

Master Thesis

Assessment of decision criteria for SAP S/4HANA deployment options and design of a decision model

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Abstract

ERP systems are evolving from a monolith to a composable suite. This is also accelerated by the trend to deploy ERP systems in the cloud. SAP, the global market leader for ERP software, is responding to this development with new deployment options. In addition to the classic provision on premise, private and public cloud are now also provided to companies as part of the RISE with SAP offering. As a result, companies that want to implement SAP for the first time or change the deployment option of their existing system are faced with the challenge of selecting the appropriate SAP S/4HANA deployment option. Since there is not yet a solid research base in this area, an exploratory research design was chosen. By conducting qualitative semi-structured expert interviews and a subsequent content analysis, 5 deployment options and 18 different decision criteria were evaluated which must be considered within the decision-making process. In a next step, a survey was conducted to determine the weighting of each decision criterion. The results of the survey confirmed that all 18 previously evaluated criteria are relevant. On the one hand, there are certain criteria (e.g., Data security) that seem to be particularly important in the decision process and on which the experts are in great agreement. On the other hand, there are criteria (e.g., Number of service providers) that are less relevant and where the answers of the experts diverge more widely. Based on these findings, a decision model was designed within the DSR framework and using DMN to support companies in the decision-making process for selecting the appropriate SAP S/4HANA deployment option.

Keywords:

ERP system, SAP, deployment options, decision-making process, decision criteria, decision model and notation

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List of Abbreviations

AHP	Analytic hierarchy process
API	Application programming interface
AWS	Amazon Web Services
BPMN	Business Process Model and Notation
BTP	SAP Business Technology Platform
CRM	Customer relationship management
DDA	SAP Digital Discovery Assessment
DMN	Decision Model and Notation
DRD	Decision requirements diagram
DSR	Design science research
ERP	Enterprise resource planning
FUE	Full User Equivalent
HCM	Human capital management
IaaS	Infrastructure-as-a-Service
IS	Information system
MES	Manufacturing execution system
OMG	Object Management Group
RQ	Research question
SaaS	Software-as-a-Service
SAP	SAP SE
SLA	Service level agreement
ТСО	Total cost of ownership
UX	User experience
XML	Extensible Markup Language

1 Introduction

In the first chapter of the thesis the motivation and background are explained. Afterwards, the aim of this thesis is described in more detail. And finally, the structure and approach are presented.

1.1 Motivation and background

Every company needs to collect and process corporate data in order to operate successfully and profitably in the long term. For this purpose, the internal processes must be mapped in order to enable processing by an information system (IS). The IS must be accessible not only to individual areas of the company but has company-wide applications for various areas. This is called enterprise resource planning (ERP) system (Ganesh et al., 2014, pp. 1–2). The ERP system can therefore be regarded as the central IS of a company as "… the most critical processes of most global businesses are running on ERP applications" (Saueressig et al., 2021, p. 26).

In the market of ERP products, there are numerous vendors, such as Oracle, Sage, and Infor. SAP SE (SAP), based in Walldorf (Germany), is the global market leader among the vendors, as shown by the statistics in Figure 1. For this reason, the thesis will be restricted to the products of SAP.



Figure 1: Market shares of ERP software vendors worldwide in 2017 Source: Gartner Inc., 2018

ERP systems have evolved over time as companies have an ever-increasing need for speed of adaptation which cannot be satisfied by older "monolithic" ERP systems that are not able to adapt quickly enough. As a result, alternative systems are used which in turn can lead to integration problems with the ERP system and result in data silos. New ERP systems combine the advantages of an integrated ERP system with the required flexibility by building on cloud technologies (Saueressig et al., 2021, p. 26).

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In the future, according to SAP, ERP systems will be based entirely on the composable concept. That means that the ERP system can be freely assembled from different packages and modules and is based on "… harmonized data models, central master data services, cross-component analytics, and a unified UX" (Saueressig et al., 2021, pp. 27–28). The described past and future development of ERP systems from the perspective of SAP is illustrated in the following Figure 2.



Figure 2: ERP Journey from Monolithic ERP Software to a Composable ERP Suite Source: Saueressig et al., 2021, p. 27

That evolution and orientation towards a cloud-oriented service is not only focused by SAP but is an important topic for most ERP vendors. In 2021, the cloud adoption was one of the most important trends within the ERP market (Luther, 2021; Peterson, 2021; Weinberg, 2021).

Many ERP vendors, including the global market leader SAP, are increasing their focus on providing ERP products in the cloud. SAP has introduced several ERP cloud products to the market in recent years, including SAP S/4HANA public cloud and SAP S/4HANA private cloud. As a result, revenue from cloud subscriptions and support has increased sharply over the past 12 years (see Figure 3).



Figure 3: SAP's cloud subscriptions and support revenue worldwide from 2010 to 2021 Source: SAP SE, 2021a

Deploying an ERP system in the cloud provides many advantages for the customer. Besides flexibility, robustness, and scalability through cloud deployment there are standardization, innovation, security and safety, and costs benefits (Saueressig et al., 2021, pp. 41–43).

Especially due to the high level of standardization in the cloud, costs that would otherwise have been incurred through "... process definitions, infrastructure, implementation, operations and updates ..." can be saved (Saueressig et al., 2021, p. 38). Over a period of 7 years, the total cost of ownership (TCO) can be reduced by 30 % (see Figure 4).



Figure 4: SAP S/4HANA Cloud - Potential Savings over a 7-Year TCO Lifecycle Source: Saueressig et al., 2021, p. 39

As customers become aware of the ERP cloud trend and see the benefits of the deployment in the cloud, they are faced with the difficult decision of choosing the right ERP deployment option. Various deployment options are available, and many criteria need to be considered during the selection process.

1.2 Related research and research gap

There are already research studies on related topics, such as ERP selection criteria, the ERP selection process, the development of ERP systems, the advantages and disadvantages of ERP cloud systems, and the comparison of different ERP cloud systems. In the following, that research is summarized and the emerging research gap is pointed out.

To begin with, studies related to ERP selection criteria and the ERP selection process are considered. Ratkevičius et al. (2012) have dealt with the ERP selection criteria and the consideration from a theoretical and from a practical point of view. Their conclusion is "... that there is no standard classification of ERP selection criteria" (p. 97). Bernroider & Koch (2001) have identified the differences in the selection criteria and the selection process between small to medium size

and large organization. In the study of Hecht (1997) main areas have been defined to which the decision criteria can be assigned. This categorization is taken up again later in the thesis. However, the studies mentioned so far all fail to take into account the different deployment options.

Further studies deal with the development of ERP systems. Such as the study by Katuu (2020): Here the history and the future development, in which cloud computing plays an important role, were examined. Reviewing literature Bender et al. (2021) have highlighted current problems of ERP systems and present a research agenda for the future. Within these two studies, however, the criteria for selection are not considered.

Also, the advantages and disadvantages of ERP cloud systems are covered in studies. Based on a systematic literature review, Abd Elmonem et al. (2016) have pointed out benefits and challenges of ERP cloud systems. Parthasarathy (2013) has compared the architecture of conventional ERP and cloud ERP systems. That is followed by a summary of potential concerns and common benefits of cloud ERP systems. Based on a literature study, also Duan et al. (2013) have elaborated benefits and drawbacks of cloud-based versus traditional ERP systems. These benefits and drawbacks were also considered on basis of the company size, a distinction was made between small to medium size and large enterprises. Nevertheless, decision criteria are not considered in those studies either.

There are also studies on the comparison of different ERP cloud systems. For example, Elbahri et al. (2019) have compared the different ERP cloud systems from the vendors SAP, Microsoft, and Oracle. However, this review compares different vendors rather than different deployment options.

Based on this research overview, the author concludes that there is a research gap in the area of decision criteria and the design of a decision model for selecting the appropriate deployment option.

1.3 Aim of the thesis

As already described in Chapter 1.1, customers are faced with the challenge of selecting the appropriate ERP deployment option for them. As SAP is the global market leader, this thesis focuses on SAP and its following five deployment options: SAP S/4HANA on premise, SAP S/4HANA on premise (by service provider), SAP S/4HANA private cloud, SAP S/4HANA public cloud and SAP S/4HANA hybrid approach. Within the scope of this thesis a decision model shall be designed. This model is built based on previous research within this thesis. The overall aim of this thesis is to support companies in making the right decision regarding the selection of the appropriate SAP S/4HANA deployment option.

The following three research questions (RQ) addressed in this thesis are:

RQ1: Which criteria are relevant in the decision-making process for organizations when choosing the appropriate SAP S/4HANA deployment option?

RQ2: Which weighting do the various criteria have in the decision-making process for organizations when choosing the appropriate SAP S/4HANA deployment option?

RQ3: How should a decision model be designed to support organizations in the process of choosing the appropriate SAP S/4HANA deployment option?

1.4 Structure and approach

In order to answer the research questions, the following structure and approach is used within this thesis. At the beginning, the motivation and background of the topic, as well as related research and the research gap are highlighted in Chapters 1.1 and 1.2. In Chapter 1.3 the resulting aim of this thesis is presented. To create common ground, the various deployment options used for ERP systems are presented in the following Chapter 2. That chapter focuses on the distinction between on premise and cloud. Chapter 3 addresses the evaluation of relevant decision criteria that are involved in the selection of a deployment option (RQ1) as well as the weighting of these criteria (RQ2). At the beginning, the theoretical foundations of decision criteria for ERP systems are elaborated. This is followed by the theoretical foundation and subsequently the practical realization of the data collection and the data evaluation. The data collection is performed in form of qualitative semi-structured expert interviews and a survey. The content analysis is done according to Mayring (2014). Next, the five SAP S/4HANA deployment options are characterized and compared in Chapter 4 using the evaluated decision criteria. Chapter 4.7 also explains the contents of RISE with SAP in which the private and the public cloud are offered to the customer. The final design of a decision model is then conducted in Chapter 5 using the design science research (DSR) framework according to Hevner et al. (2004) and the Decision Model and Notation (DMN) (RQ3). This is followed by a discussion of the results and limitations, as well as an outlook on future research areas in Chapter 6. A recommendation for action is provided in Chapter 7 which is intended to illustrate the usage of the decision model. Finally, this thesis closes with the conclusion in Chapter 8.

2 Deployment options for ERP systems

In the following, the different deployment options for ERP systems are presented. At the beginning, the so far classic deployment option on premise is described. After that, the two options of cloud deployment are presented: here, a distinction is made between the public and the private cloud option. Finally, the hybrid deployment of ERP systems is explained. An overview of the different deployment options is shown in Figure 5.



