Maccoby 1954, p. 449.) The conversation is a prosperous and indispensable source of information on personal perspectives. The controversy in the conversation is the benefit and limitations of the interview. Therefore, the qualitative interview is the most objective method for collecting data from qualitative targets. (Mulhall, 2007.) The benefits of operating interviews are diverse and unique data based on the study's requirements, customized target group, and short-time reliable results. On the other hand, the limitations come from the elements of conducting the interview. For example, the target group requires specific customization from the preparation stage due to a need for more information. (Brinkmann, 2013, p. 5.) Moreover, if the interviewees are familiar with the terms of interviewing or with the interviewer, the results' neutrality and preciseness could be more reliable. Human relationships help interviewers to reach specific targets; however, they should be avoided in setting questions, transcripts, and collecting answers. (Briggs, 2007, p. 566.)

The interviewing process contains four steps: preparation, interview, analysis, and report. The preparation stage defines the purpose of the study. The purpose includes creating relevant questions and deciding descriptive targets. The interviewee considers the benefits of the relevant questions to the study. The Information-oriented selection is the method for selecting the interviewers. According to Flyvbjerg (2006, p. 230), the selection utilizes the data from small samples. Moreover, the confidentiality of the targets is essential during the interview process. Therefore, the questions must inform consent, protect security, and ensure the interviewees' consequences. The scale of participants is not explicitly defined. However, the more interviews are conducted, the more reliable outcomes are. The interview stage implies a unified style in setting questions and background stories for the interviewers. During the conversation, the interviewer should catch up with the respondents' answers and make follow-up questions. The discussion transcript contains paraphrased information using coding, induction, deduction, and abduction. Lastly, the report

concludes the outcomes from the transcripts and feedback from the interviewers. The conclusion mentions the results with benefits and limitations for the study. (Brinkmann, 2013, pp. 46-67.)

In the case study of the company A, the purposes of using the interview method are understanding the current implementing situation and analyzing the function of possible solutions. There are two interviews which include company A's manager and ERP consultant. The question list for the manager is Appendix 6, and for the consultant is Appendix 7.

The first interviewer is company A's head of the IT department. The manager manages the technical system operation and the user interface design. Moreover, the manager observes the platform's current projects and implements future plans. According to the company case, the primary target is finding the most suitable ERP system for the procurement feature. Therefore, the interview's purpose is to understand the platform's demand and situation. There are thirteen questions in total for two parts. The first part asks about the decision and reasons for the implementation. Moreover, the questions define the company's readiness, such as forming a project team and funding. The second part clarifies the company's current status and preparation for the implementation. The questions are related to the technical perspectives, such as users' scale, deployment, and user interface. The interview asks the manager about the ideal products for the following reasons. Therefore, based on the given ERP selection criteria and critical features of the ideal products, both interviewer and the manager understand the vision for the solutions. Lastly, the interviewer asks about the forecasted scale-up and the implementing risks of the company within five years.

The second interview is conducted with a junior ERP consultant in an ERP and E-commerce Consulting firm. The junior ERP consultant has been working for two years with several experiences in consulting for SMEs in different cases. The target of the second interview is finding solutions for company A and its users' requirements. After the first interview and the survey, the specialized issues require the specialist's opinions to improve the thesis's outcome. The interview with the ERP consultant is online, for fifteen to thirty minutes. Six questions contain information about the survey result and the first interview. The first question is about the definition of a good UI with examples. The second to fifth questions cover information about ERP implementation. The results cover the critical factors, reference visits, time consumption, and the incurred costs of the integrated

process. The last question asks about the risks and difficulties when implementing an ERP system into an e-commerce platform. Most questions encourage the interviewee to have examples of case studies or pictures to support the answers.

4.4 Quantitative method

The objectives of quantitative research are creating and expanding theories through statistical observations and hypotheses with variables. The researcher is precise about collecting the numerical data, such as survey variables. The outcome of quantitative research is specific with calculations to avoid errors. The researcher also quantifies respondents' behavior to decide on the research scale. The further stage requires interpreting the numerical data into valuable information. The interpretation design includes the objectives, motives, and data from the objectives. The types of statistics used in the design are frequency distribution, central tendency measurements, and desperation. The statistics can apply in normal distribution to observe. Different states of histograms have various definitions and meanings. Hypotheses in quantitative research require further testing and effect sizes. (Allen et al., 2009, pp. 3-29.)

Survey

The survey data is collected in standardized forms such as questionnaires or interviews. The survey aims to understand the situations at a specific time. The survey cannot control variables, conditions, and allocate methods for participants. Moreover, the purposes are exploring the perspective of a situation, recovering explanations, and providing information for hypotheses. (Denscombe, 2005.) The advantage of conducting the survey is the practical data usage with the cost-efficient method. Typical representatives can generalize the coverage of samples and events. The survey results produce a large number of statistics in a short period. The data needs to be addressed and more accurate if the researchers focus on the exclusive coverage of problems and theories. The unresponsive actions of the respondents can make the data lack details and investigation. The process of the survey research includes building research questions and research methods. The research methods are creating questionnaires, inviting interviews, and designing survey layouts. The questionnaire layouts should be well-presented and clear. (Kelley et al., 2003, 261-264.)

The survey in the thesis is stated as an "ERP experience survey." The survey aims to understand users' situations, requirements, and experiences on the ERP platform. The survey sample is company A's users, and the sample scale is 40. The tool to do the survey is Google Forms. The survey is anonymous and takes around two to five minutes to complete. The question types are multiple choices, yes/no questions, short-form answers, scale, and check-box grid. Some questions are mandatory, and others can skip to the following sections. The mandatory questions have a red asterisk at the end of the sentence.

There are fifteen survey questions in total divided into four parts. Appendix 1 asks about the information of the company. The background information includes the company sizes, industrial field, and current ERP usage. If the company uses an ERP system, the survey turns to Appendix 2. Appendix 2 collects the opinions of the company about the current ERP system. The survey asks about the modules of current ERP systems, satisfaction scales, and difficulties in the company. If the company does not acquire any ERP system, the survey will lead to Appendix 3. Appendix 3 illustrates possible solutions and expectations from the company about future ERP systems. Moreover, the survey asks about potential solutions and required modules of the company. The modules in the survey are included in the ERP package, such as Procurement, Finance, Production, Inventory, and other modules. After finishing Appendix 2 and Appendix 3, the respondents are led to Appendix 4. Appendix 4 collects respondents' opinions about the plan for using ERP. The company can leave their expectation note for company A. The confirmation letter and thank-you note are sent to the respondents after finishing the survey (Appendix 5).

5 Results

This chapter described the results from the qualitative and the quantitative methods. The interviews were conducted with company A's IT manager and ERP consultant. The interview results were paraphrased transcripts based on the interviewees' answers. Therefore, further details about shortlisted ERP products were mentioned. The chapter included the responses and analysis from the survey. Further qualitative methods contained data from reliable sources and supported the evaluation of shortlisted ERP products.

5.1 Results from company's manager interview

The first interview lasted for estimated thirty minutes via online meeting. The manager stated that the demand for ERP implementation was urgent for the company's development. The e-commerce platform included the ERP system as a future feature. Moreover, most of the platform's users, SME suppliers, needed ERP products. The ERP feature would be a significant competitive factor. The company had formed a project team working full-time for the implementation. The company believed that any mainstream ERP vendors would meet the selection requirements. Further ERP selection criteria within the procurement department are attached in Chapter 3.5.

From the company side, the internal usage scaled from three to five users. The external usage for the suppliers would be estimated at 100 users. The company users were expected to rise exponentially in the next five years. The deployment of the ERP system was a public cloud hosted by ERP vendors. The company had reserved a budget for the ERP implementation. Regarding the ideal products, the company was interested in SAP Ariba and Coupa. First, project members had experience using those products before. Moreover, the company had references from SAP Ariba and Coupa employees. Lastly, the two products had high reliability and popularity within the procurement field.

According to the manager, the SAP Ariba objectives would be more suitable for the platform since spending management is not the company's current focus. However, the manager stated that the users might prefer Coupa's main direction, especially suppliers in manufacturing and hardware. The company preferred an ERP solution that could integrate seamlessly with other ERP vendors. The integrating factor was an essential point in the ERP selection process. The customization had been discussed with the references. The company was aware of the TCO and thought that SAP Ariba could cost more in the long run. The manager commented that Coupa might integrate better with the platform. The user interface requirements were modern and easy to follow. About the future plan, the company forecasted to have more enterprises joining the system. Therefore, the manager confirmed that implementing the ERP system was a core step for the company's development.

5.1.1 SAP ARIBA

SAP Ariba is a cloud-based spend management software for B2B clients developed by SAP Corporation in 2012. SAP Ariba focuses on operating the procurement cycle for millions of businesses and operations. Suppliers can manage and optimize customer relationships to scale the benefits and business growth. Buyers can access the procurement function to optimize purchasing and sourcing on a sustainable level. SAP Ariba provides clients with specialized spend analysis for overview management. Users can integrate the company's resources with SAP Ariba's source-to-pay process for practical value. The platform has references working with many companies from different industries and regions. Therefore, the platform expands the network by introducing new companies to the global communities with potential suppliers. SAP Ariba brings future-focused strategies to the clients for future development. The platform solutions include procurement, supplier management, invoice & payment management, and sourcing & contracts. (*"What is Ariba?"* n.d.)

SAP Ariba modules contain six fields procurement, supplier enablement, supply chain collaboration, integration, financial supply chain, and strategic sourcing. The procurement module provides the purchasing tasks and allows clients to customize the platform. The module includes spot buying, which saves budgets for indirect goods and time for sourcing. The suppliers' enablement allows users to maintain the data of new suppliers in the system. SAP Cloud integration gateway, which is for Ariba users, contains mapping prepackage with automation. The supply chain collaboration supports companies with the optimization structure of the SCM field. The financial supply chain module operates a source-to-pay process to process swift ROI. The strategic sourcing feature contains leading and trending direct and indirect sourcing strategies. ("SAP Ariba module overview," 2022)

5.1.2 COUPA

Coupa is an international business spend management software founded in 2006. The platform is a cloud-based solution by roles of procurement, finance, SCM, and IT. Coupa Solutions provide financial management demands, spending analysis, procurement tasks, and supplier management. The ERP system supports business vision in spending management. Moreover, Coupa connects with the BSM community to network with customers, suppliers, and partners seamlessly. The ERP

system integrates with multiple ERP and non-ERP products. Coupa targets to optimize several modules to help clients operate the business smoothly and forecast risks. ("Coupa," 2022.)

Coupa's name stands for comprehensive, open, user-centric, prescriptive, and accelerated characteristics. Coupa is a cloud-based platform that allows users to access anytime, anywhere. The spending activities of the platform are secure and transparent. The UI of Coupa is customized based on the users' requirements. Therefore, the users can organize the working interface to improve workflow. Coupa guarantees to match and process the capabilities of incoming expenses and create data visualization. Coupa delivers valuable significance to the company's procurement functions. ("Why coupa" n.d.)

5.2 Results from survey

The survey is one of the tools for the quantitative method of the thesis. The survey targeted the ERP experience of onboarded supplier users of company A. The objectives of the survey were to collect the decisions from users about using company A's ERP system and to analyze their requirements. The total population of the survey was 33 companies. The survey was sent to the companies via email. The period for receiving responses was from 7/4/2023 to 21/4/2023. Weekly, the companies received reminder emails with the link to the survey. The survey resulted in 11 respondents, which took 33.33% of the total population. Therefore, the results of the survey were based on the active respondents. The results analyzed the ERP experience of three companies with and eight without ERP systems. Most companies were small-and-medium businesses (SMEs) in advanced materials, nanotechnology, and nanomaterials. (See Figure 9)

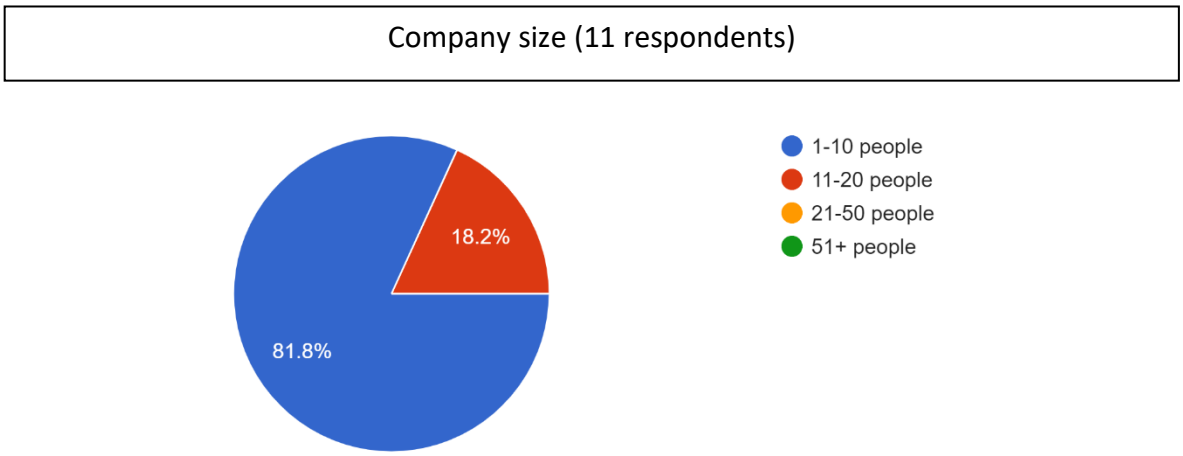

Figure 9 Company size (11 respondents)

At the end of the survey, the respondents decided whether to join company A's ERP system. Ten respondents agreed while one respondent refused to join the system. From Figure 10, 90.9% of total respondents agreed on the integration. The chapter generates further details on each case of response.

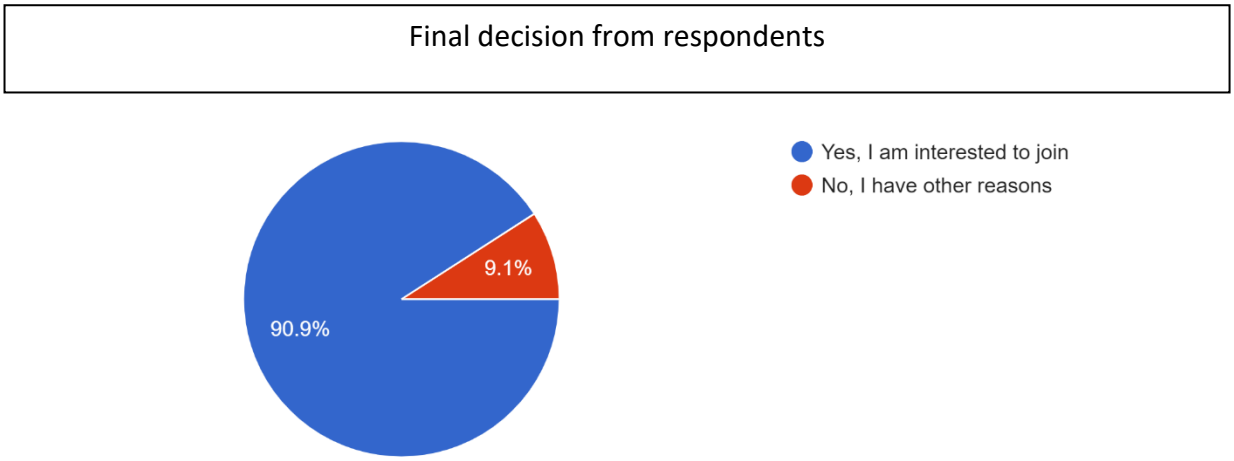

Figure 10 Final decisions from respondents

5.2.1 Companies with ERP system

Three companies that used ERP systems participated in the survey. The companies were SMEs; two had 1-10 employees, and one had 11-20 people. The results included detailed companies'

responses about the current ERP products. The responses contained names, modules, satisfaction rates, and difficulties of the ERP systems. The module questions collected a list of ERP functions, allowing respondents to mark or add choices (see figure 11). The scale for satisfaction used a linear scale from one to five, corresponding from "not satisfied" to "very satisfied." The survey allowed respondents to reflect on the difficulties of the current system.

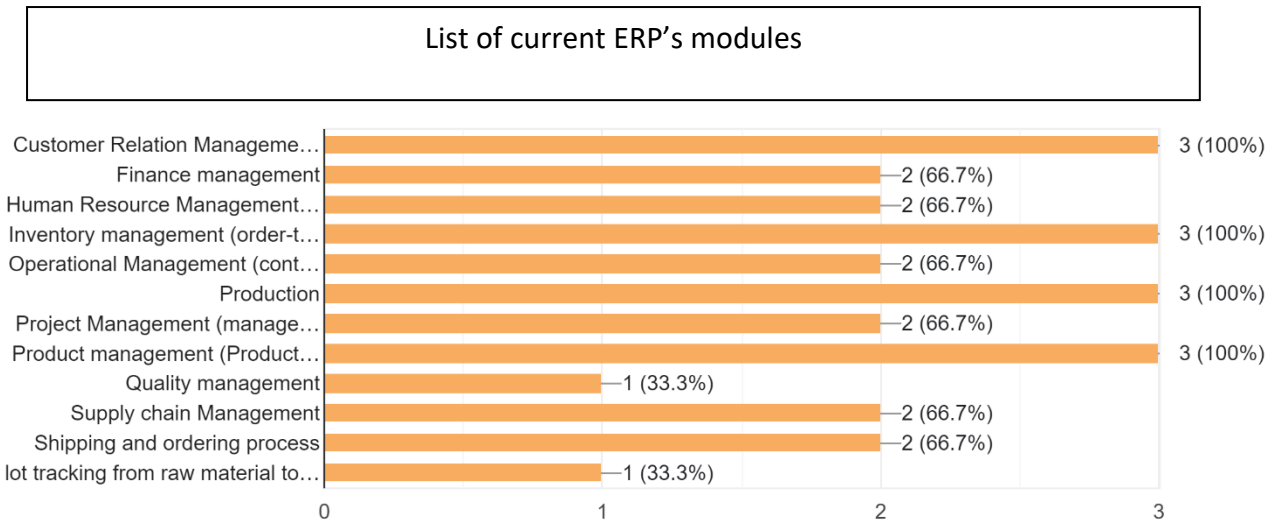

Figure 11 List of current ERP's modules

The first company used Odoo as an ERP solution for a scale of 1-10 people. Odoo provided most ERP functions, excluding Quality Management and Shipping & Ordering Processes. The company felt satisfied with the current system, scoring 3/5. The current difficulties were "not used to ERP" and "not easy to incorporate workflow with ERP system." The company was ready to join company A's ERP system with an expectation of a "friendly user interface."

The second company used "customized product" as an ERP solution for a scale of 11-20 people. The customized product provided Customer Relation Management (CRM), Inventory Management, Production, Product Management, Shipping & Ordering Processes, and Lot Tracking. The company felt quite satisfied with the current ERP system, scoring 4/5. The only difficulty was the incompatibility of the ERP with the Linux Operating System (OS). The company is ready to join company A's ERP system with an expectation of intuitive and compatibility with different OS.

The third company used Odoo as an ERP solution for a scale of 1-10 people. Odoo provided the company with all modules from the survey's list. The company felt quite satisfied with the current ERP system, scoring 4/5. The company found that the current system had a poor user interface, limited web design, and expensive add-ons. The company was ready to join company A's ERP system with an expectation of a "good user interface."

The table below summarizes the results from ERP-implemented companies from the survey. The average satisfaction score from the three companies is 3,67/5. All ERP products include CRM, Inventory Management, Production, and Product Management. The secondary modules are Finance Management, HRM, Operational Management, Project Management, SCM, and Shipping & Order Processes. The third used modules are Quality Management and Lot Tracking. All companies agreed to integrate or use company A's ERP system. The expectations are a friendly user interface, easy to use, and compatible with different OS.

Table 5 Summary of ERP-implemented companies' responses

Respondents / *Elements*	**Company 1**	**Company 2**	**Company 3**
Company scale (people)	1-10	11-20	1-10
Current system	Odoo	Customized product	Odoo
Satisfaction rate	3/5	4/5	4/5
Difficulties	Not used to ERP and not easy to incorporate workflow with ERP system	Not compatible with Linux OS	Poor user interface, limited web design, and expensive add-ons
Readiness to join	Yes	Yes	Yes
Expectation	Friendly user interface	Intuitive and compatible with different OS	Good user interface

5.2.2 Companies without ERP system

Eight companies responded that their companies did not implement any ERP products. The results from the survey showed different expectations and requirements for future ERP systems. The survey contained six questions of multiple choice, multiple-choice grid, and short responses. The results showed responses from past experiences, exciting solutions, requirements, specific modules of purchasing, and expected features. To conclude, seven companies agreed to join company A's ERP system, while one refused to join for other reasons. The chapter generated the detailed results of different cases from eight companies.

The first question asked about past experiences of companies using ERP systems. The answers allowed one company to give more than one option. Most of the companies had no experience with ERP systems as they were start-ups. One company claimed to have experience with four products. One company claimed to know one product without any proficiency. Another company stated to be experienced in two products. Lastly, one company said they could use one ERP system. The figure 12 below shows the statistics of companies' familiar products. The most familiar ERP product was Oracle Netsuite. The second regular ERP products were Dynamic 365 Business Central and SAP Business One. The third regular ERP product was SAP Ariba.

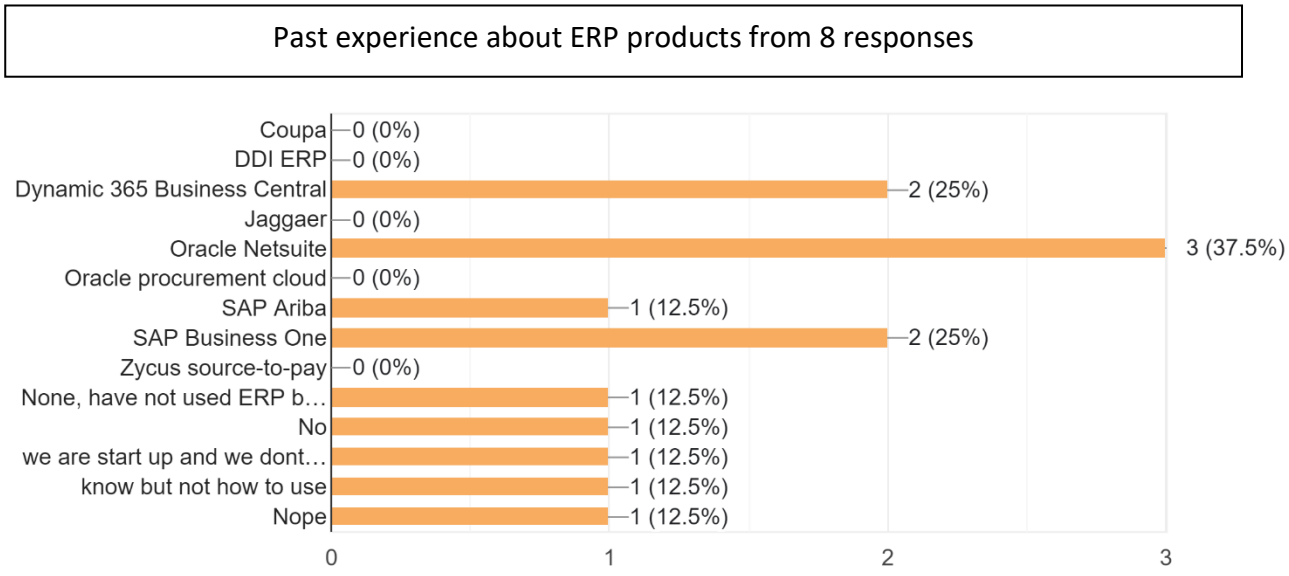

Figure 12 Past experience about ERP products from 8 responses

The second question figured respondents' opinions about the most suitable solution for their companies. The question allowed short responses and was not compulsory to answer. Three respondents left out the question with blank answers. Five respondents were unsure to give out the answers. The reasons were a lack of knowledge about the products and no experience in ERP implementation. Moreover, two respondents gave out their concepts for future ERP systems. The concepts included solutions for manufacturing and production from the start-up position.