Figure 5: Deployment options for ERP systems

2.1 On premise

The term "on premises" has the following original meaning: "inside a building or on the area of land that it is on" (Merriam-Webster, n.d.). In the field of IT, the term "on premise" has become established in its singular form. As the original definition already suggests, the term in the field of IT means that the application is installed on servers in the company's own data center (Seubert, 2018, p. 45).

By deploying on premise, the customer itself has direct access and control over its hardware and stored data. However, in this case the entire operation, administration, and security and safety is in the responsibility of the customer.

2.2 Cloud

As opposed to the on premise deployment, in this case the customer does not use its own hardware or infrastructure. In the case of cloud deployment, the hosting is carried out by a hyperscaler. A hyperscaler is a provider of cloud, network, and Internet services at a large scale. They provide access to infrastructure for their customers (Birkhoff, 2021). According to Gartner Inc. (2021), Amazon, Microsoft, and Google with their products Amazon Web Services (AWS), Microsoft Azure and Google Cloud are the market leaders in the hyperscaler segment (see Figure 6).



Figure 6: Magic quadrant for cloud infrastructure and platform services Source: Gartner Inc., 2021

By deploying in the cloud, the hyperscaler is responsible for the entire responsibility for operation, administration, and security. This means that the customer does not need any internal know-how to perform these tasks. In the following, the two cloud deployment options public cloud and private cloud are differentiated from each other.

2.2.1 Public cloud

All services on the public cloud are available to all customers (Yandong & Yongsheng, 2012, p. 1086). Since the provided services run on shared hardware, customers do not have a dedicated assigned infrastructure. Instead, customers share infrastructure with other customers. Nevertheless, the data of the customers is shielded and separated from each other (Seubert, 2018, pp. 43–44). In addition, the customer has neither direct access on the hardware nor influence on the location of the hardware (Vikas et al., 2013, p. 79).

2.2.2 Private cloud

In contrast to the public cloud, the customer of a private cloud is provided with a dedicated infrastructure. This means the customer does not share any resources with other customers (Vikas et al., 2013, p. 79). In the literature, the responsibility of hosting is defined differently. According to Yandong & Yongsheng (2012), the private cloud is always hosted by the customer itself in its own data center. Vikas et al. (2013) leave the choice of hosting open between the customer's own hardware and by a hyperscaler. Whereas for Seubert (2018), the private cloud is hosted exclusively by a hyperscaler.

Within this thesis, the private cloud is defined as being hosted by a hyperscaler. This definition is used because the product SAP S/4HANA private cloud is also hosted by a hyperscaler (SAP SE, 2021b, p. 19).

2.3 Hybrid

In addition to the clearly definable options mentioned above, there are also various hybrid approaches which combine the previous options.

On the one hand, a hybrid approach can be a combination of the public and the private cloud in order to combine the respective advantages (see scenario C in Figure 7). Usually, the private cloud is extended by certain public cloud services. This means that data protection-critical elements can remain in the private cloud, and the public cloud can be scaled as large and cost-effectively as required (Seubert, 2018, p. 45).

On the other hand, a hybrid deployment can consist of an on premise component and a cloud component (see scenario A in Figure 7). This variant is mainly used by customers with large corporate structures (Saueressig et al., 2021, pp. 32–33). In this case, the headquarter uses the on premise deployment and the subsidiary runs a cloud deployment.

Furthermore, with a hybrid approach it is possible not only to link corporate systems, but also to connect non-corporate systems, such as the system of a subcontractor or a dealer (see scenario B and D in Figure 7). Figure 7 shows four possible hybrid scenarios as they can be deployed with SAP S/4HANA cloud.



*Corporate or non-corporate scenario – for largely autonomous business units or divisions; very attractive if your company fosters entrepreneurship and innovation through the "corporate startup" model

**Central services scenario - to enable central provisioning of certain business services, such as a procurement hub

*** Ecosystem – to enable business collaboration with vendors, subcontractors, or dealers

Figure 7: Possible hybrid deployment options for SAP S/4HANA cloud Source: SAP SE, 2021c, p. 29

3 Evaluation of decision criteria

This chapter discusses the evaluation of the decision criteria (RQ1). For this purpose, a theoretical basis for decision criteria for ERP systems in general is laid at the beginning. This is followed by the fundamentals of data collection which is based on a model by Mayring (2014). Subsequently, the practical procedure in the context of the expert interviews is enlightened and the analysis on the basis of the qualitative content analysis by Mayring (2014) is explained. The chapter is concluded by weighting the evaluated criteria through a survey (RQ2).

3.1 Theoretical foundation of ERP system selection

As already mentioned in Chapter 1.1, the ERP system is the central IS of a company. For this reason, the selection of the right ERP system is of high importance. If the implementation of the ERP system fails or the choice of the system was made incorrectly, this has serious consequences for the company (Verville et al., 2007, p. 58). When it comes to the process and decision criteria of selecting an ERP system, a lot of scientific research has already been done and various literature is available on this. However, since this thesis is about the decision between the different deployment options of an ERP system and not about the general selection of an ERP product, the existing knowledge can only provide support to a certain degree.

Hecht (1997) defines the following six main areas for ERP system selection criteria: functionality, technical architecture, cost, service and support, ability to execute, and vision. The decision-making process often focuses on functionality, but according to decision drivers it should not take up more than one-third of the total weighting. The technical architecture refers to the fit between the IS and the needs of the end users. More specifically, it refers to the following aspects: environment (database, server, client environment), user interface, software architecture, development and management tools, and available data and process models. With regard to the costs, a realistic estimate is crucial. The aspect of service and support refers to the financial condition and thus the long-term existence of the provider is summarized with the aspect "ability to execute". Lastly, the vision and future plans for the ERP product of the vendor is another area that is relevant in the decision process for the right ERP system (Hecht, 1997, p. 58). This categorization of criteria will also be used in the context of data collection (see Chapter 3.3.4).

In addition to the criteria as such, the weighting of the criteria in the decision-making process is also highly relevant. A widely used method in this area is the Analytic hierarchy process (AHP), which was developed by Saaty (1990). A key component of the AHP is the pairwise comparison. Here each criterion is compared in pairs with another criterion and the relevance of the two criteria is contrasted (Saaty, 1990, pp. 12–14).

3.2 Theoretical foundation of data collection

The evaluation of the decision criteria is based on the step-by-step model for the research process by Mayring (see Figure 8).



Figure 8: Step-by-step model for the research process Source: Mayring, 2014, p. 15

In the following sections, certain steps are explained in more detail.

3.2.1 Research question

In the first step in the process of research, the research question must be defined concretely. "Without this specification, the research process remains arbitrary" (Mayring, 2014, p. 10). In addition, a reference to practice should be recognizable in the research question in order to make it relevant. If the research methodology is quantitative, hypotheses must also be formulated; in qualitative research, this can be neglected. However, in the case of qualitative research, the researcher needs to "... [formulate] his or her standpoint in advance, and this is a form of hypotheses as well" (Mayring, 2014, p. 10).

3.2.2 Research design

Based on the defined research question, the appropriate research design must be chosen. Mayring distinguishes between the following four research designs: explorative, descriptive, correlational, and causal design (Mayring, 2014, p. 11).

Exploratory design is often used in qualitative research but can also be found in quantitative research. In the exploratory approach, an initial analysis is conducted to explore data in more detail. This can uncover findings that were not previously known. The explorative design should be used when the state of research of the subject is only vague, so that no hypotheses, or concrete questions can be formulated (Mayring, 2010, pp. 231–232).

Descriptive design is also often used in qualitative research but can be found in quantitative research as well. The difference to explorative design is that in the descriptive approach a certain state of research must already exist in order to be able to formulate hypotheses or more precise questions (Mayring, 2010, p. 233).

Correlational design is often used in quantitative research but can also be found in qualitative research. Within the correlational design, single case comparisons are performed systematically. These cases are selected according to a defined variable (e.g., good students - weak students or city - country). The correlation analysis tests whether a correlation exists on the basis of the selected variable (Mayring, 2010, p. 234).

Causal design is also often used in quantitative research but can be found in qualitative research as well. A requirement for a causal analysis is the definition of variables and their division into independent and dependent variables. Subsequently, the influence of the independent variables on the dependent variables is tested (Mayring, 2010, p. 235).

3.2.3 Sampling strategy

In the next step, the sample must be defined which's determination needs to be based on a sampling strategy. Thereby, the sample size needs to be described and the sampling strategy justified (Mayring, 2014, p. 12). Rarely data can be collected and analyzed from every possible case or member. So, if constraints in time, money, or access limit either the collection or the analysis of all the data, the amount of data to be collected and analyzed needs to be reduced by using a sampling method (Saunders et al., 2009, p. 210). According to Saunders et al. (2009), the sampling strategies "... can be divided into two types:

- probability or representative sampling;
- non-probability or judgemental sampling" (p. 213).

In probability sampling, each case has an (often equal) probability of becoming part of the sample. Through this procedure, conclusions can be drawn from the sample to the total quantity. These sampling strategies are often used for surveys and experiments. In non-probability sampling, the probability of a case becoming part of the sample is unknown. This makes it impossible to draw statistical conclusions form the sample to the total quantity (Saunders et al., 2009, p. 213). The sampling strategies can be differentiated into further types as shown in Figure 9.



Figure 9: Sampling strategies Source: Saunders et al., 2009, p. 213

3.2.4 Methods of data collection

The methods of data collection can basically be divided into two areas: On the one hand there are the methods of primary research and on the other hand there are the methods of secondary research. In primary research, new data is collected initially. The methods of primary research are observations, interviews, and questionnaires. During observation, the behavior of people is monitored and evaluated. However, this form of data collection is slightly neglected in research (Saunders et al., 2009, p. 288). Interviews are goal-oriented conversations with one or more interview partners (Saunders et al., 2009, p. 318). According to Saunders et al. (2009) "… interviews may be categorised as one of:

- structured interviews;
- semi-structured interviews;
- unstructured or in-depth interviews" (p. 320).

Structured interviews consist of predefined standardized questions. The prepared questions should be asked in the same way to all interview partners (Saunders et al., 2009, p. 320). In semi-structured interviews, topics and questions which should be addressed during the interview are defined in advance. However, the concrete formulation and sequence of the questions can be individually adapted depending on the interview partner and the situation (Saunders et al., 2009, p. 320). Unstructured interviews allow the interview partner to answer freely. Questions are not prepared. Nevertheless, the topics to be covered must be clearly defined in advance (Saunders et al., 2009, p. 321).

Questionnaires can be divided into two types: self-administered and interview-administered. In both cases, the participating persons are asked the questions in the same wording and in the same order. In contrast to the self-administered questionnaire, in which the participant submits his or her answers on its own, in the interviewer-administered questionnaire the answers are gathered by the interviewer (Saunders et al., 2009, pp. 360–363).

Secondary research analyses data that already exists, e.g., has been collected in advance. Secondary data can basically be divided into three types: documentary secondary data, survey-based secondary data, and multiple-source secondary data. Regardless of type, when using secondary data, it is important to consider the extent to which this data can be useful in answering the research question, as the data was usually originally collected for a different purpose (Saunders et al., 2009, pp. 256–263).

3.3 Practical realization of data collection

In order to evaluate the decision criteria that are relevant when choosing between the different SAP S/4HANA deployment options, expert interviews were conducted as part of this thesis. The individual steps and decisions taken during the research process are explained in detail in the following sections.

3.3.1 Research question

The research question for the expert interviews is formulated as follows:

RQ1: Which criteria are relevant in the decision-making process for organizations when choosing the appropriate SAP S/4HANA deployment option?

As Chapter 1.1 illustrates, ERP systems are evolving and providers such as SAP are increasingly focusing on cloud solutions and offering their customers a wide range of different deployment options. Thus, the reference of the research question to practice is obvious.

3.3.2 Research design

Since there are no relevant research findings so far regarding criteria in the decision-making process of SAP S/4HANA deployment option, the exploratory research design was chosen. The explorative research design has the disadvantage that the results are difficult to generalize. However, initial findings can be obtained in this area, which in turn can be further researched through more in-depth studies. The results of exploratory research are completely open and research methods can be used in a flexible manner.

3.3.3 Sampling strategy

As shown in Figure 9, there are various sampling strategies. Since the method of data collection is the expert interview which requires contact to the experts and the possibility of interviewing the experts, the strategy of self-selection sampling was chosen.

A total of ten experts were interviewed. The expert role is divided into two different categories: On the one hand, people were interviewed who have expert knowledge due to their work as a consultant in the SAP ERP area. On the other hand, people were interviewed who are responsible for the ERP system on the customer's side. In order to collect data that is as differentiated as possible, a distinction was not only made between the two roles, but the surroundings of the participants should also be as diversified as possible. Thus, the participants were selected from different companies. The ten interview participants come from seven different organizations. All participants must have at least eight years of professional experience in the ERP environment. In addition, each of them should have already dealt with SAP S/4HANA cloud. This means they have expertise not only with the on premise deployment option but also with the hybrid and (private and public) cloud approaches. The selected participants can be seen in Table 1.

Interview Organi-		Job title	Expert	Date	Dura-		
ID	zation		role		tion		
	ID						
1 (Pilot test)	1	Department Manager	Consultant	03/30/22	76 min		
2	1	Executive Project Manager	Consultant	04/04/22	58 min		
3	1	Department Manager	Consultant	04/04/22	54 min		
4	2	Head of Competence Center	Consultant	04/05/22	42 min		
5	3	Partner Solution Center Manager	Consultant	04/05/22	68 min		
6	4	Architect for SAP ERP Platform	Customer	04/06/22	61 min		
7	3	Business Developer	Consultant	04/06/22	62 min		
8	5	Head of Demand Management	Customer	04/07/22	36 min		
9	6	Solution Architect	Consultant	04/08/22	37 min		
10	7	Head of IT	Customer	04/28/22	45 min		

Table 1: List of interview partners

As part of the sampling strategy, a decision was made to survey more consultants than customers because of the following assumption: Consultants know several customers and thus have a broad view of the decision criteria. Customers, on the other hand, often only know their own corporate environment and are therefore only concerned with those criteria that are relevant to their own organization. In return, the customers have more depth of detail and can better explain the reason for certain criteria. Since this thesis is more focused on the various criteria themselves than on their backgrounds and reasons, the amount of input of the consultants is considered to be higher. This assumption was confirmed during the interviews.

3.3.4 Method of data collection

Since there are few or no existing findings on this research topic, the methods of secondary research (e.g., literature reviews) are not applicable. Within the scope of the research, new insights are to be gained regarding the criteria involved in the decision-making process for SAP S/4HANA deployment options which were collected through primary research. The data collection with the help of an observation seems to be unsuitable in the context of the research question because expertise and experience are to be collected. The method of a questionnaire was also rejected, as there are not enough findings available to date that would be necessary to design a questionnaire. For these reasons the expert interview was selected as the method of data collection. This method guarantees and open and deep discussion with the experts.

Interview guideline

To conduct the expert interview in a purposeful way, a semi-structured interview guideline was created. The interview guideline is structured as follows:

- A. Information about the research
- B. Information about the interview
- C. Introduction
- 0. Introductory questions
- 1. Deployment options
- 2. General criteria
- 3. Functionality
- 4. Technical architecture
- 5. Cost
- 6. Service and support
- 7. Vision of the vendor
- 8. Round off

D. Closing

Sections A and B contain basic information about the research and the interview. However, these are not directly communicated or presented to the interview partner. The actual interview started with section C and included an introduction. Here, the interviewer and the context in which the interview takes place were presented. Also, the agreement to the audio recording as well as other open questions were clarified.

The section 0 includes a few icebreaker questions to start the interview and provide a soft opening into the topic. Then, in section 1, the deployment options were identified that are currently relevant for organizations when selecting an SAP S/4HANA system. This was intended to prevent a relevant deployment option from being left out of the subsequent comparison. In the second section general criteria in the decision-making process were asked. This gave the interview partner the opportunity to express him or herself freely and openly on the subject.

The sections 3 to 7 are based on the approach of Hecht (1997), see Chapter 3.1. However, the aspect "ability to execute" was not adopted, since in this case the provider of all deployment options is SAP and thus there are no differentiations. In addition, the aspect "vision" was expanded to "vision of the vendor" to avoid confusion with the vision of the customer.

In section 8 and D of the semi-structured interview guideline, the interview partner was given the opportunity to name previously unmentioned criteria. Furthermore, the participant was thanked for taking part in the interview and the further procedure of the thesis was explained.

The interview guideline consists of open questions, so that the interview partner could answer as openly as possible, and many new insights could be gained. In addition to the (main) questions, the interview guideline also contains pre-formulated follow-up questions that could be asked depending on the situation and the responses of the interview partner. The complete interview guideline can be found in Appendix 1.

Interview realization

At the beginning, the semi-structured interview guideline was checked with the help of a pilot test. The pilot test did not reveal any problems in the guideline; in fact, the interview went as planned. Only the pilot interview length of 76 minutes was longer than anticipated, but this can be attributed to the familiarity between the interviewer and interview partner and the fact that the interview guide was used unchanged in the follow-up interviews, the decision was made to also include the interview of the pilot test in the subsequent analysis.

A total of ten expert interviews was conducted. All of them were held online using Microsoft Teams. In addition, every interview was recorded in order to be able to transcribe the interviews afterwards. The interviews were done in a one-on-one format. The duration of the interviews was between 36 and 76 minutes. Moreover, the interviews were conducted in German, since the interview partners all have German as their mother tongue and could therefore answer more easily in German than in English.

Transcription

After the interviews were completed, the transcription was done using the recordings. The transcription was made based on the following rules (Dresing & Pehl, 2018, pp. 16–26):

- Verbatim transcription, not phonetic or summarizing.
- Word blends are approximated to written German. E.g, "so 'n Buch" becomes "so ein Buch".
- Sentence form is retained even if it contains syntactic errors. E.g., "Bin ich nach Kaufhaus gegangen".
- Colloquial particles such as "ne, ähm, hm" are left out.
- Aborted words are ignored.
- Word doublings are only included if they are used as a stylistic device for emphasis, otherwise they are left out.
- Half-sentences that are not completed are marked with the abort character "/".

- Punctuation is smoothed in favor of readability. That means, in case of a brief lowering of the voice or ambiguous emphasis, a period rather than a comma is used. Units of meaning should be retained.
- Breaks are not transcribed.
- The terms "on premises", "on prem" and "prem" are changed to "on premise" for uniformity and ease of analysis.
- Names, companies, and places are anonymized if one might draw conclusions about the interview partner.

Mayring (2014) refers to this type of transcription as a "clean read or smooth verbatim transcript" (p. 45). The complete transcripts of all ten expert interviews can be found in Appendix 2.

3.4 Theoretical foundation of data analysis

The subsequent content analysis of the interview transcripts is based on the qualitative content analysis according to Mayring (2014). In this context, Mayring differentiates between specific techniques of qualitative content analysis. Among others, he names deductive category assignment and inductive category formation.

At the deductive category assignment, the categories are based on previously selected theories or are based on findings from the literature. Thus, the material is worked through, and passages are assigned to the already defined categories (Mayring, 2014, pp. 95–97).

At the inductive category formation, the categories are formed out of the material itself. Thus, the categories do not come from theoretical considerations (Mayring, 2014, p. 79).

3.5 Practical realization of data analysis

After the expert interviews were conducted and the corresponding transcripts were created, the data analysis followed. For this purpose, a content analysis was carried out in the first step. Then the results of the content analysis were evaluated with the help of analysis functions of MAXQDA.

3.5.1 Qualitative content analysis

In the process of qualitative content analysis according to Mayring (2014), the inductive category formation was used. The reason for this is the lack of literary foundation and the lack of a suitable theory on which to base the categories. This would have been necessary for the deductive category assignment. In the case of the used inductive category formation, the categories were freely formulated from the material itself. For this purpose, the procedure as shown in Figure 10 is used:



Figure 10: Steps of inductive category development Source: Mayring, 2014, p. 80

The research question to be answered by the content analysis is the already formulated RQ1. However, in order to ensure that no deployment options are left out in the design of the decision model, the relevant deployment options shall also be worked out in the course of the content analysis. Accordingly, the following two selection criteria were defined for the definition of a category:

- 1. The material describes a relevant deployment option of SAP S/4HANA.
- 2. The material describes a criterion that is relevant in the decision process for the appropriate deployment option.

On the basis of these two criteria for defining a category, all interview transcripts were processed. If one of the two criteria applies, it was checked whether there was already a category created and the text section could be assigned to this category or whether a new category must be created. Within the transcripts, only statements by the experts were categorized, since only the experts are considered to have the necessary know-how. Statements made by the interviewer were not categorized, even if they fall into a category according to the definition. After processing half of all transcripts, the categories created up to that point were reviewed. Here, it was checked whether the definition of the categories was clear (no overlaps) and whether the level of abstraction was appropriate for the objective of the analysis. After reviewing the categories, the following two main categories were defined: Deployment options and decision criteria. After that, the material was worked through a second time (Mayring, 2014, pp. 80–81).