The third issue mentioned the possible reasons when choosing ERP systems. The answers allowed multiple choices with an option to write the respondents' opinions. The most important factor was a "nice user interface." The second important factors were "recommendations/good reviews" and "include modules that the company needs." The third important element was the "low cost of ownership." Other concerns were the popularity, quality, and functions of the ERP systems. One response was not clear about the selection criteria for ERP products. (See Figure 13)

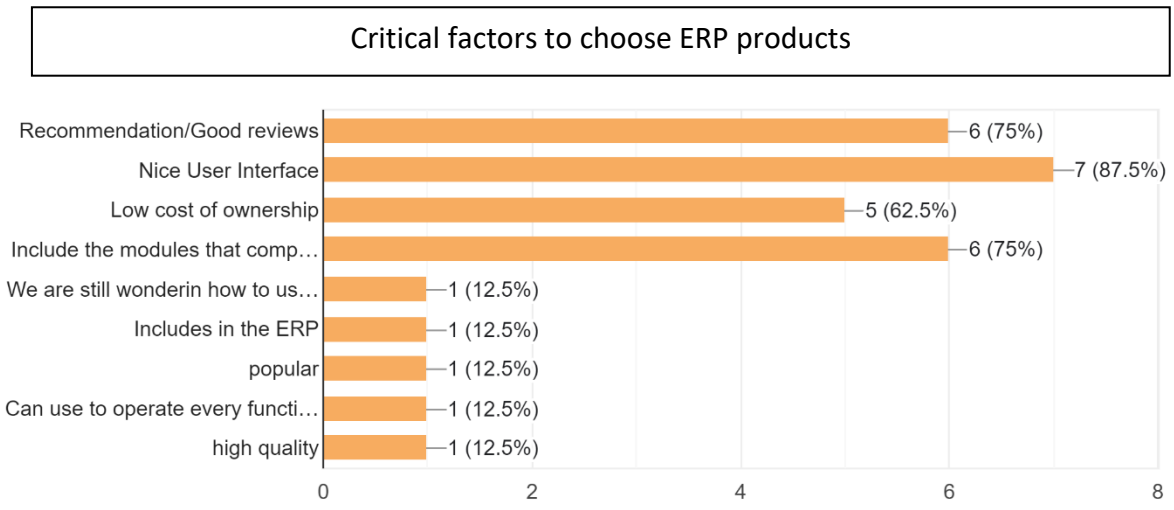

Figure 13 Critical factors to choose ERP products

The sixth question was not mandatory; however, a short-responded form for companies to give out their detailed opinions. The question asked about the future features that companies expected to use. The responses were expected of Spend Management, Invoices, Spend Analysis, and Real-time Rate Exchange.

The target of the fourth question was to give respondents specific concepts of ERP modules. The answers were multiple choices; therefore, respondents could choose many options. By answering the question, respondents understand their companies' demand and ERP offers. 87,5% of respondents thought CRM, Inventory Management, and Shipping & Order Processes were the most important when implementing ERP. The second critical factors with seven responses were Production, Project Management, Quality Management, and Purchasing. The third critical factors with four to five responses were Finance Management, Operational Management, and Product Management. Other critical modules were SCM, Goods Receive, and geographical factors. (See figure 14)

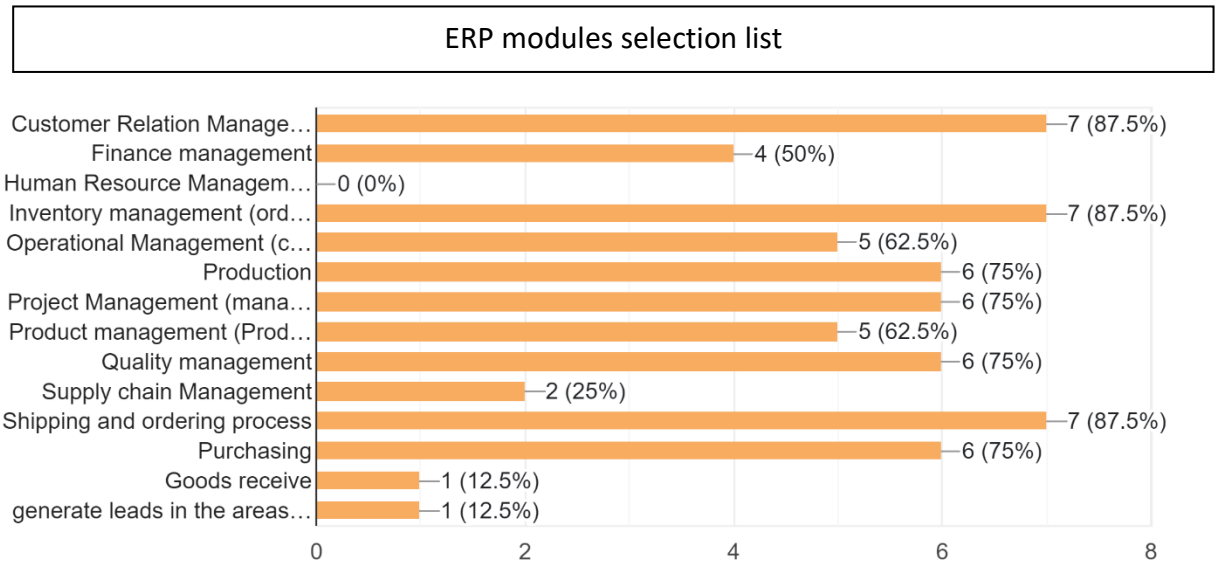

Figure 14 ERP modules selection list

The fifth question focused on the specification of the purchasing department. The company planned to implement an ERP system specialized for procurement. Therefore, the fifth question concentrated on understanding users' demands regarding purchasing functions. The grid-linear scale answers allowed respondents to choose the level of importance for each element. The scales went on three levels "not important," "good-to-have," and "must have." The purchasing features included five main elements as Supplier Management, Strategic Sourcing (indirect), Direct spending (manufacturing and production), Procurement (buying), and Invoice Management. The most

important features were Invoice Management and Direct Spend, with six and seven votes for "must-have." Procurement and Strategic Sourcing elements were partly essential based on different backgrounds and industries. However, the respondents stated that the Procurement feature was more "must-have" than Supplier Management with three votes. Strategic Sourcing was the optional feature, with the opinions of "not important" and "good to have. " (see Figure 15)

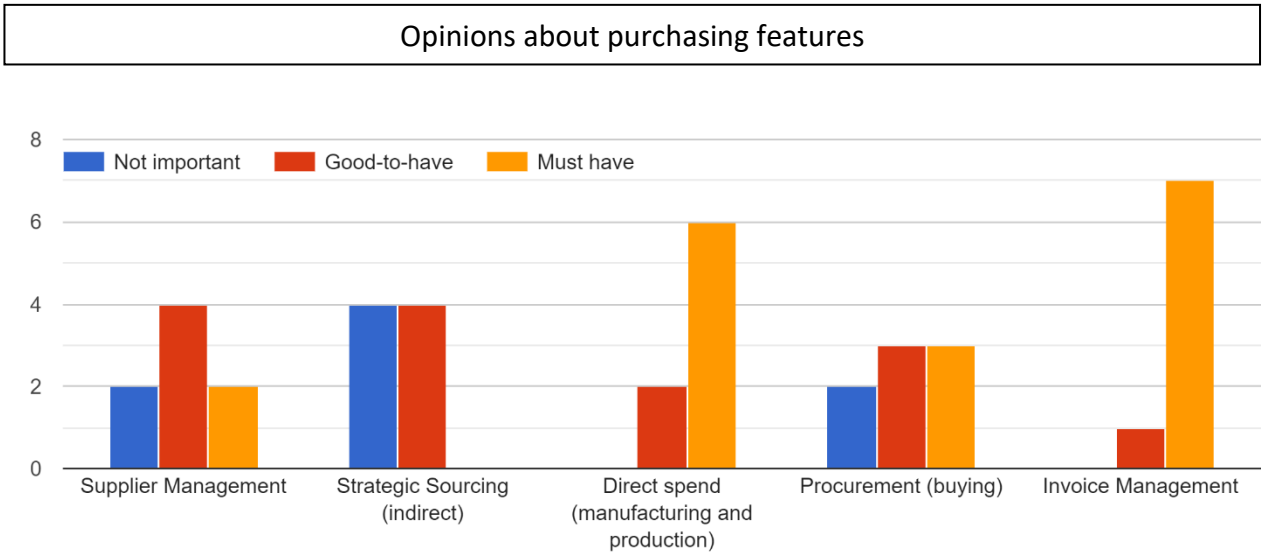

Figure 15 Opinions about purchasing features

Seven out of eight respondents agreed to join company A's ERP system, while one refused for other reasons. The expectation from non-implemented companies was about the costs, user interfaces, and integration with companies' backgrounds. The respondents expected a friendly user interface and low-cost, easy-to-use ERP systems. Others wanted to replace or integrate their systems with Company A's new ERP. The refused respondent expected to validate and be short-staff in the future system.

5.3 Results from ERP consultant interview

The first question was about the factors of "user-friendly UI" and possible examples. The interviewee stated that there were no specific standards for UI because the platform was customizable, and people had different opinions on the web organization. However, a good UI supports the users by outlining the main features of the web with a clear vision. The web objects could be fewer,

and the details were hidden inside each big object. For example, when users moved the cursor to the requisition number, the created time and destination information were available. The ERP consultant suggested that the company could eliminate unnecessary web objects to follow the information more accessible.

The second question asked about the critical factors when selecting an ERP system. The interviewee advised the company to consider the size, budget, technical resources, scope, and digitalized internal data. The size of the company decided the tier of ERP. SMEs could choose tier 2 or 3 ERP because the budget was suitable and the functions met the demand. The company had an IT department to prepare the technical problems such as connecting platforms or deployment. The company needed to understand the business flow and digitalize the data. These critical factors supported the company and the ERP vendor in implementation.

Thirdly, the ERP consultant's company had its successful case study to promote new customers. The offered package was developed and improved as the company worked in the ERP-integrated industry. The reference visits were taken from internal sources of the company. If the customers asked about a case the company had never worked with, the company bought rendered data from a third party to create the forecast and development plan.

The fourth question was about the average time to implement an ERP system without a training period. The ERP consultant noted that the consulting stage depended on the client's requirements. The average time for a company to finish the process of only one module was two to three months. If the company wanted to implement the whole system, the average time could be six months to one year. The duration was based on the core requirements of the company.

The fifth question questioned the incurred costs in the TCO. The ERP consultant stated that the duration time of the implementation affected the increasing costs. The company's confusion might lead to excessive resources to find suitable options. The company might pay for development and maintenance cos in the long runts. However, the ERP consultant thought the development and maintenance costs were worthy investments.

The last question was about the risks in ERP implementation into an e-commerce platform. The implementation required an API platform to transmit the data. The risk could come from the IT department if they needed more coding knowledge. The requirement was that the API mapping included necessary information fields. The issues mainly came from the API platform. The ERP consultant suggested that the company focus on data security.

6 Discussion

This chapter generates the possible ERP solution based on the requirement analysis from the results, alignments with company A's requirements, and academic background from the literature review (Chapter 2 and Chapter 5). Moreover, the chapter includes the research limitation while conducting the study. The limitation highlights the boundary between literature researching and operating research methods. Lastly, the long-term development plan suggests further implementing steps and suggestions after the current phase.

6.1 Possible ERP solution

6.1.1 Current situation

Bradford (2020, pp. 68-69) stated that organizational readiness was essential for the company to have significant expectations and targets for ERP. The ERP planning stage included forming a project team with discussion with top management. (Bradford, 2020, pp. 69-70.) Moreover, the TCO budget was forecasted to prepare for ERP implementation. As the TCO might rise above the current budget limit, the company might consider carefully ERP implementing decisions. (Nestell et al., 2017, pp. 63-64.)

The result of interviewing the IT manager of Company A described the current situation. According to the manager's statement, company A had officially decided to implement an ERP system. The ERP system served the purposes of procurement functions. Company A had formed a project team with the approval of top management to specialize in integrating ERP. Moreover, the company was aware of preparing the TCO budget. The manager had given an ERP purchasing module requirement list. Furthermore, the company reviewed the references and focused on two products, SAP Ariba and Coupa. The reasons' background was concrete and solid. In conclusion, company A

had completed the ERP planning stage with detailed steps and thorough consideration. Good preparation is a solid foundation for long-term integration.

6.1.2 Requirement analysis

The requirement analysis answers the second research question (RQ2) about the ERP selection criteria for the case study. According to Parthasarathy (2007, p. 31), the objectives of the ERP system set the selection criteria. The selection criteria depended on the demand of the company. However, after analysis, the core criteria were based on the company's size, user interface, module requirements, price range, and other factors. The intangible targets of the selection criteria were gaining customer satisfaction and improving capabilities. (Parthasarathy, 2007, p. 31.) The size of company A is a small-and-medium business with scales for 100 users by public cloud-hosted deployment. The shortlisted products were SAP Ariba and Coupa for procurement modules. The company preferred an ERP system that integrates seamlessly with other ERP products—the UI of the ERP system needed to be user-friendly and easy to follow. The TCO is suitable for the company's budget in the long term, with exponential growth in users' numbers—moreover, the ERP consultant advised company A to understand the demand and plan well. The ERP consultant suggested that the company purchase suitable products in the ERP tier to save costs. Regarding the implementation, the ERP consultant suggests the company focus on building API connections and data security.

The current users of Company A were mainly SMEs and preferred to join Company A's ERP systems. The users with ERP systems, such as Odoo or Customized Product, expected better user interfaces than their current platforms. Moreover, the ERP system could connect with Linux OS. Their current systems include purchasing modules. The users without any ERP system had few experiences with ERP. The non-implemented ERP companies expect to have CRM, Inventory Management, Shipping, Purchasing, Production, and Project Management in the future system. Regarding Purchasing feature, they expected to have Invoice Management, Direct spending, Procurement, and Supplier management. Respondents expect low costs, ease of use, and a complete system to replace their companies' functions.

In conclusion, the solution for company A ranges from ERP tier 2 and tier 3. The total number of users for the ERP platform is expected to be 100 this year. From a technical perspective, the ERP

product provides a user-friendly UI, good API connection, multi-ERP integration, and connects with Linux OS. From a functional perspective, the procurement suite must include invoice Management, Direct spending, Procurement, and Supplier management. In the future, users wish to use CRM, Inventory Management, Shipping, Purchasing, Production, and Project Management in Company A's ERP environment. Further requirements can be added after Company A tries the demo version of two ERP products.

6.1.3 Software comparison

Company A has recently had discount management, so the future ERP system does not necessarily have this module. To summarize, Company A prioritizes ERP products with outstanding performance in the procurement cycle, operational analysis, and data visualization. The further analysis of comparing SAP Ariba and Coupa includes comparison in ERP modules, User Interface, deployment, price range, and available devices. The analysis forms a concrete background for choosing the suitable ERP system for Company A.

ERP modules

During the interview, the ERP consultant stated that defining the required modules was important. The cost of implementing modules was high. Therefore, the company should only choose the essential modules for demand. The list of ERP selection criteria is given by Company A in Chapter 3. The modules' comparison list has collected information from verified peer-to-peer reviewed websites such as Gartner, G2, Get App, and other platforms. In Table 6 below, the "must-have" modules from the requirements of company A are marked as orange. Both ERP software meets the requirements of must-have modules. Coupa has most of the features, including supply chain management solutions. While SAP Ariba has the same functions, without bank reconciliation, demand forecasting, and general ledger, SAP Ariba can access those functions with integration with other modules in SAP Network or outside. The integration has the license costs but connects seamlessly with SAP Ariba. ("Compare SAP Ariba and Coupa" n.d.) In conclusion, both ERP systems include "must-have" module criteria, but Coupa offers more options for "good-to-have" modules.

Table 6 Modules' comparison list (adapt from “Compare SAP Ariba and Coupa” n.d.)

Coupa	Modules	SAP Ariba
X	Accounts Payable	X
X	Accounts Receivable	X
X	Audit Management	X
X	Bank Reconciliation	
X	Billing & Invoicing	X
X	Cataloging/Categorization	X
X	Compliance Management	X
X	Compliance Tracking	X
X	Contract Lifecycle Management	X
X	Contract/License Management	X
X	Core Accounting	X
X	Data Visualization	X
X	Demand Forecasting	
X	Discount Management	X
X	Expense Tracking	X
X	Financial Reporting	X
X	General Ledger	
X	Inventory Management	X
X	Inventory Optimization	X
X	Invoice Creation	X
X	Invoice History	X
X	Invoice Processing	X
X	Mobile App	X
X	Online Invoicing	X
X	Order Management	X
X	Procurement Management	X
X	Purchase Order Management	X
X	Purchasing & receiving	X
X	Requisition Management	X
X	Returns Management	X
X	Shipping Management	X
X	Sourcing Management	X
X	Spend Analysis	X
X	Spend Control	X
X	Spend Management	X
X	Supplier Management	X
	Supply Chain Management	
	Warehouse Management	

User Interface

UI is a critical selection criterion for the ERP selection process. The thesis aims to compare two UI based on the perspective-based evaluation. Wilson (2014) stated that the perspective-based UI evaluation provided a requirement range and saved costs in finding the right solution. The factors for evaluation could be page elements, the size of clickable items, web terminology, and the scanning possibilities. The users' opinions were the foundation for the characteristic list. (Wilson, 2014.) According to the survey's results and the IT manager's interview, the ideal ERP system must provide user-friendly UI. Company A's users wanted a UI that was easy to learn, effectively used, and customizable. The ERP consultant commented that the user-friendly UI did not necessarily contain many elements and complicated fields on one page. A good UI contains essential web elements only with easiness of finding web functions. The UI comparison are operated in Invoice Management, Direct spending, Procurement, and Supplier management modules.

The procurement module includes purchase requisitions and purchase orders (PO). From a UI perspective, buyers and suppliers can access procurement activities in separate roles. In Coupa, the suppliers can manage PO by different categories of PO numbers, delivery information, order document numbers, status, and actions ("Coupa Purchase Order Management," n.d.). The data visualization is included in "actions" and rankings of PO. Moreover, data visualization helps suppliers to analyze the POs by department and commodity. The icons help the users to process the PO faster and easier. In SAP Ariba, the web elements do not contain many colors. SAP Ariba UI focused on generating information from the PO, such as address, type, and settlement elements ("See How It's Done: View a Purchase Order," *2020)*. The "actions" section is the dropdown menu with texts. The text's content is straightforward. However, new users could need clarification on the functions of each part of the menu. (See Appendix 8 and 9)

Moreover, in Coupa, suppliers can create purchase requisitions or information for the product with pictures. The company's employees can search for surface-preferred products with ratings and comparable action. The benefits of data-visualized PO are highlighting the characteristics of products, managing discount terms, and other strategic activities. ("Coupa Purchase Order Management," n.d.) In SAP Ariba, the purchase order contains more information than in Coupa. The plain text supports the purchasing reading process in a more specialized way. However, the large amount of information with large unnecessary fields makes the UI harder to read. The time for

learning how to use the purchase order page might be longer for SAP Ariba. (See Appendix 10 and 11)

The Spend Management of Coupa provides SOW-based services and contains spot-buy capabilities ("Coupa Purchase Order Management," n.d.). The UI does not contain much information but focuses on data visualization of a bar chart to illustrate the information. The outcome of Coupa generates good and easy-to-conduct analysis. SAP Analytics Cloud, another SAP product, conducts the Spend management in SAP Ariba. SAP Analytical Cloud provides more charts and graphs analysis on different scales and levels. ("SAP Ariba Spend Analysis," 2021.) The output of the content is helpful for professionals to analyze business spend. However, the large amount of web elements is hard for beginners to practice on the platform. (See Appendix 12 and 13)

The invoice management of Coupa supports e-invoicing with automation and security ("Coupa invoice management," n.d.). The UI contains basic information in summary. The web design is easy to read and follow. In SAP Ariba, the user enters the number of PO or other categories to view an invoice of PO. Then, the user can add and fix information on the invoice. ("How to Send an Invoice on Ariba Network," 2018.) The process requires many steps, which new users can obtain by watching instructions and ERP education. The process flow is simple but requires users to find the right place to enter the data. The load of information in the invoice is enormous, and much text. (See Appendix 14 and 15)

Coupa provides supplier's risk and performance management. The platform enables evaluation forms for suppliers' performance. ("Coupa third-party risk management," n.d.) Risk management enables to use multi-tier risks model with pie charts, colors, and tables. SAP Ariba allows companies to upload forms for supplier request forms. SAP Ariba shows the lifecycle of suppliers with a big heading, which is a plus point. The view of processing the actions towards the suppliers is easy to find and operate. Supplier risk management also includes data visualization to categorize risks. (See Appendix 16 and 17)

In conclusion, Coupa and SAP Ariba have good user interface. However, the level of usage is quite different. The web elements are informative, clear, and easy to read for both cases. Coupa is more suitable for Company A since users and companies have few experiences with ERP. SAP Ariba is an

advanced option with more comprehensive selections, complicated terms, and web fields. Both ERP system provides good interaction with users in various function. In the case of Company A, Coupa is the ERP product with a more user-friendly UI.

Table 7 UI comparison

	Coupa	**SAP Ariba**
Purchase Order Management	Enough information with icons in the "actions" task, data visualization of POs by department and commodity, PO rankings, requisition's picture for products.	Contains many web's fields of information, dropdown menu for "action" task with short-texted options, many information, lack of data visualization.
Spend Management	Basic, easy to create and understand graphic analysis, suitable for beginners' level to generate data.	Conducts by SAP Analytics Cloud, includes many graphic analysis, web's elements are too much, might be hard to create for beginners.
Invoice Management	Fundamental basis of terms in invoice, not so many categories.	Advanced, very informative, complicated to find and fix.
Suppliers' management	Graphic designs to illustrate and categories risks in many levels, easy to follow.	Graphic designs in different scales and categories, many web elements in modules.

API

Kaya & Aydin (2019, p. 221), the technical solution for integrating ERP and e-commerce platforms included the intermediate layer or API. The benefits of the layer are simplifying the data changes, better communication between servers, and providing requested programmatical functionalities. (Geewax & Skeet, 2021.) In the interview with the ERP consultant, the importance of API was confirmed by coming along with implementation success. Therefore, the API must contain requested requirements and conserve security. SAP Ariba and Coupa support API applications for the

implementation into the company business data. SAP Ariba provides REST API with two-legged OAuth 2.0 secure authentication and client credential authorization ("Use of the API Gateway and OAuth to Authenticate Applications," n.d.). The list of active SAP Ariba APIs and documents can be found in Business Accelerator Hub with the link https://api.sap.com/package/SAPAribaOpenAPIs/rest. Coupa provides API with RESTful criteria and industry-security standards. Coupa API depreciation keys also include R32-OAuth 2.0 for new customers. ("Get Started with the API," n.d.)

Price range

The tiers of ERP products are divided into three classes based on the company size. Tier 2 and tier 3 provide services with limited to medium complexity and low to medium TCO. (Bradford, 2020, p. 11.) The ERP consultant commented that the ideal ERP product was not necessarily the best in the market. The consultant agreed that the ERP selection depended on the company size. Company A marked itself as an SME with exponential growth. Therefore, Company A suits tier 2 or tier 3 ERP products. In this case, SAP Ariba and Coupa are reasonable for the case study. The price range depends on the ERP solution's complexity, duration, and requirements. Both ERP solutions are suitable for small and medium businesses. According to an ERP consultant, SAP Ariba has a price range of $10,000 to more than $100,000 per year for the procurement solution suite. Coupa offers $15,000 to more than $100,000 per year for a full suite. Both companies provide live demo versions and custom quotes. However, the ERP consultant suggests direct discussion with the ERP vendor to negotiate the official plan and quotations. The ERP investment is a long-term activity with continuous changes. Therefore, the budget for the development can be higher than expected.

Deployment

Cloud-based ERP platforms do not require the on-premise system and support the implementation based on technical resources (Hayek & Odeh, 2020, p. 2). The deployment of SAP Ariba and Coupa is public and private cloud-based deployment. SAP Ariba takes around twelve weeks or less to implement. Coupa takes a few weeks to a few months to fully implement with dependent customization. ("Coupa vs. Ariba: Which Cloud-Based Strategic Sourcing Procurement Platform to Choose?" n.d.) The deployment includes several stages: planning, configuring, testing, and other steps. The training certificates are specified to various modules. For example, if the employees work in the

procurement department, they need to complete procurement and reporting certificates. In conclusion, the average implementing time takes about two to three months of full implementation for a successful case.

Available devices

SAP Ariba and Coupa can be used from various compatible web browsers. The available devices include web-based, Android, iOS, Windows, Mac, and other devices with internet networks. Both ERP systems have compatibility requirements. Therefore, Linux OS devices are available when the web browsers meet compatible demands. ("Coupa vs. Ariba (or other): Which is the best platform?" n.d.)

6.1.4 ERP recommendation

The final solution is the answer to research question 3 (RQ3) about the recommendation for the case study. After conducting research methods and comparative analysis, the result can be decided. The shortlisted ERP vendors are SAP Ariba and Coupa. The thesis author thinks that Coupa might be a suitable ERP system for company A. Both ERP systems meet the general requirements; however, there are specific reasons to choose Coupa. Firstly, Coupa has more “good-to-have” modules than SAP Ariba with lower costs. Both ERP systems allow customization to optimize the workflow. However, with more options to select, Coupa provides better object selection for users. The UI of Coupa is suitable for people without any ERP experience in the case study. Moreover, the UI is user-friendly with easy-to-follow web designs, simple organization, and including many data visualization. On the other hand, SAP Ariba has many advanced and complicated applications with commands. In fact, SAP Ariba operates the business on the scale of an enterprise with more shortcuts and automation to increase productivity. The purchasing modules of both platforms have good reviews. For start-up company A’s case, which does not have much experience with ERP systems, Coupa is a suitable option with exclusive usage and reasonable price. In the future, the case company should proceed with further testing and continuous analysis for more information.