To ensure the quality of the coding, an intra-coder agreement check was carried out on a small scale to check to what extent the text segments were coded with the same code after a second time without seeing the already coded segments (Mayring, 2014, p. 111). Since the material has already been worked through twice and in order to not exceed the effort, this check was only performed on few text passages. The result is that all text passages were coded with the same code, with minimal differences in the length of the coded segments. Since there were only minimal differences, this can be evaluated as a measure of reliability. An inter-coder agreement check could not be performed due to the lack of a second coder.

Since the interviews were conducted in German and thus the transcripts were created in German, translation into English needed to take place at some point. It was decided to do the translation during the category formulation. When processing the German transcripts, the categories were thus defined in English and the passages were assigned accordingly. The creation of the transcripts and the content analysis was done with the help of the software MAXQDA.

After completion of the content analysis, the following results were obtained:

Deployment options:

- 1. On premise
- 2. On premise (by service provider)
- 3. Private cloud

Decision criteria:

1. Business focus	10.	System performance
2. Business processes	11.	Interfaces
3. Implementation methodology	12.	Innovations and updates
4. Costs and price model	13.	Data security
5. Employees competence	14.	System latency
6. Industry, process and country coverage	15.	External and mobile access
7. Extensibility and modifiability	16.	Individuality of the service level
8. Implementation period	17.	Number of service providers
9. Scalability	18.	Different needs at different sites

A detailed representation of the coding system can be found in Appendix 3 (incl. definitions and anchor samples). Which text sections were tagged with which code can be seen in the coded segments in Appendix 4. The content analysis thus revealed that a total of 5 different deployment options and 18 criteria are relevant in the decision-making process for the appropriate SAP S/4HANA deployment option.

- 4. Public cloud
- 5. Hybrid approach

3.5.2 Presentation of the interview results

In the following, the individual categories are explained in more detail. This includes an explanation of what the interview partners mentioned in relation to the respective categories and why the categories and the respective deployment options and decision criteria are relevant within the decision-making process.

Deployment options – On premise

As already mentioned in Chapter 2.1, in the case of the SAP S/4HANA on premise deployment, the customer is basically responsible for providing the system. This means that the customer must purchase the hardware independently and needs to ensure within the company that appropriately trained employees can take care of the operation of the system.

Deployment options - On premise (by service provider)

The deployment option "On premise (by service provider)" refers to the combination of the on premise software stack with hosting by a service provider. The company buys on premise licenses in this option but does not use them on servers in its own data center. Instead, it uses the offerings of service providers and thus outsources all server hosting activities.

Deployment options – Private cloud

The "Private cloud" option refers to the product SAP S/4HANA private cloud. In terms of the software stack, this is also on premise but unlike the previous option, SAP manages all further contacts with service providers and hyperscaler in this case. The costs here are charged through a monthly subscription model.

Deployment options – Public cloud

The "Public cloud" option represents the SAP S/4HANA public cloud product. This is the only option that actually uses a different software stack. As with the private cloud, SAP regulates all further contracts, and the costs are charged via a subscription model.

Deployment options – Hybrid approach

Technically speaking, the hybrid approach is not a deployment option in its own sense. As already explained in Chapter 2.3, it is rather a combination of two deployment options. Either an on premise option (on premise or on premise (by service provider)) can be combined with a cloud option (private cloud or public cloud) or the private cloud is combined with the public cloud.

Decision criteria – Business focus

Each company has a different business focus. This is also dependent on the respective strategy of the company. Within the interviews, a rough distinction is made between two different business focuses which are to be differentiated within the decision-making process: First, the focus on the core business of the respective company. This means that the company concentrates on the value-adding core processes and takes responsibility for these internally. For other processes and tasks that are not part of the core business, the company is willing to outsource them. In the second variant, the SAP system is part of the company's business focus because the company can generate

competitive advantages through the SAP system and its processes, or because the ERP system is simply part of the company's core business.

Decision criteria – Business processes

In the context of the business processes, the following aspects and considerations are mentioned by the participants: First, the current complexity of business processes within the company plays a role in the decision. For example, it is relevant whether the company is currently already working with standard processes or has strongly adapted the processes to its own needs. If greater adaptation is already done, the company must consider whether it wants to adopt the existing processes unchanged or whether it is willing to change these processes and is open to standard processes and best practices from SAP.

Decision criteria – Implementation methodology

The implementation methodology is divided into two approaches: One is the greenfield approach, and the other is the brownfield approach. In the greenfield approach, the system is implemented from scratch. This means that no data is transferred and the processes must be set up from the ground up by starting with the standard processes delivered by SAP. For customers who do not have an SAP system yet, this is the only applicable approach. Customers who already use an SAP system and want to perform a transition can choose between greenfield and brownfield. In the brownfield approach, the data and processes (depending on the required scope) can be transferred from the old system into the new one. This can provide the advantage that the changeover can be completed more quickly than with greenfield but in return all errors and legacy issues are transferred into the new system.

Decision criteria - Costs and price model

With regard to the costs incurred, there are basically two pricing models within the deployment options considered: One pricing model is the one-time license purchase for the system. This means the company has high initial costs. In the further course, regular maintenance fees are due, depending on the number of licenses purchased. In addition, the costs for the hardware and the necessary employees must be taken into account. This is in contrast to the subscription model. Here, the customer pays a monthly fee which is primarily dependent on the number of users. These costs already include any service fees and rent for the use of the servers. It can be said that these costs are more transparent because the price is clearly defined for the customer. There is no general answer to the question of which price model is actually more attractive for the respective company.

Decision criteria – Employees competence

The area of employees competence is partly linked to the business focus and thus also to the business strategy. Depending on this, the company may already employ personnel who have the appropriate competence and know-how to operate an SAP system independently. If this is not the case, the company must decide whether such employees should be educated internally, as it may be important to have this knowledge in-house. Alternatively, the company may decide to purchase this competence through external service providers.

Decision criteria - Industry, process and country coverage

Another important criterion is the coverage of the respective industry of the company. Depending on the industry, different processes are used. However, not all industries are covered by all deployment options. This coverage must therefore be checked in advance. The check can be done using the "Digital Discovery Assessment" (DDA) by SAP. In addition, the SAP Best Practices Explorer can be used to check which standard processes are available, how they are designed in detail and whether they might be applicable in the company. Finally, the country coverage must be checked. Some processes (e.g., in the area of finance) are very country-specific. Depending on the country in which the company wants to use the system, the corresponding country coverage must be verified.

Decision criteria - Extensibility and modifiability

The extensibility and modifiability of the system is another aspect that was frequently mentioned by the interview partners. Extensibility of the system refers to the ability to add more functions to the system. This can be done, for example, through add-ons. Depending on the respective deployment option, this extensibility is either more or less limited. If the customer already uses certain add-ons in their old SAP system, it must be checked to what extent they are also available in the new deployment option. Also, through modifications the system can be equipped with further functions or already existing functions can be changed. The scope of possible modifications varies depending on the option. If the company already knows that required processes cannot be mapped in the standard, it must be checked to what extent these processes can be modified in the respective deployment option to meet the needs of the company.

Decision criteria – Implementation period

The implementation period is also a distinguishing factor of the deployment options. On the one hand, the implementation period can depend on the implementation methodology. On the other hand, the extent of the used standard processes is an important indicator for the implementation period. Since the deployment options are partly more and partly less focused on the usage of standard processes, the implementation period also depends on the deployment option. In general, the closer the company stays to the standard processes and the fewer changes are made to the processes, the faster the implementation can be.

Decision criteria – Scalability

Scalability refers to the possible change in the size of the system. More precisely, it is about the flexibility in terms of performance, e.g., by adjusting the hardware. Depending on the deployment option, there are differences in terms of speed of execution and effort. This aspect can be particularly relevant for companies that have already planned concrete growth or acquisitions.

Decision criteria - System performance

The required system performance can also be a decision criterion. This aspect must always be taken into account if the company causes above-average system workloads for certain processes (e.g., due to the volume of requests). There is a deployment option where the company itself is responsible for the provision of the servers and can therefore influence the performance itself. In other deployment options, the company must request the necessary server configuration from a

service provider. And in yet another deployment option, the company shares the server resources with other customers of the service provider.

Decision criteria – Interfaces

The decision criterion "interfaces" refers to the possibility of connecting third-party systems to the SAP system. There are different ways of connecting a third-party system to an SAP system. For example, there is the option of connecting the SAP system to a third-party system at development level. Alternatively, the connection can also be established via the SAP Business Technology Platform (BTP). In this case, the BTP serves as an intermediary and manages (usually through application programming interfaces (APIs)) the exchange of data between the two systems. Depending on the deployment option, the options that can be used differ and the effort required to set up an interface can also vary. Companies that have already connected third-party systems with their old system, e.g., a manufacturing execution system (MES), and want the MES to exchange data with the new system as well, must check whether this connection can also be implemented in the new deployment option.

Decision criteria – Innovations and updates

Depending on the respective deployment option, the provision of system updates is different. On the one hand, there are differences in terms of cost. In some cases, only security updates and patches are included in the costs. Larger release updates are relicensed. On the other hand, there are differences in the scheduling of the updates. This means that the updates are either installed automatically on the system without any effort on the part of the customer and without any possibility of objection or the updates have to be actively planned, prepared and carried out by the customer himself. If the company wants constant access to the latest innovations, there is a further aspect to consider, because SAP publishes the latest versions in the public cloud first. These functions are then made available to the other deployment options at a later point in time.

Decision criteria – Data security

Another frequently mentioned decision criterion is the aspect of data security. Many companies either place a high value on data security of their own initiative or they are bound to comply with certain requirements by laws or specifications from the respective industry. Depending on these internal or external requirements, the decision for the deployment option can also be influenced. Either the company has stored the data on its own server in its own data center and is therefore responsible for data security itself. In this case, the company must have the necessary staff but it also has control over the data. Or the data is stored on external servers. If so, the company does not have to take care of data security itself but needs to rely on the information provided by the service provider.

Decision criteria – System latency

The system latency is important for a company if third-party systems are connected to the future system that expect a very short response time within the interface. This is the case, e.g., with MES which are often used in the manufacturing industry. If the two systems are located in different data centers and have to communicate with each other over a greater distance, this can lead to errors in the third-party system.