6.2 Research challenges

The challenges of the research come from the literature review, survey, and ERP product information. The literature review of ERP integration into e-commerce platforms is relatively narrow.

Most studies after 2018 only discuss the implementation of ERP and e-commerce systems, not the platform. The discussion mostly mentions the benefits and challenges but needs more technical information. The terms "ERP selection" or "ERP implementation" are widespread; however, not many results have been shown for "ERP and e-commerce platform." Therefore, during the literature review, the lack of literature selections brought difficulties in doing the research. There are materials before 2018, but the duration of the information is no longer valid. The survey's responses are the second limitation of the thesis. Since the response rate is not 100%, there might be more opinions on the ERP implementation of company A. Further detailed information for each responded case cannot be analyzed. The survey structure includes short-form answers to capture the attention of the respondents. However, the short answers cannot contain long texts of information. Some respondents might want to express their opinions in longer texts. Lastly, the thesis lacks information about ERP products such as SAP Ariba and Coupa because the information requires quotation requests. The thesis can only conduct the requirement analysis stage and product comparison based on online information and thesis methods. Company A will contact ERP vendors and have further information about demo versions or exact prices. Therefore, the ERP conclusion from the thesis is a significant result with academic background. Company A can use the processing module from the thesis with future consulting to get the best outcome.

6.3 Long-term development plan

The thesis has selected the requirements from the interviews and surveys for case study analysis. Based on the given information, the thesis has selected and shortlisted the possible solutions for the case study. Due to a lack of internal information from the ERP vendors, the thesis cannot conduct further analysis on demo versions and quotations. The author suggests that company A can use the thesis outcome as an academic background to conduct the next step. In the next step, company A can use demo versions and selected categorized fields to put in the weighted score sheet. The selected solution will analyze the product's characteristics in a fit/gap analysis. The company can ask for reviews and experiences from other companies' references when using the selected solution. Lastly, the company negotiates the contract with the ERP vendor to adjust the terms of the ERP product and improvement process. Therefore, company A has a statistics-based final decision. ERP implementation is a long-term plan and requires continuous improvement. In the future, after the implementation stage, company A should have an evaluation framework to

optimize and control the quality of the ERP system.

Figure 16 Current stage of the thesis outcome on case study

7 Conclusion

The thesis provided information regarding the ERP implementation into an e-commerce platform with application to a case study. The research covered the connection between ERP systems and e-commerce platforms, ERP selection criteria, and recommended ERP systems for the case study. The objectives of the thesis were to understand the theory base and its application to the case study. The conclusion chapter generated the restate and outcome of the thesis.

ERP system and E-commerce platform had a strong external and internal connection. ERP system managed the back-office activities and controlled the business processes. The E-commerce platform operated the trading movement such as product cycle, services, and information via the internet. Integrating ERP and e-commerce was a critical factor for operational success. ERP system systematically improved the accuracy of data management, reduced errors, and saved time. The improvement in business organization positively and significantly affected customer satisfaction and business partners with the e-commerce platform. Implementing ERP allowed businesses to open new opportunities and elevate companies' performance. However, the ERP selection process was complicated and expensive. The challenges in the process stayed in the preparation and selection process. Lack of preparation led to costs over budget and delay time. The company had to prepare a strategic approach with a step-by-step process and organizational changes. The relationship between ERP systems and e-commerce platforms earned beneficial advantages and shared the same vision of upgrading the business scale.

Company A, an e-commerce company, planned to upgrade the purchasing module by implementing ERP. The ERP selection criteria depended on different perspectives of the company. The thesis conducted qualitative and quantitative methods to find the ERP selection criteria for the case study. The ideal ERP system was in the tier 2 and tier 3 ERP systems range. The forecasted total number of users was estimated to be 100 people this year. The company predicted the user numbers to grow exponentially in 5 years. From a technical perspective, the ERP product had a user-friendly UI and a good API connection. Moreover, the platform could integrate seamlessly with other ERP products and connect with Linux OS. The procurement suite had to provide Invoice Management, Direct spending, Procurement, and Supplier management modules. In the future, company A's users expected to use CRM, Inventory Management, Shipping, Purchasing, Production, and Project Management. Company A might discuss with ERP vendors to build up the requirement analysis in the future.

Company A had shortlisted two products, SAP Ariba and Coupa. After considering ERP selection criteria and analyzing the comparison of shortlisted products, Coupa was the suitable solution for the case study. The advantage of Coupa was a user-friend UI with a wide range of technical functions. Furthermore, the data visualization and simplified web design of Coupa were suitable for beginners in the ERP field. The price range of Coupa was considerable, with a full suite of "must-have" required modules. The outcome had many challenges regarding the narrow research scale and the need for quotations from the ERP vendors. The next step for ERP implementation was conducting an in-depth analysis after contacting ERP vendors. The ERP recommendation of the thesis was a solid academic background and practical analysis for company A's case study.

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Appendix 1. Introduction and background information

ERP experience survey

ERP (Enterprise Resource Management) is an integrated software program that combines all departments and corresponding functions across a company. ERP solution is popular nowadays because it saves time and costs and makes the information flow more manageable and accurate. Alinor plans to implement an ERP system to the platform, so suppliers and buyers can access and track data in one click. The survey contains questions about companies' opinions, situations, and expectations of an ERP system. (Survey is taken anonymously.)

What is the company size? *

- ◯ 1-10 people
- ◯ 11-20 people
- ◯ 21-50 people
- ◯ 51+ people

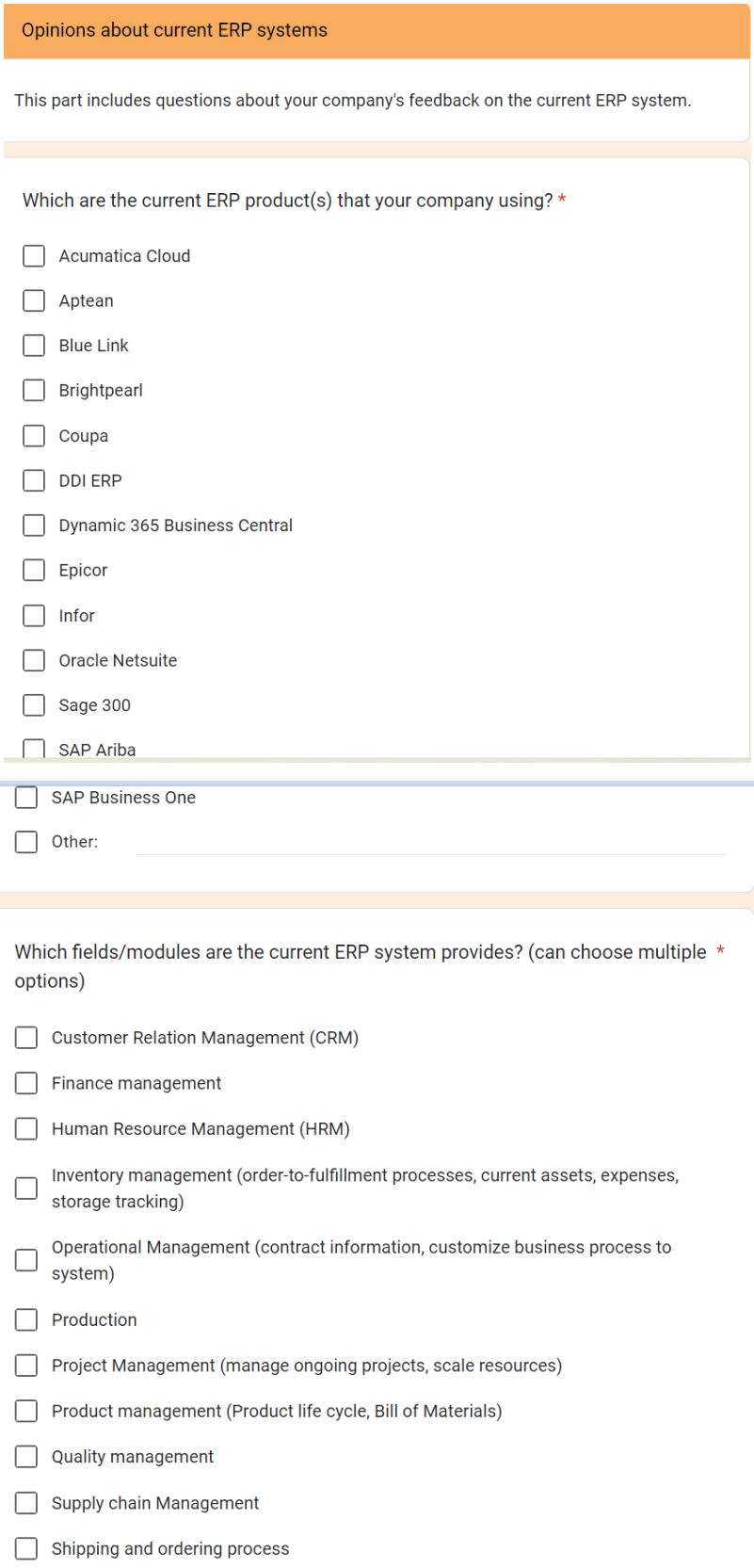
What is the industry/field of your company? *

Câu trả lời của bạn

Is your company using any form of ERP systems? *

- ◯ Yes
- ◯ No

Appendix 2. Opinions about current ERP system



Opinions about current ERP systems

This part includes questions about your company's feedback on the current ERP system.

Which are the current ERP product(s) that your company using? *

- [ ] Acumatica Cloud
- [ ] Aptean
- [ ] Blue Link
- [ ] Brightpearl
- [ ] Coupa
- [ ] DDI ERP
- [ ] Dynamic 365 Business Central
- [ ] Epicor
- [ ] Infor
- [ ] Oracle Netsuite
- [ ] Sage 300
- [ ] SAP Ariba
- [ ] SAP Business One
- [ ] Other:

Which fields/modules are the current ERP system provides? (can choose multiple options) *

- [ ] Customer Relation Management (CRM)
- [ ] Finance management
- [ ] Human Resource Management (HRM)
- [ ] Inventory management (order-to-fulfillment processes, current assets, expenses, storage tracking)
- [ ] Operational Management (contract information, customize business process to system)
- [ ] Production
- [ ] Project Management (manage ongoing projects, scale resources)
- [ ] Product management (Product life cycle, Bill of Materials)
- [ ] Quality management
- [ ] Supply chain Management
- [ ] Shipping and ordering process

- [ ] Other: _____

Are you satisfied with the current system?

	1	2	3	4	5	
Not satisfy	○	○	○	○	○	Very satisfy

Difficulties/ Problems when using the current system? (can choose multiple options) *

- [ ] Hard to use/ Take a lot of time for training
- [ ] High total cost of ownership (includes cost/users, license cost, implementation cost, etc.)
- [ ] Lack of technical support services
- [ ] Not very good user interfaces
- [ ] I have no problems with the current system
- [ ] Other: _____

Appendix 3. Expectation about possible solutions

Expectation about possible solutions

This part describes possible solutions for your company's demand and expectation.

Are you familiar with any of the systems listed below? (can choose multiple options) *

- [ ] Coupa
- [ ] DDI ERP
- [ ] Dynamic 365 Business Central
- [ ] Jaggaer
- [ ] Oracle Netsuite
- [ ] Oracle procurement cloud
- [ ] SAP Ariba
- [ ] SAP Business One
- [ ] Zycus source-to-pay
- [ ] Other:

What is the most suitable/interesting solution for your company?