Decision criteria - External and mobile access

If internal employees need mobile access to the system (e.g., service employees or sales staff) or if external persons, such as customers or partners of the company, are to be granted access to the system (e.g., for a customer portal), then this criterion is relevant within the decision-making process. This is because, depending on the deployment option, setting up such access involves a lot of effort or almost none at all.

Decision criteria - Individuality of the service level

The "individuality of the service level" refers to the influence that the company has on the design of the services. This includes system availability, the handling of backups, and the planning of maintenance time windows. For example, it may be essential for a company that the SAP system has an availability of at least 99.9%. Or it is particularly important that system backups run according to a certain schedule. Depending on the deployment option, the influence on these aspects differs. For example, the company may be responsible for the service level itself, or the service level may be agreed with the service provider through service level agreements (SLAs). In the latter case, the available service level depends on the offer of the respective service provider.

Decision criteria - Number of service providers

The number of service providers can also be a decision criterion for companies. If the company has a contractual relationship with a higher number of service providers, the company faces more coordination effort. For this reason, some companies prefer to keep the number of service providers to a minimum.

Decision criteria - Different needs at different sites

The last decision criterion is relevant for assessing the appropriateness of a hybrid approach. Since a hybrid approach can only be considered if a company is represented at several sites, this deployment option is primarily intended for larger companies. However, if the company has different needs for the SAP system at these different sites, then it makes sense to consider a hybrid approach.

3.5.3 Analysis of the interview results

For further analysis of the coding of the interviews, two analysis functions of MAXQDA were used and their results are presented in the following sections.

Code matrix browser

The first analysis function used is the code matrix browser. This analysis shows the number of coded text segments per code and per interview. In order to identify possible differences between the roles (consultant or customer), the individual interviews are grouped according to the respective role of the interview partner.

The first part of the analysis focuses on different deployment options. The corresponding code matrix browser is shown in the following Table 2.

Deployment option	Consultants	Customers	Total
1. On premise	51	20	71
2. On premise (by service provider)	7	3	10
3. Private cloud	48	17	65
4. Public cloud	103	29	132
5. Hybrid approach	13	3	16
Total	222	72	294
Number of interviews	7	3	10
Average assignments	31.71	24.00	29.40

Table 2: Code matrix browser (deployment options)

The analysis shows that a total of 294 text segments deal with the deployment option. Of these, the consultants mentioned deployment options 222 times, while the customers mentioned it 72 times. However, this difference should not be weighted too heavily, as it must be taken into account that a total of 7 consultants were interviewed but only 3 customers.

An evaluation of the totals of the individual categories mentioned shows that the deployment options "On premise" and "Public cloud" were mentioned most frequently. This can be explained by the fact that these are the two options with the greatest differences and are therefore often distinguished from each other. This is also illustrated by the following interview quote:

"So on premise you can do anything you want. This is your own system. You can develop till the end. In the public cloud, the amount of development is very low and it is also recommended that you develop as little as possible in the public cloud." (Transcript ID 3, pos. 78)

The deployment option "On premise (by service provider)" was rarely mentioned in comparison. This might be due to the fact that the interview partners do not always separate the two options "On premise" and "On premise (by service provider)" clearly. Only in cases where the second option was clearly mentioned it can be coded accordingly. The "Hybrid approach" was also rarely mentioned. This fact is due to the lack of practical experience of the interview partners with this option, as the following quote shows:

"I have heard of that. But I do not have any experience with it yet." (Transcript ID 9, pos. 18)

In addition, the "Hybrid approach" consists of two other deployment options which are then treated separately from each other.

To compare the two roles despite the different number of interviews, the number of coded segments is divided by the number of interviews to obtain the average number of assignments per interview. A direct comparison shows that the consultants, with an average of 31.71 mentions, dealt with the options more often than the customers with 24.00 mentions (see Table 2).

In the second part of this analysis, focus is placed on the different decision criteria. The corresponding code matrix browser is shown in the following Table 3.

Decision criteria	Consultants	Customers	Total
1. Business focus	22	15	37
2. Business processes	39	14	53
3. Implementation methodology	22	14	36
4. Costs and price model	65	19	84
5. Employees competence	26	11	37
6. Industry, process and country coverage	32	15	47
7. Extensibility and modifiability	72	19	91
8. Implementation period	8	0	8
9. Scalability	23	14	37
10. System performance	7	0	7
11. Interfaces	26	10	36
12. Innovations and updates	43	13	56
13. Data security	25	9	34
14. System latency	1	3	4
15. External and mobile access	21	8	29
16. Individuality of the service level	19	19	38
17. Number of service providers	5	4	9
18. Different needs at different sites	3	1	4
Total	459	188	647
Number of interviews	7	3	10
Average assignments	65.57	62.67	64.70

Table 3: Code matrix browser (decision criteria)

One can see that a total of 647 text segments deal with decision criteria. 459 of these mentions were made by consultants, 188 by customers. As mentioned earlier, the unequal distribution of interview roles must be considered here.

It is also noticeable in the code matrix browser that the two criteria "Implementation period" and "System performance" were not mentioned at all by the customers. This can either be attributed to a lack of knowledge on part of the customers that the deployment options differ in these aspects, or the customers do not consider these criteria to be relevant.

In addition to the two criteria "Implementation period" and "System performance", the criteria "System latency" (4 times), "Number of service providers" (9 times) and "Different needs at different sites" (4 times) were also rarely mentioned by the interview participants. The criterion "Different needs at different sites" is directly related to the deployment option "Hybrid approach", as this criterion can be used to determine the usefulness of a hybrid deployment option. However, as stated above, the "Hybrid approach" was rarely mentioned which means that this criterion was also rarely mentioned. In addition, some participants understood the "Hybrid approach" differently than SAP (see Figure 7), as the following quote reflects:

"So for me, a hybrid model would be, for example: I have a S/4HANA private cloud and a SuccessFactors." (Transcript ID 7, pos. 38)

This different understanding also means that this criterion is less applicable. In contrast, the two criteria "Costs and price model" (84 times) and "Extensibility and modifiability" (91 times) were mentioned most frequently. The costs were often mentioned as they always play a relevant role in business decisions and because this criterion is an essential distinguishing characteristic between the deployment "On premise" and "On premise (by service provider)" versus "Private cloud" and "Public cloud". Also, the criterion "Extensibility and modifiability" is an essential distinguishing characteristic that clearly differentiates the "Public cloud" form the other deployment option. For this reason, the participants frequently mentioned this criterion. This is also demonstrated by the following quote:

"Of course, there are customization rules, customization capabilities in the public cloud as well. But these customization capabilities are very limited compared to the private cloud." (Transcript ID 7, pos. 116)

The comparison of the average assignments shows that the decision criteria were mentioned more frequently by the consultants (65.57 mentions) than by the customers (62.67 mentions). However, the difference is not as clear as in the previous comparison, which referred to the deployment options.

Code relations browser

The second analysis function used is the code relations browser. This analysis shows the number of text segments that are assigned with more than one code at the same time. With the help of this analysis, codes that frequently occur together can be pointed out and relations within the code system can be identified. The corresponding code relations browser is shown in the following Table 4.

	A.	B.	C.	D.	E.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
Deployment options																							
A. On premise	/	0	11	12	0	2	1	0	11	4	7	11	2	2	0	1	3	2	1	2	5	0	0
B. On premise (by service provider)	0	/	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
C. Private cloud	11	0	/	31	0	1	1	0	10	1	6	8	0	0	0	0	1	5	1	4	6	4	0
D. Public cloud	12	0	31	/	1	1	11	2	17	1	20	18	5	1	0	6	16	9	1	2	2	0	1
E. Hybrid approach	0	0	0	1	/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Decision criteria																							
1. Business focus	2	0	1	1	0	/	3	0	1	4	0	0	0	1	0	0	0	2	0	0	0	0	0
2. Business processes	1	0	1	11	0	3	/	2	3	0	2	6	1	1	0	0	3	0	1	0	0	0	0
3. Implementation methodology	0	0	0	2	0	0	2	/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Costs and price model	11	0	10	17	0	1	3	0	/	2	0	1	3	2	0	0	1	0	0	0	5	0	0
5. Employees competence	4	0	1	1	0	4	0	0	2	/	0	0	0	0	0	0	0	4	0	0	0	0	0
6. Industry, process and country coverage	7	0	6	20	0	0	2	0	0	0	/	3	1	0	0	1	1	2	0	0	0	0	1
7. Extensibility and modifiability	11	0	8	18	0	0	6	0	1	0	3	/	2	0	0	5	1	0	0	0	0	0	0
8. Implementation period	2	0	0	5	0	0	1	0	3	0	1	2	/	0	0	0	0	0	0	0	0	0	0
9. Scalability	2	1	0	1	0	1	1	0	2	0	0	0	0	/	0	0	0	0	0	0	0	0	0
10. System performance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	/	0	0	0	0	0	0	0	0
11. Interfaces	1	0	0	6	0	0	0	0	0	0	1	5	0	0	0	/	0	0	0	0	0	0	0
12. Innovations and updates	3	0	1	16	0	0	3	0	1	0	1	1	0	0	0	0	/	1	0	0	0	0	0
13. Data security	2	0	5	9	0	2	0	0	0	4	2	0	0	0	0	0	1	/	0	0	0	0	1
14. System latency	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	/	0	0	0	0
15. External and mobile access	2	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	/	0	0	0
16. Individuality of the service level	5	1	6	2	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	/	1	0
17. Number of service providers	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	/	0
18. Different needs at different sites	0	0	0	1	4	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	/

Table 4: Code relations browser

At the beginning, it is analyzed to what extent the different deployment options were mentioned by the interview partners at the same time (see upper left area of Table 4). In this area, "On premise" and "Private cloud" were frequently mentioned together (11 times). This is probably because the software stack on which these two options are based is the same and thus the technical architecture and functions are almost identical, as the following quote also illustrates:

"Or private cloud, because for me there is actually not much difference between private cloud and on premise." (Transcript ID 3, pos. 30)

There is also a relation between "On premise" and "Public cloud", as they were mentioned together in 12 passages. As stated in the code matrix analysis, these two options have the greatest differences and were therefore often distinguished from each other (example: Transcript ID 3, pos. 78). However, the two deployment options that were mentioned the most together are "Private cloud" and "Public cloud" (31 times). This circumstance is presumably due to the fact that the interview partners often spoke of "the cloud", referring to the private and public cloud, as can be seen in the following quote:

"Of course, now there is also the deployment option to do that in the cloud. Either in the public cloud or in the private cloud." (Transcript ID 9, pos. 14)

In the next step the relations between the deployment options and the decision criteria are checked (see upper right resp. bottom left area of Table 4). In this area, it is noticeable that decision criteria were frequently mentioned, particularly in connection with the deployment option "Public cloud".

More precisely, "Public cloud" and "Costs and price model" were addressed together 17 times. This could be cause by the frequent mention of the new public cloud billing model (see the following interview quote).

"As a customer, you do not have this one-time investment, i.e., this high entry price. But you actually only pay for the usage of the system. And the measure for this is the so-called full user equivalent." (Transcript ID 5, pos. 154)

At this point, however, it must be mentioned that this subscription model is not limited to the public cloud but is also used for the private cloud. "Public cloud" and "Industry, process and country coverage" were mentioned 20 times together. This coverage is particularly relevant for public cloud, as it is limited only in this deployment option. For the other three options (hybrid approach excluded), the coverage is fully available. Same applies to the "Extensibility and modifiability" in the "Public cloud", which occurred together in 18 passages. This is another area where the public cloud has limitations that play an important role in the decision. And "Public cloud" and "Innovations and updates" were addressed together 16 times. This common mention is due to the fact that, firstly, the latest innovations are first published in the public cloud and, secondly, the company has no influence on the installation of the updates. These are two unique characteristics of the public cloud, as the following two quotes also illustrate:

"If I move to public cloud then from my point of view one of the huge advantages is that I get innovations delivered continuously." (Transcript ID 7, pos. 236)

"In the public cloud you are not asked when an update is coming, but the update comes." (Transcript ID 2, pos. 146)

Finally, this passage focuses on the relations within the decision criteria (see bottom right area of Table 4). The decision criteria "Business focus" and "Employees competence" were mentioned
together 4 times. This is based on the fact that the viewpoint on the competence of the employees is often part of the business focus. The following quote serves as an example:

"It is also a bit about the philosophy. So do I want to have all the people in my company who understand the system from the ground up. Now I also have the control. And then I also want the control." (Transcript ID 10, pos. 16)

Also "Business processes" and "Extensibility and modifiability" occurred together in 6 passages because the interview partners talked about the fact that in some cases, due to the existing business processes through which benefits can be achieved, it is necessary to modify the system. An example is given in the following quote:

"So I built a transaction that no one else has and I am much faster than the others and it saves time." (Transcript ID 2, pos. 90)

In addition, the decision criteria "Costs and price model" and "Individuality of service level" were addressed together 5 times. This relation exists because adjusting the service level also influences the costs. "Employees competence" and "Data security" are also named together 4 times. In these cases, the interview partners talked about the extent to which internal employees should be trained in data security. See following example:

"Otherwise, I would have to build up all the qualifications myself to do data security. And that simply does not pay off. Because I am a specialist in the production of some great machines, but I am not a specialist in data protection and cybercrime and all that kind of things." (Transcript ID 1, pos. 179)

Finally, the decision criteria "Extensibility and modifiability" and "Interfaces" were also mentioned together in 5 passages. This is because the extensibility of the SAP system through add-ons was also mentioned in the context of the extensibility through the connection of third-party systems via interfaces.

Since the interviews were conducted in German, the quoted passages were translated into English. The original passages and their translations can be found in Appendix 5.

3.6 Weighting of the decision criteria

Through the qualitative expert interviews, the criteria that are relevant within the decision-making process were collected. Thus, RQ1 can already be answered. The RQ2 is:

Which weighting do the various criteria have in the decision-making process for organizations when choosing the appropriate SAP S/4HANA deployment option?

In order to answer RQ2 as well, the weighting of the decision criteria was evaluated in the following. The data collection was conducted in form of a survey.

3.6.1 Theoretical foundation of surveys

As already formulated in RQ2, the weighting of the decision criteria is to be evaluated. In order to be able to evaluate the answers in a goal-oriented manner, it was decided to address the questions to the participants in a structured manner. Thus, each participant should be asked the same

questions in the same format. Saunders et al. refer to this form of primary data collection as a "questionnaire" (p. 360). This form of data collection is in turn divided into "self-administered" and "interview-administered". In the first variant, the answers are recorded by the participants themselves. In the second variant, responses are documented by the interviewer (Saunders et al., 2009, pp. 362–363). Because the participants are easily accessible online and because the questions are not very complex, the format of internet-mediated questionnaires is applied (Saunders et al., 2009, p. 364). In the following, the term "survey" is used for this type of questionnaire.

Mainly closed questions were used as question format. They only allow a certain number of predefined answer options. This makes it possible for the participants to answer the questions more quickly and makes it easier to compare the answers (Saunders et al., 2009, pp. 374–375).

3.6.2 Practical realization of the survey

In order to evaluate the weighting of the individual criteria, a survey was conducted. The survey assesses the relevance of the 18 criteria that were evaluated during the expert interviews. The survey took place in an online format and was conducted using Google Forms. In addition, the surveys, such as the interviews, were conducted in German.

In order not to overwhelm the participants of the survey and not to take up too much of their time, it was decided to ask for the weighting in form of a six-level scale and not to carry out a weighting according to AHP (see Chapter 3.1). The weighting should be sufficient with the help of the scale and all asked participants should be able to find the time to participate. A six-point scale was deliberately chosen so that no mean value is included in the scale. The scale ranges from 1 "not relevant" to 6 "very relevant". Also, an option "I cannot judge" was deliberately left out, since all participants are assumed to have the necessary expertise. In addition to the 18 mandatory questions, there are two voluntary open questions at the end of the survey. On the one hand, participants had the opportunity to name additional criteria that had not yet been mentioned in the survey, and on the other hand, comments and feedback could be given. The entire survey can be found in Appendix 6.

The following section deals with the selection of survey participants and the sample strategy. The original plan was to include more people in the survey in addition to the ten people already interviewed. However, after consultation and feedback with some participants, it was decided not to do so, as the survey requires more background knowledge than expected. Thus, only the ten individuals who had already been part of the expert interviews took part in the survey. As with the interviews, the strategy of self-selection sampling was used in the survey. Although this has the disadvantage that the number of survey participants is quite small, it can be ensured that all ten participants have sufficient knowledge to answer the questions and that the results are not distorted. Of the ten experts invited to the survey, unfortunately only nine experts participated.

3.6.3 Survey results

To begin with, the results of the first 18 mandatory questions which were all formulated as closed questions, were examined. For an analysis of the survey results, MAXQDA Stats was used. The results of this statistical analysis can be seen in Table 5. In the table, the highest (green) and lowest (red) values per column are highlighted.

	Number of		Standard deviation			
Decision criteria	values	Mean	(Population)	Minimum	Maximum	Range
1. Business focus	9	5.00	1.32	2	6	4
2. Business processes	9	5.67	0.50	5	6	1
3. Implementation methodology	9	5.22	0.83	4	6	2
4. Costs and price model	9	4.11	1.05	3	6	3
5. Employees competence	9	4.33	1.00	3	6	3
6. Industry, process and country coverage	9	5.78	0.44	5	6	1
7. Extensibility and modifiability	9	5.11	1.05	3	6	3
8. Implementation period	9	4.44	1.01	3	6	3
9. Scalability	9	4.56	0.88	3	6	3
10. System performance	9	4.00	1.12	2	5	3
11. Interfaces	9	5.22	0.83	4	6	2
12. Innovations and updates	9	4.33	1.58	1	6	5
13. Data security	9	5.78	0.44	5	6	1
14. System latency	9	4.67	0.87	3	6	3
15. External and mobile access	9	4.78	0.97	4	6	2
16. Individuality of the service level	9	4.00	1.12	2	5	3
17. Number of service providers	9	3.89	1.05	2	5	3
18. Different needs at different sites	9	4.00	1.32	2	5	3

Table 5: Statistical analysis of the survey results

The number of values for the first 18 questions is always 9, since a total of 9 participants took part in the survey and an answer to the first 18 questions is mandatory. Due to the small number of participants, it must be pointed out that the expressiveness and generalizability of the further statistical analysis is limited.

When looking at the mean, the following important finding must be stated: All 18 decision criteria which were collected on the basis of the expert interviews and evaluated in the context of the content analysis, seem to be relevant in the decision process, since the mean is above 3.5 for all criteria. 3.5 is the middle of the six-point scale ((1+6)/2 = 3.5). Answer items 1 to 3 are on the irrelevant half of the scale, and options 4 to 6 are on the relevant half. Thus, if the mean of all answers is above 3.5, all criteria can be considered relevant. This confirms the validity of the previous results. The criterion "Number of service providers" has the lowest mean with a value of 3.89. This criterion therefore appears to be relevant in the decision-making process but not as relevant as other criteria. Two criteria have the highest mean with a value of 5.78: "Industry, process and country coverage" and "Data security". These two criteria therefore appear to have a particularly high value within the decision. The remaining means range between the two extreme values mentioned. Overall, it is noticeable that the means are very close to each other which implies that even small deviations represent a major difference in relevance.

When considering the standard deviation, it is noticeable that this is lowest (0.44) for the two criteria with the highest mean (criteria 6 and 13). This means that the participants also agreed most

on the two most relevant criteria. The answers to the criterion "Innovations and updates" have the highest standard deviation (1.58). In this area the participants seem to be very divided.

This fact also becomes clear when considering the range which has the possible maximum value of 5 for the 12th criterion, since the minimum (1) and maximum (6) of the scale are exhausted by the responses of the participants. When looking at the range in more detail, it can also be seen that it is logically lowest for the criteria with the lowest standard deviation (criteria 6 and 13).

Finally, the results of the last two questions, which were optional and could be answered openly, are discussed. Only one participant responded to the second last question which asked for decision criteria that had not yet been mentioned. The low number of responses is positive, as it means that almost all relevant criteria were already taken into account. In the answer, the survey participant mentioned the criterion "Trust in the ERP provider". The participant described this more precisely in terms of whether the strategic orientation of the ERP provider has an impact on the long-term planning of the company and whether the business needs of the company are supported in the long term. It was decided not to include this criterion in the decision for the following reason: This criterion implies a choice between different ERP vendors. However, since only deployment options from SAP are considered in this thesis, it is assumed that the decision has already been made in favor of SAP. Nevertheless, the aspects of this criterion should be examined in advance by the company to ensure whether SAP is the right provider at all.