Your answer

The reasons to choose the following solution *

- [ ] Recommendation/Good reviews
- [ ] Nice User Interface
- [ ] Low cost of ownership
- [ ] Include the modules that company need
- [ ] Other:

What are the requirements for the ERP modules? (can choose multiple options) *

- [ ] Customer Relation Management (CRM)
- [ ] Finance management
- [ ] Human Resource Management (HRM)
- [ ] Inventory management (order-to-fulfillment processes, current assets, expenses,
- [ ] Operational Management (contract information, customize business process to system)
- [ ] Production
- [ ] Project Management (manage ongoing projects, scale resources)
- [ ] Product management (Product life cycle, Bill of Materials)
- [ ] Quality management
- [ ] Supply chain Management
- [ ] Shipping and ordering process

What are your requirements for Purchasing features? *

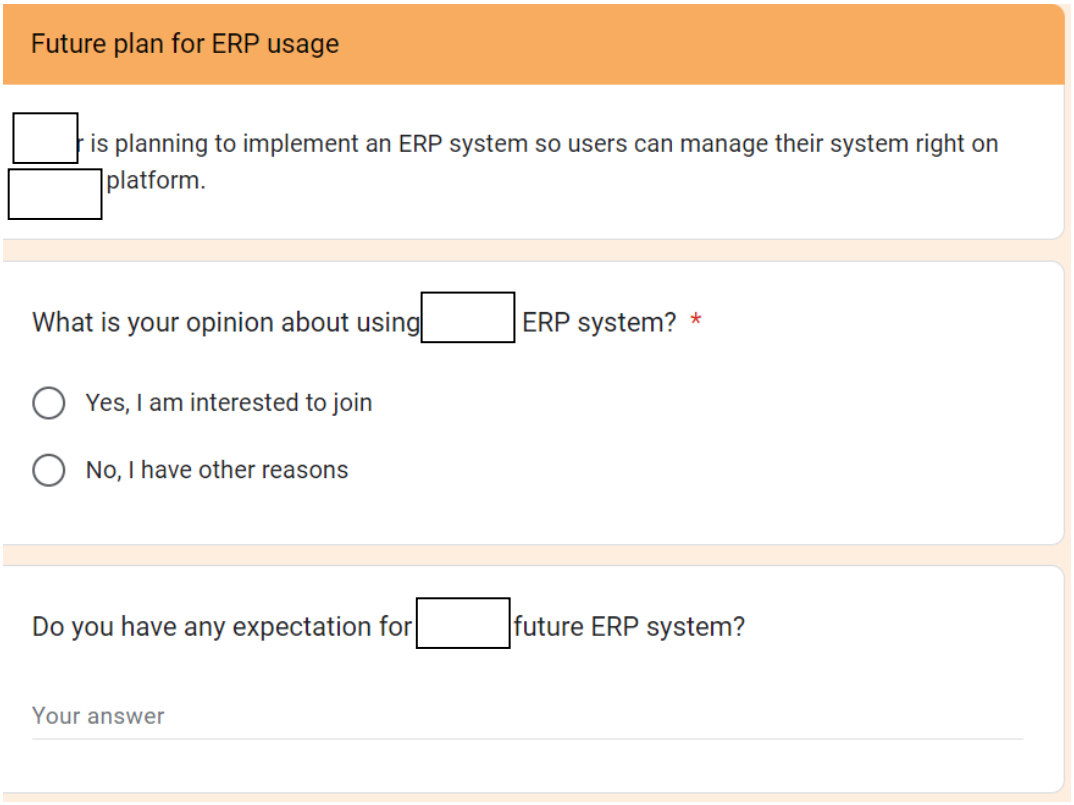
	Not important	Good-to-have	Must have
Supplier Management	○	○	○
Strategic Sourcing (indirect)	○	○	○
Direct spend (manufacturing and production)	○	○	○

Strategic Sourcing (indirect)	◯	◯	◯
Direct spend (manufacturing and production)	◯	◯	◯
Procurement (buying)	◯	◯	◯
Invoice Management	◯	◯	◯

Are there any features of purchasing department that you expect to use?

Your answer

Appendix 4. Future plan for ERP usage



Future plan for ERP usage

[ ]r is planning to implement an ERP system so users can manage their system right on [ ] platform.

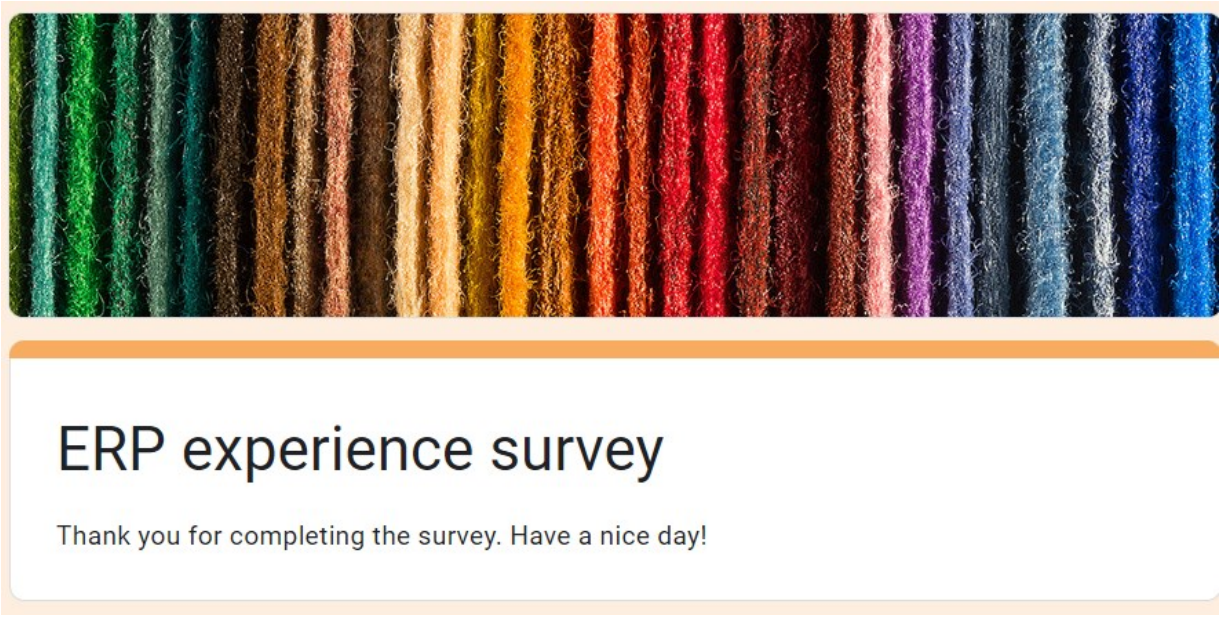
What is your opinion about using [ ] ERP system? *

- ◯ Yes, I am interested to join
- ◯ No, I have other reasons

Do you have any expectation for [ ] future ERP system?

Your answer

Appendix 5. Thank-you note and confirmation letter



ERP experience survey

Thank you for completing the survey. Have a nice day!

Appendix 6. Company's A manager interview questions

Part 1. Company's readiness

1. Why do you decide to implement an ERP system to the platform? Is the need for an ERP system urgent for the platform development?
2. Has the company formed a project team to work with the ERP implementation process?
3. How do you think the ERP system meets the company's requirements?

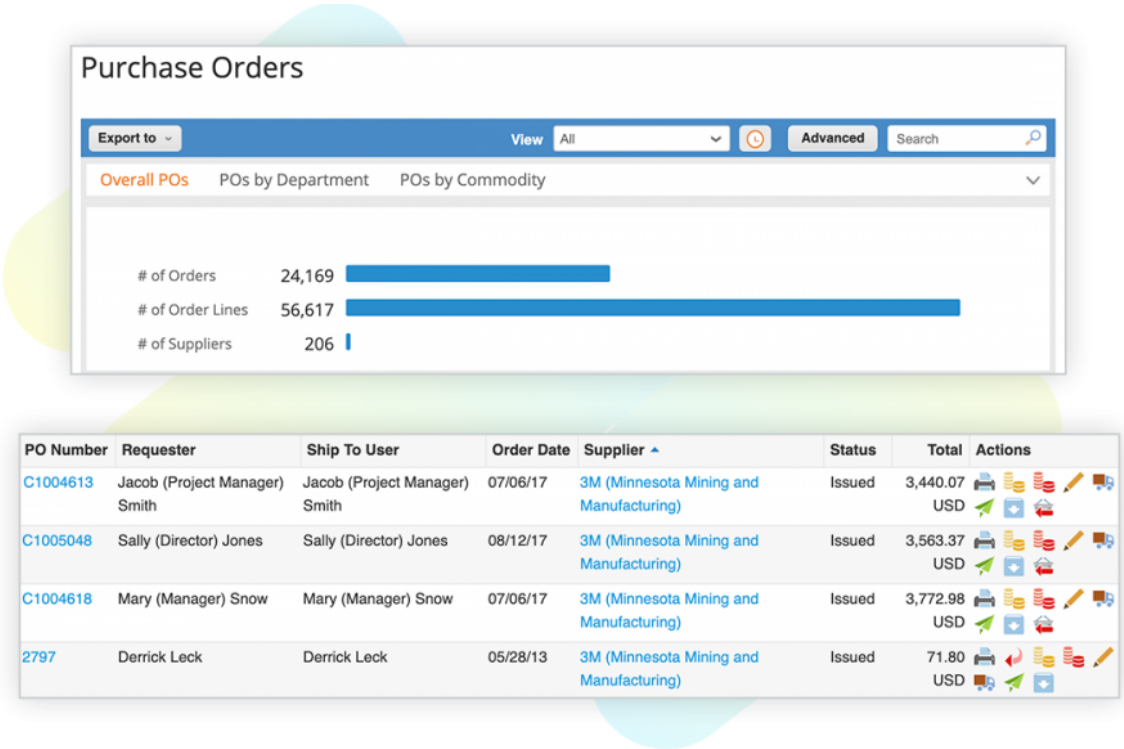
Part 2. Company's current status and preparation

1. How many estimated ERP users?
2. Is the deployment public cloud or private cloud?
3. When adopting the ERP system, all the related costs are called total costs of ownership. Do you have an estimated number for the TCO fund?
4. Do you have any ideal ERP products and the reasons for choosing them (for example, references and recommendations)? (2-3 ERP products)
5. (Follow-up question) Coupa's main focus is business spend management with visibility, while SAP Ariba focuses on e-Procurement and Supply Chain Management with process improvement. Which module is more of the company's focus?
6. In case the suppliers have already installed the ERP systems. Would the company prefer the future ERP system to be able to integrate with other ERP systems?
7. What are the risks that can occur in the ERP implementation?
8. Do you have any requirements for the user interface?
9. What do you think about the company's scale-up in the next five years?

Appendix 7 ERP Consultant interview questions

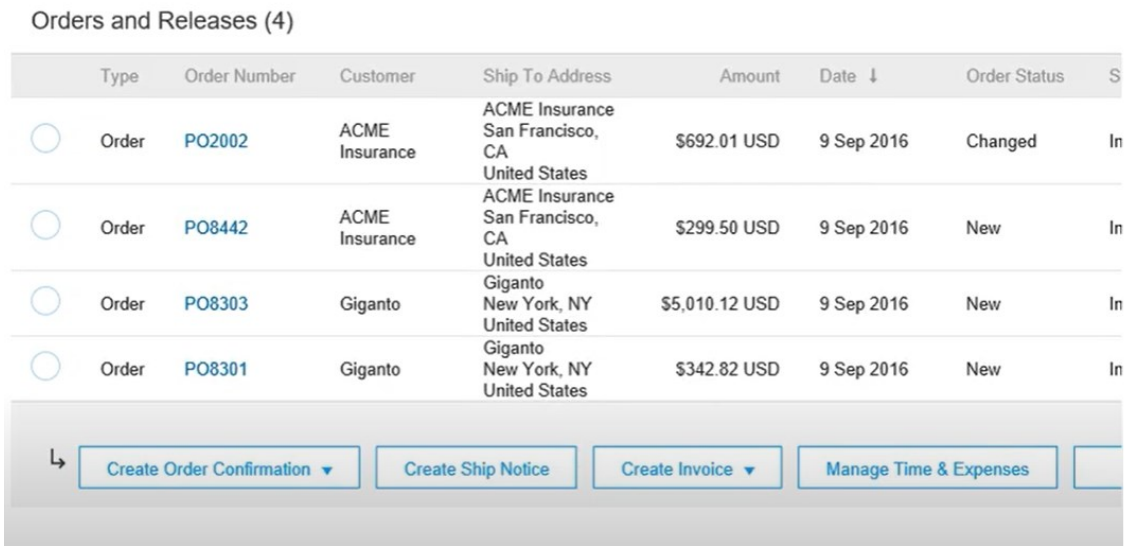
1. What are the requirements for “user-friendly UI”? Please name some examples, if possible.
2. What are the critical factors when choosing a suitable ERP system?
3. Where do you get the reference visits when introducing the solutions to new customers? By any reliable review websites or any other methods?
4. What is the average time to fully implement the ERP system (without training) for an SME?
5. Which costs are the most over the budget or hard to manage? (for example, maintenance costs, deployment)
6. When an ERP system is implemented into an E-commerce platform, what are the risks and difficulties? Please benchmark any example, if possible.