The last question of the survey gave participants the opportunity to provide comments and feedback. This possibility was taken by three participants, whereby one of the three answers can be neglected as it does not contribute to the topic. In the first feedback, one participant noted that almost all criteria should have been rated with a 6. While this confirms the actual relevance of the criteria, it also shows that the scale is quite narrow, as only options 4 to 6 of the scale can be used for a relevant weighting. This problem has already been mentioned within the statistical analysis because the mean values of the answers are very close to each other. Small deviations in the mean value therefore already show large differences in relevance.

In the second feedback, a participant addressed the importance of the company's corresponding industry. The participant named the automotive industry as an example, for which not everything is available in the cloud yet. In contrast to the service industry, for which the missing features are negligible. As the result of the expert interviews shows, the mentioned aspect of the industry was already taken into account with the decision criterion "Industry, process and country coverage". In fact, this criterion (along with "Data security") appears to be the most important one in the decision as can be seen from the survey analysis.

The complete survey results can be found in Appendix 7.

4 SAP S/4HANA deployment options

In order to better understand the influence of the criteria in the decision for the appropriate option, the five deployment options are first presented in a basic way and then characterized based on the evaluated criteria. This is followed by a comparison of all five options. Finally, the RISE with SAP offering is presented, which is relevant for both the private and public cloud options.

4.1 SAP S/4HANA on premise

The deployment option "On premise" is offered as a product. Due to its few restrictions, it is suitable for all customers who want to have maximum control over their SAP system and want to host it in their own data center (SAP SE, 2021b, p. 17).

According to SAP, on premise is suitable for "customers who require:

- Complete control and ownership of their application and data landscape
- The ability to manage unique, customer-specific needs which cannot be addressed by public cloud or private cloud offerings
- The utilization of their existing IT departments, infrastructure, budget, and IaaS vendor agreements
- Specific compliance with industry- and country-specific regulatory requirements" (SAP SE, 2021b, p. 18)

In the following, the on premise deployment option is characterized based on the decision criteria:

Business focus

For an "On premise" solution, the customer must take care of the entire system, including hosting, administration, and maintenance. This option is therefore suitable for companies that like to take over the responsibility. On premise is also suitable for companies that control their core business with the ERP system and thereby generate competitive advantages, as this is where the highest degree of influence over the system is possible. For companies that want to outsource tasks outside their core business, this option is unsuitable.

Business processes

In the context of business processes, on premise offers the greatest flexibility. Here, all processes can be mapped in the standard on the basis of SAP Best Practices and any necessary modifications to the processes can be made in the system without any restrictions.

Implementation methodology

This option is also unrestricted in terms of the implementation methodology. On premise can be implemented with a greenfield approach as well as with a brownfield approach, e.g., if the company is dependent on the transfer of historical data.

Costs and price model

The pricing model of on premise basically requires the initial purchase of software licenses. This is followed by monthly maintenance fees which depends on the value of the software licenses. The

customer therefore faces high investment costs for the licenses at the beginning unless financing options are used to spread the sum over a longer period of time. It must also be taken into account that the customer must finance the entire infrastructure including hardware and employee costs.

Employees competence

As already mentioned, the customer is responsible for the entire system and therefore the customer needs employees with the appropriate competence. If the competence is not yet available, existing employees must be trained or new employees must be hired. For companies that value having the competence in-house or already have the relevant employees, on premise is the appropriate option.

Industry, process and country coverage

So far, the coverage of industries, processes and countries is still greatest in the on premise option. On premise has the largest number of industry solutions, the most best practices processes, and the solution is provided for the most countries.

Extensibility and modifiability

The extensibility of the system through add-ons is possible without restriction with on premise. This means that both SAP-approved add-ons and completely custom add-ons can be set up in the system. Modifiability is also unrestricted.

Implementation period

Depending on the implementation methodology and the number of modifications the system is rolled out with, it may result in longer implementation periods.

Scalability

As the customer is responsible for hosting, the customer must also provide additional hardware if this is no longer sufficient. In this case, also additional licenses have to be purchased. In the event of a downsizing of the system, it must be checked to what extent the hardware and licenses can be returned.

System performance

In the case of on premise, the system performance depends on the hardware configuration of the customer. However, there are no upper limits.

Interfaces

In terms of interfaces, the on premise option is unrestricted. Interfaces can be set up directly in the system or the BTP can be used to connect third-party systems.

Innovations and updates

In the on premise option only security updates and patches are included in the costs. Larger release updates are usually relicensed. Moreover, the customer has to install the updates on its own but can also schedule them in the way that is most suitable for the company. It must also be considered that SAP releases the latest innovations in the public cloud first. For customers who want to be up to date and have the latest innovations available, this option is unsuitable.

Data security

Since the customer is hosting the system on his own, he is also responsible for data security. In return, he knows exactly where his data is located and who has access to it.

System latency

Because the system is hosted in the data center of the customer, the customer has the possibility to connect other systems with very low latency as long as they are also hosted in the company's own data center.

External and mobile access

As the system is not accessible from the Internet by default, the customer needs to set up this access and ensure the appropriate security which requires an increased effort.

Individuality of the service level

The customer is responsible for any service (except support by SAP). This means that the customer can handle issues such as system availability and backups as desired.

Number of service providers

The number of service providers is kept to a minimum, as everything is performed in-house.

Different needs at different sites

If the company has different needs for the ERP system at different locations, a combination of this deployment option with another deployment option is conceivable.

4.2 SAP S/4HANA on premise (by service provider)

The deployment option "On premise (by a service provider)" is also offered as a product. As with on premise, this option is suitable for those customers who want to have maximum control over their SAP system but would like to hand over the hosting to a service provider (SAP SE, 2021b, p. 17).

This deployment option is the same installation as the "On premise" in terms of the software stack. The only difference is that hosting is managed by a service provider. Depending on the service agreement with the service provider, other aspects such as maintenance and administration are also taken over. For this reason, the following decision criteria are not discussed further, as they correspond with the "On premise" deployment option: business processes, implementation methodology, industry, process and country coverage, extensibility and modifiability, implementation period and interfaces.

Business focus

In this option, hosting is managed by a service provider. Therefore, this option is suitable for all companies that are willing to outsource tasks outside their core business. The scope of these tasks, such as maintenance and administration of the system, can be specified individually with the service provider.

Costs and price model

The costs and pricing model for this option vary widely, as they are negotiated individually with the service provider. As with on premise, the customer pays SAP for the software licenses and a monthly maintenance fee. In addition, there are costs for hosting and, if necessary, other tasks that the service provider takes over.

Employees competence

Compared to on premise, this option does not require the customer to have employees hosting the SAP system. However, depending on how much is taken over by the service provider, inhouse SAP expertise may be required for other tasks.

Scalability

The scalability of the system depends on the offering of the service provider. Since the service provider probably operates a larger data center, scaling the system is easier to handle than with on premise.

System performance

The system performance depends on the hardware configuration of the service provider chosen by the customer. However, there are no upper limits with regard to hardware specifications and resulting system performance.

Innovations and updates

Basically, this point is identical to the on premise option. In addition, the execution of updates must be coordinated and scheduled with the service provider. It must also be considered that SAP releases the latest innovations in the public cloud first.

Data security

The issue of data security is strongly dependent on the service provider. In contrast to on premise, the customer does not have direct access to the server, as it is localized in environment of the service provider. However, the service provider must ensure the security of the server. The details of data security must be contractually agreed between the customer and the service provider.

System latency

Since the system in this case is not hosted in the customer's own data center, the issue of latency must be considered in more detail. Depending on where the connected system is hosted (at the customer's site or even at the same service provider), the latency may be higher or lower.

External and mobile access

Depending on how the service provider makes the system available to the customer, the system is already available via the Internet. Setting up external and mobile access is therefore likely to require less effort than with on premise.

Individuality of the service level

The individuality of the service level of this option depends on the offering of the respective service provider. Depending which system availabilities and backup options the provider offers, those can be defined with the customer through an SLA.

Number of service providers

The number of service providers depends on whether the various tasks within the system hosting are performed by different providers or by the same provider.

Different needs at different sites

If the company has different needs for the ERP system at different locations, a combination of this deployment option with another deployment option is conceivable.

4.3 SAP S/4HANA private cloud

The deployment option "Private cloud" is offered as a service. Through the private cloud, customers receive cloud value and are provided with the latest innovations without having to forego their previous investments in the SAP system (such as modifications) by converting their old system to the private cloud (SAP SE, 2021b, p. 17).

According to SAP, private cloud is suitable for "customers who desire:

- Gradual transformation to a pure SaaS landscape at their own pace with a well defined conversion methodology
- Software, support, technical managed services, and infrastructure, from a single point of contact, with one set of SLAs
- Full SAP S/4HANA functionality 25 industries/64 countries with benefit of subscription-based, cloud economics
- Ability to safeguard prior investments including ECC customizations, configurations, and partner add-ons including SOLEXs and certified solutions" (SAP SE, 2021b, p. 18)

SAP S/4HANA private cloud (also referred to as SAP S/4HANA cloud, private edition or SAP S/4HANA PCE) is provided by SAP as part of the "RISE with SAP" offering (see Chapter 4.7). In terms of the software stack, this is also an on premise installation. In addition, hosting is provided by a hyperscaler. Unlike the "On premise (by service provider)" option, however, with the private cloud the customer only has a contract with SAP, all further service providers are managed by SAP. In the following, the private cloud is characterized based on the decision criteria:

Business focus

With this deployment option, the entire responsibility for hosting, administering, and maintaining the systems is handed over to a service provider (more precisely to a hyperscaler). The customer can therefore use this option to outsource any task related to the ERP system that does not fall within their core business and focus entirely on their core business.

Business processes

As already mentioned, this is also an on premise installation in terms of the software stack. This means that all the process customization options available on premise are also available in the private cloud. However, SAP advises not to stretch these possibilities too far.

Implementation methodology

See on premise.

Costs and price model

Unlike on premise, the private cloud is a subscription model that must be paid for on a monthly basis. The amount of the monthly costs depends primarily on the number of Full User Equivalents (FUEs). The minimum number for the use of private cloud is 60 FUEs.

Employees competence

Since the entire responsibility for hosting, administering, and maintaining the system is outsourced, SAP expertise on the part of the customer is neither mandatory nor required.

Industry, process and country coverage

See on premise.

Extensibility and modifiability

As with on premise, the extensibility and modifiability are unrestricted. However, modifications are not recommended by SAP.

Implementation period

See on premise.

Scalability

The scalability of the system is high in this deployment option because the system is already hosted by a hyperscaler and thus the size can be adjusted as desired and quickly.

System performance

See on premise (by service provider).

Interfaces

See on premise.