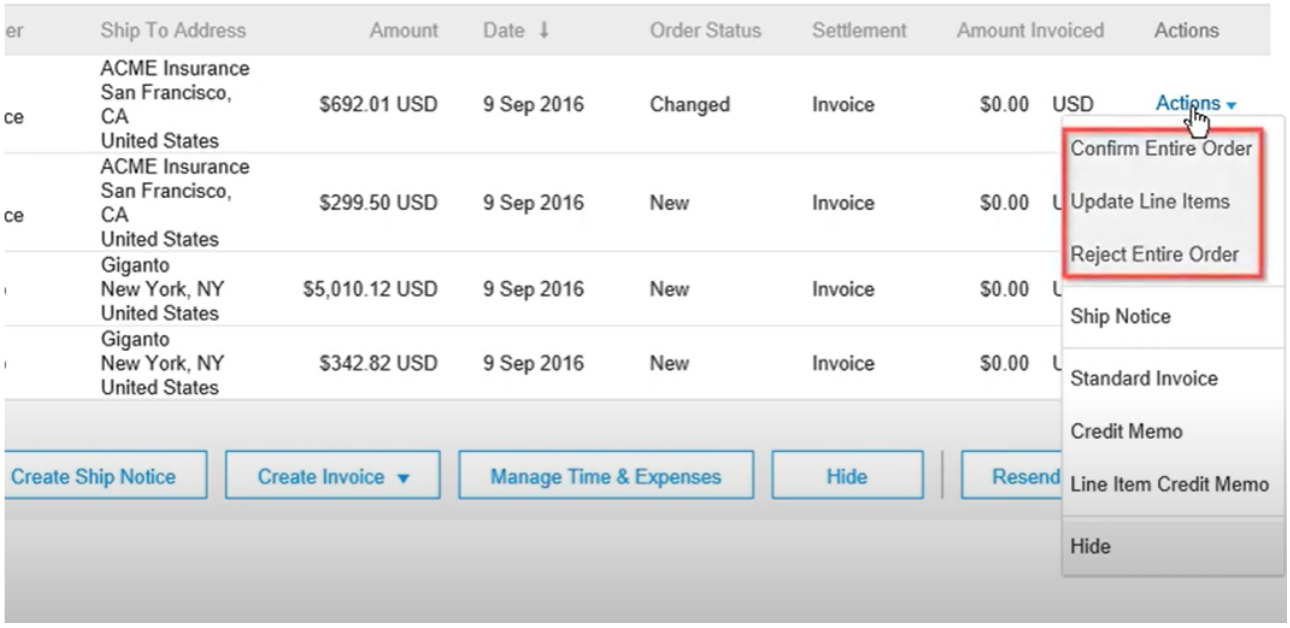
Appendix 8 Coupa's purchase order management



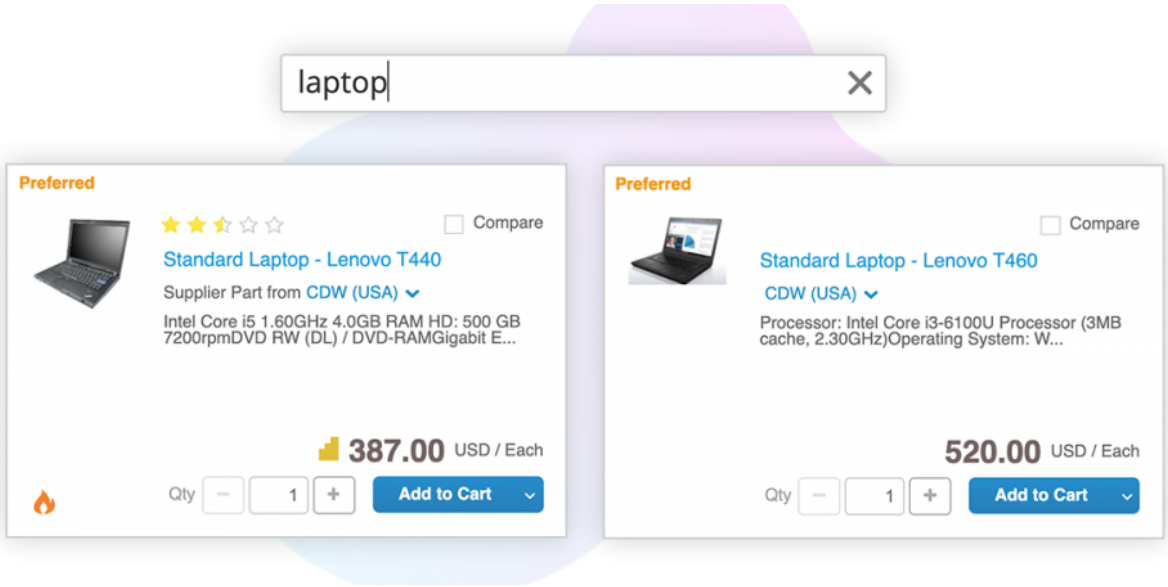
PO Number	Requester	Ship To User	Order Date	Supplier	Status	Total	Actions
C1004613	Jacob (Project Manager) Smith	Jacob (Project Manager) Smith	07/06/17	3M (Minnesota Mining and Manufacturing)	Issued	3,440.07 USD	
C1005048	Sally (Director) Jones	Sally (Director) Jones	08/12/17	3M (Minnesota Mining and Manufacturing)	Issued	3,563.37 USD	
C1004618	Mary (Manager) Snow	Mary (Manager) Snow	07/06/17	3M (Minnesota Mining and Manufacturing)	Issued	3,772.98 USD	
2797	Derrick Leck	Derrick Leck	05/28/13	3M (Minnesota Mining and Manufacturing)	Issued	71.80 USD	

Appendix 9 SAP Ariba's purchase order management

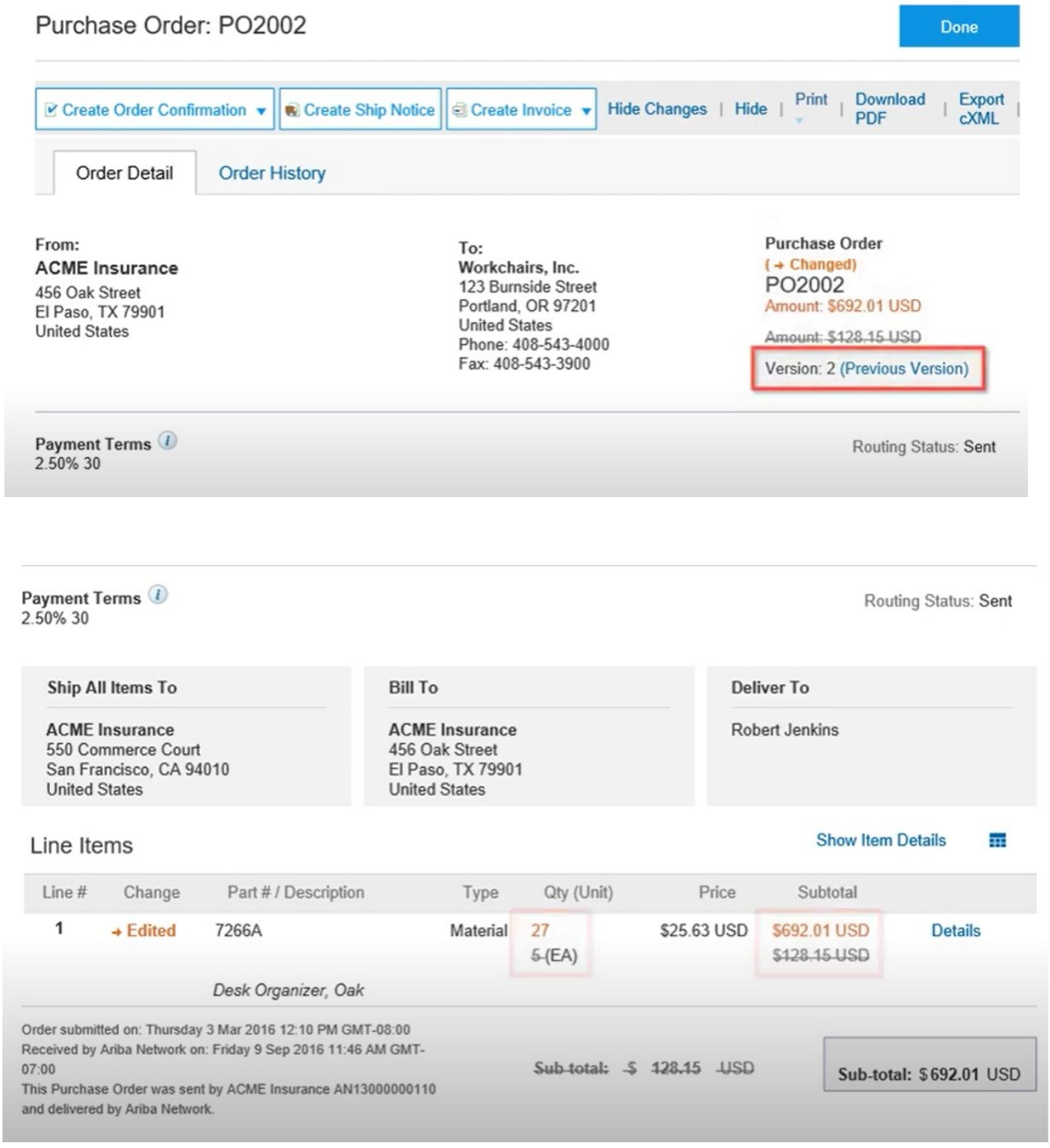




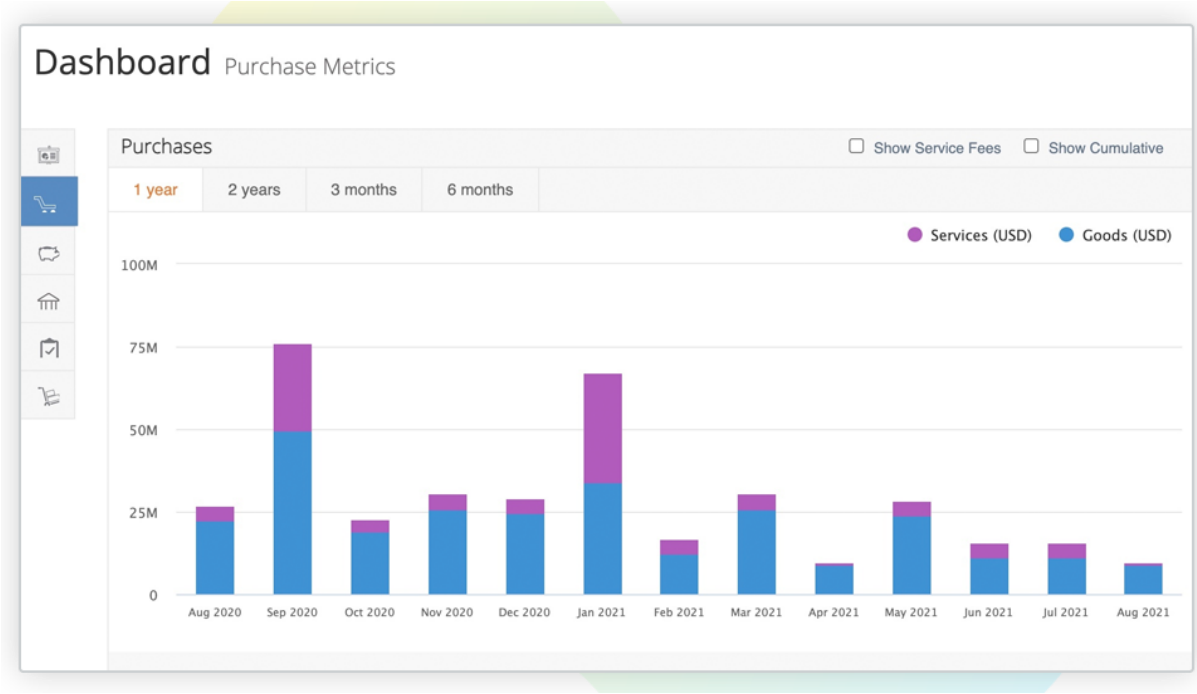
Appendix 10 Coupa's purchase requisition



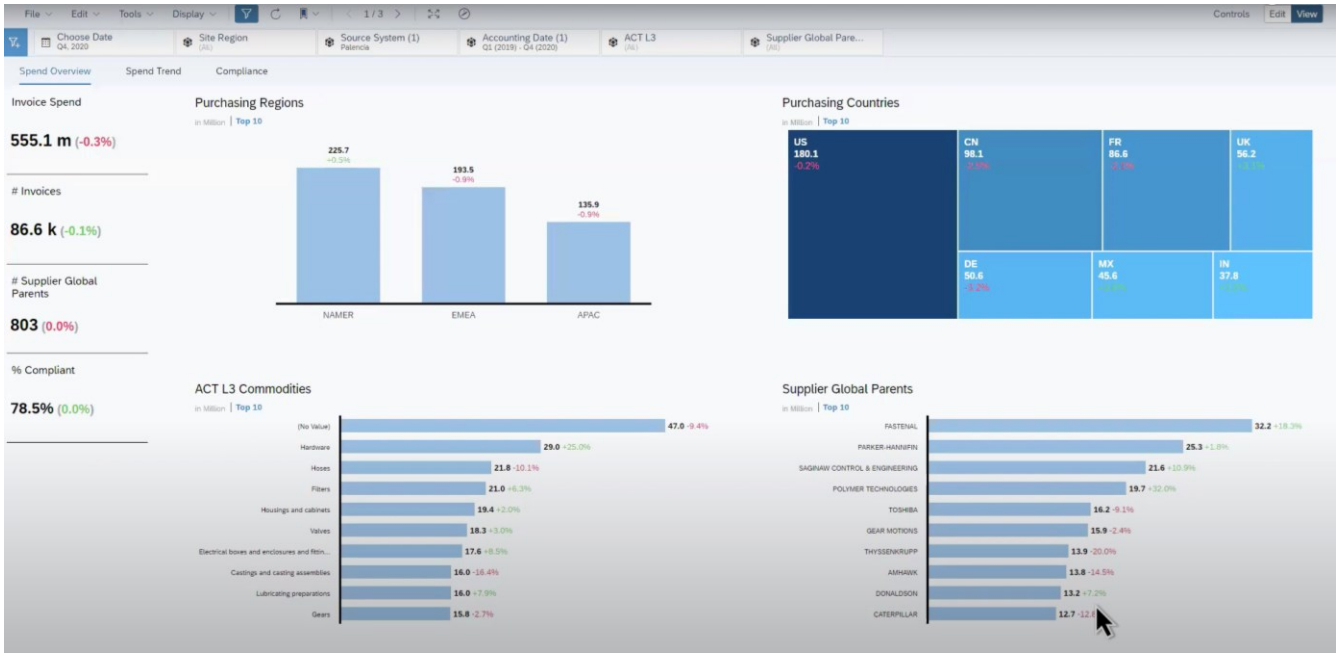
Appendix 11 SAP Ariba's purchase order



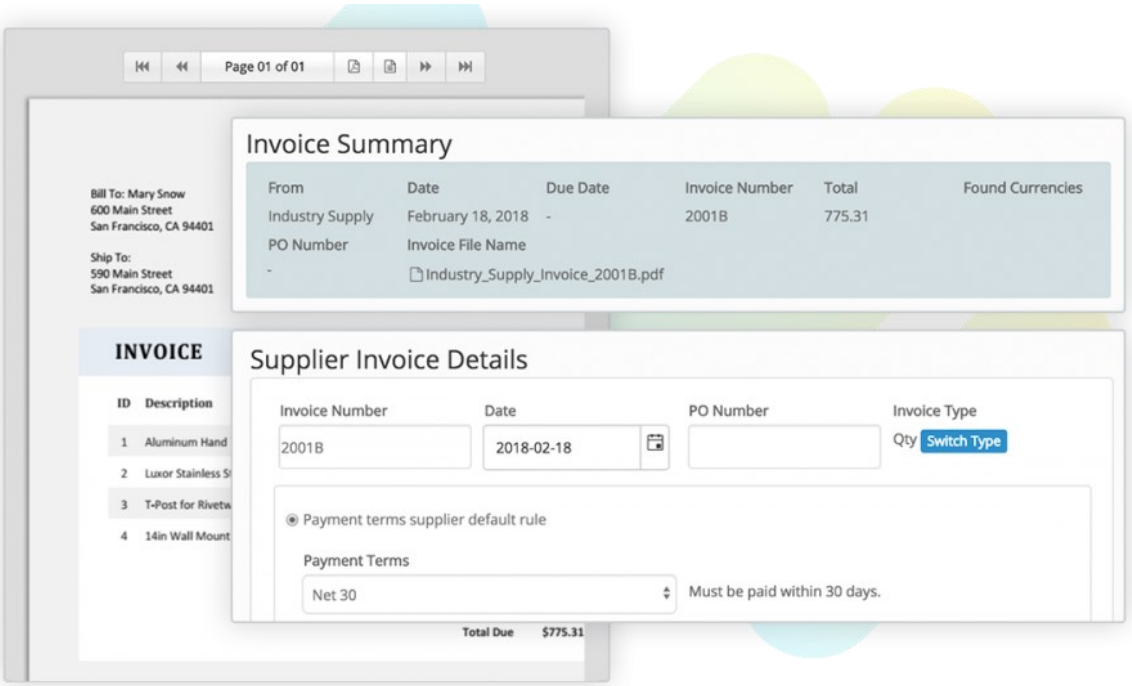
Appendix 12 Coupa's spend management



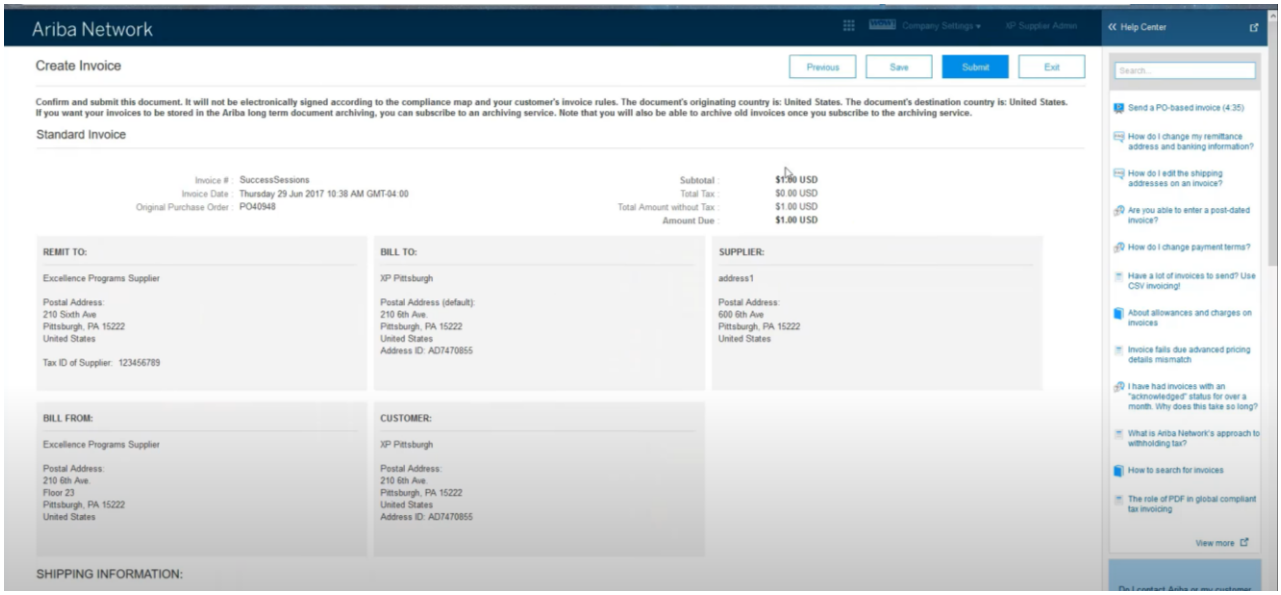
Appendix 13 SAP Ariba's spend management



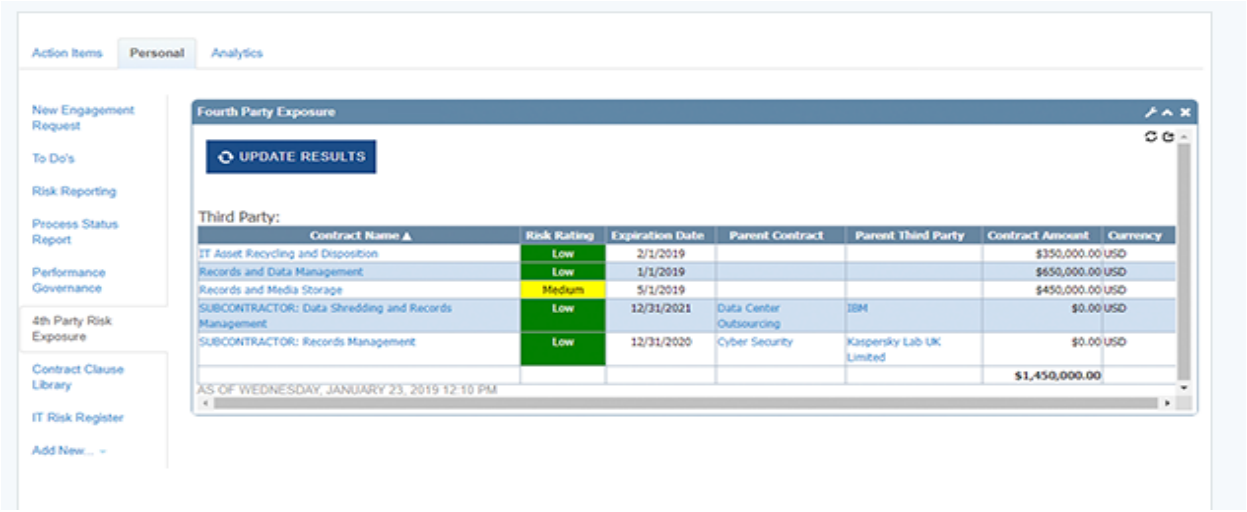
Appendix 14 Coupa's invoice management

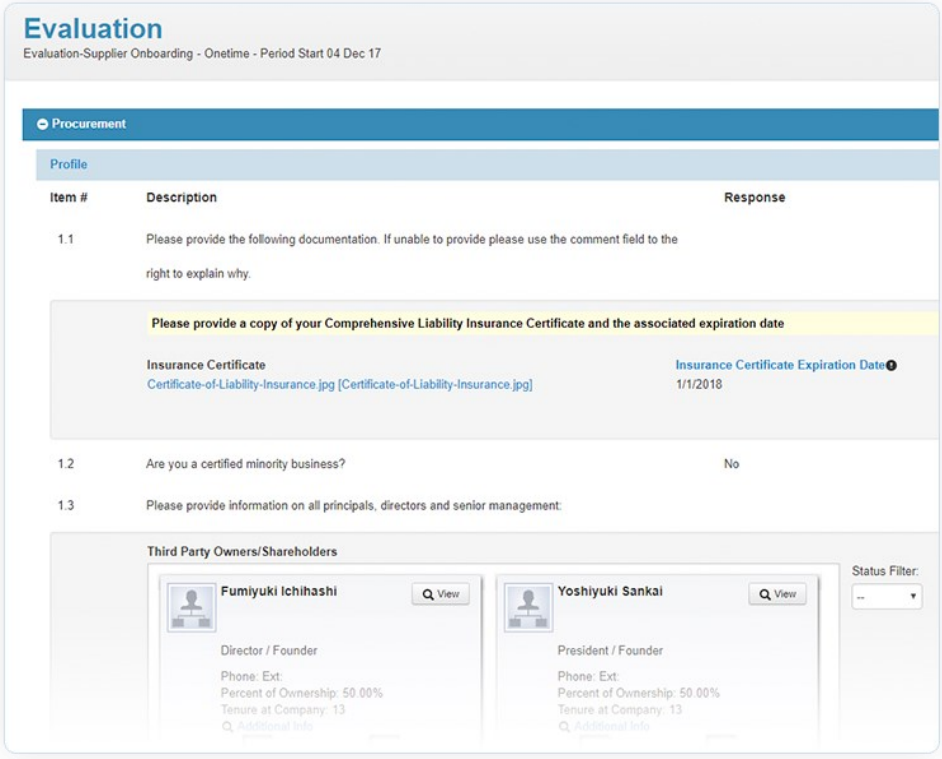


Appendix 15 SAP Ariba's invoice management



Appendix 16 Coupa's supplier risks and management





Appendix 17 SAP Ariba's supplier risk and management