Innovations and updates

Unlike the options mentioned so far, all updates are included in the costs for the private cloud. But the customer needs to schedule and organize the updates together with SAP. However, it must be taken into account here that the updates can only be postponed until a certain time. The minimum update frequency is five years in order to stay in the mainstream maintenance of SAP.

Data security

See on premise by service provider.

System latency

See on premise by service provider.

External and mobile access

Since the system is already available via the Internet, setting up external and mobile access requires less effort than with on premise.

Individuality of the service level

The individuality of the service level is limited as one is restricted to the offering of SAP. If a customer does not agree with SAP's offer, e.g., with regard to system availability or the backup strategy, this option is not suitable.

Number of service providers

In the case of private cloud, the customer has a contractual relationship exclusively with SAP. SAP is responsible for coordinating other service providers such as the hyperscaler. The customer therefore has the advantage that he only needs to be in contact with SAP.

Different needs at different sites

If the company has different needs for the ERP system at different locations, a combination of this deployment option with another deployment option is conceivable.

4.4 SAP S/4HANA public cloud

The deployment option "Public cloud" is also offered as a service. Customers who want to implement a new SAP system receive a complete, modern SAP system with predefined processes through the public cloud (SAP SE, 2021b, p. 17).

According to SAP, public cloud is suitable for "customers who desire:

- A complete, modern, native SaaS ERP solution with the full benefits of public cloud
- The fastest path to innovation and the lowest TCO
- A clean Cloud ERP solution without converting old/legacy ERP processes and configurations.
- To reimagine business processes and take advantage of standardized best practices" (SAP SE, 2021b, p. 18)

Compared with the deployment options mentioned so far, the SAP S/4HANA public cloud (also referred to as SAP S/4HANA cloud) has a different software stack, resulting in some significant differences, particularly in the areas of "Industry, process and country coverage" and "Extensibility and modifiability". SAP is clearly focusing on the usage of standard processes with the public cloud. Only minor deviations from the standard processes and best practices are possible. In addition, several customers share the same server environment, which also means that the customizations must be limited based on technical feasibility aspects. Such as the private cloud, the public cloud is also an SAP offering as part of the "RISE with SAP" strategy (see Chapter 4.7). In the following, the public cloud is characterized based on the decision criteria:

Business focus

See private cloud.

Business processes

As already mentioned, standard processes and SAP Best Practices are to be used in the public cloud. Only minor deviations are permitted. This option is therefore unsuitable for customers for whom these standards are not applicable.

Implementation methodology

The public cloud can only be implemented with the greenfield approach. A brownfield approach is not possible which means no legacy data can be transferred.

Costs and price model

As for the private cloud, the public cloud is a subscription model that is charged monthly. Unlike the private cloud, the minimum number of FUEs is not 60, but 35, making the public cloud suitable for smaller organizations.

Employees competence

See private cloud.

Industry, process and country coverage

In contrast to the options mentioned so far, the public cloud has limitations in terms of industry, process and country coverage. Not all SAP industry solutions are available in the public cloud. Some country versions are also missing in the public cloud. This aspect must therefore be evaluated before a decision can be made, using the tools SAP DDA and SAP Best Practices Explorer.

Extensibility and modifiability

Also, in the context of extensibility and modifiability, the public cloud is restricted. On the one hand, only add-ons that are certified by SAP can be used in the public cloud. On the other hand, the standard processes can only be modified to a certain degree.

Implementation period

Since the modifiability of the public cloud is limited and the overall focus of the public cloud is on the usage of standard processes, the implementation period is also shorter than for the previous options. The many and partly in-depth process adjustments which are very time-intensive, are eliminated.

Scalability

See private cloud.

System performance

Because public cloud customers generally share the infrastructure with other customers, it is possible that the system may reach its limits when many customers exhaust the performance of the server at the same time.

Interfaces

With the public cloud, only the BTP can be used to connect third-party systems. In principle, it should still be possible to connect all the required systems. In exceptional cases, however, the effort required may be so high that the creation of an interface may be uneconomical.

Innovations and updates

As with the private cloud, all future updates are included in the monthly fee for the public cloud. However, the customer can neither decide whether the updates are installed nor when they are installed. They are installed automatically every six months. In return, the customer has the advantage of always having the latest software version with all the latest innovations.

Data security

See on premise by service provider.

System latency

See on premise by service provider.

External and mobile access

See private cloud.

Individuality of the service level

See private cloud.

Number of service providers

See private cloud.

Different needs at different sites

If the company has different needs for the ERP system at different locations, a combination of this deployment option with another deployment option is conceivable.

4.5 SAP S/4HANA hybrid approach

The hybrid approach cannot be clearly defined. Rather, it is a possible combination of two of the deployment options mentioned so far. Thus, the characteristic of the hybrid approach depends on the choice of combination. The possible combinations are shown in Figure 7.

Different needs at different sites

In general, this option is interesting for companies that have different needs for the ERP system at different sites. This means that two different deployment options are used at the sites and both systems are connected with each other.

4.6 Comparison of the deployment options

In this section, the deployment options are compared in order to better understand their differences and similarities. In the first step, a comparison of SAP is used which focuses on the different responsibilities of the deployment options (see Table 6).

	SAP S/4HANA Public Cloud	SAP S/4HANA Private Cloud	SAP S/4HANA On-Premise	
License Model	Software Subscription *		Perpetual Software	
Implementation	Partner / SAP / Customer			
Content Ownership	SAP / Partner / Customer	Partner / SAP / Customer		
Application Management Services	SAP *	Partner / Customer / SAP ECS		
Content Lifecycle Management	SAP *	Partner / Customer / SAP ECS		
Product Support	SAP *	SAP *	SAP / Resell Partner	
Technical Operations	SAP *	SAP *	Partner / Customer / SAP ECS	
Infrastructure	Hyperscaler / SAP *	Hyperscaler / SAP*	Customer DC / Hyperscaler / SAP / Premium Supplier / Partner	
			* Included in SAP Subscription	

Table 6: Comparison with focus on responsibilities Source: SAP SE, 2021b, p. 19

In this comparison, the option "On premise (by service provider)" is not explicitly mentioned but it is part of the "On premise" deployment option with the infrastructure being provided by a hyperscaler, partner, etc. It is noticeable that, particularly in the case of the public cloud, many tasks fall within SAP's area of responsibility. On the one hand, this has the advantage for customers of only having to coordinate these areas with one single partner, SAP. On the other hand, it has the disadvantage that the customer is restricted to SAP as a partner. A service provider other than SAP is not intended for the public cloud in the areas of Application management services, content lifecycle management, product support, and technical operations.

In the second step, the deployment options are compared based on the 18 evaluated decision criteria. In this comparison, the hybrid approach is excluded since it is a combination of the other deployment options. The comprehensive table can be found in Appendix 8.

4.7 RISE with SAP

RISE with SAP is a relatively new offering, released in early 2021. However, it is not a new or standalone product. Rather, it is a package of already existing SAP offerings which is intended to provide customers "business-transformation-as-a-service". RISE with SAP is designed to make it easier for customers to enter the SAP cloud world. The core strategy of RISE with SAP is to bundle the different components into one offer and thus into one single contract between the customer and SAP. Thus, the customer has to pay a fixed monthly amount, coordination is only necessary with SAP. All other services, e.g., the hosting of the SAP system by a hyperscaler, are managed by SAP (Fesko, 2021). RISE with SAP consists of the following solutions, tools and services:

Cloud ERP

The core component of the RISE with SAP offer is S/4HANA cloud. Here, the customer can choose between the two deployment options private cloud and public cloud (SAP SE, n.d.-b).

Business process intelligence

Another part of the bundle is the business process intelligence starter pack. This pack includes, among other things, user licenses for SAP Signavio. With this tool business processes and business decisions can be modeled and analyzed (SAP SE, n.d.-a).

Business platform and analytics

The contents of this component refer to the BTP. Depending on the volume of private or public cloud licenses, the customer is granted credits that can be used in the BTP (SAP SE, n.d.-b).

Business networks

The business network starter pack offers the customer access into the following networks: Ariba network, SAP Asset intelligence network and SAP logistics business network (SAP SE, n.d.-b).

Outcome-driven services and tools

The last component refers to services provided to the customer by SAP partners. The most important part here are the hyperscaler partners: AWS, Google Cloud and Microsoft. The customer can choose between them in terms of hosting of the cloud system (SAP SE, n.d.-a).

More details on what is included in the RISE with SAP offering can be found in the following SAP presentation slide (Figure 11).



Figure 11: RISE with SAP - What's really included? Source: SAP SE, n.d.-b

5 Design of a decision model

Now that the criteria as such (RQ1) and the weighting of the criteria (RQ2) have been evaluated, the last part of this thesis is about the design of a decision model and therefore about the answer to RQ3:

How should a decision model be designed to support organizations in the process of choosing the appropriate SAP S/4HANA deployment option?

5.1 Theoretical foundation of decision models

In order to create a common knowledge base, the following two sections present the design science research framework on the one hand and the decision model and notation on the other.

5.1.1 Theoretical foundation of design science research

The design of the decision model is done within the DSR framework by Hevner et al. (2004). "DSR seeks to enhance human knowledge with the creation of innovative artifacts and the generation of design knowledge [...] via innovative solutions to real-world problems" (vom Brocke et al., 2020, p. 1). This solution-oriented practical approach is therefore particularly suitable for creating an answer or solution for the RQ3.

The DSR framework basically consists of three different areas: Environment, knowledge base and IS research. The area of environment includes people, organizations, and technology. In this case, it is about those organizations that are dealing with the different deployment options of SAP S/4HANA and are faced with the decision to implement a new system or change the deployment option of their existing one. People with different roles are involved in this process, such as the users of the SAP system and the employees of the IT department. However, the decision-makers in the company who finally decide which deployment option is to be selected are most important. In addition, the processes and strategies of the companies must be taken into account, as shown by the corresponding evaluated decision criteria (e.g., "Business processes" and "Business focus"). In the area of technology, one of the things that must be considered is the existing infrastructure of the companies.

The knowledge base includes the foundations and methodologies. In the case of this thesis, the foundations refer to research of ERP system selection and the six areas of selection criteria by Hecht (1997). However, since there is no further research in the area of ERP system deployment options and the corresponding decision criteria, methods are used to collect and analyze data in order to extend the knowledge base (expert interviews and survey).

The center of the framework, the IS research, covers the development and building of a theory or an artifact and subsequently about the evaluation of it. Here, the business needs of the environment must be taken into account and the foundations and methodologies of the knowledge base must be applied.

The comprehensive framework is shown in Figure 12.



Figure 12: DSR framework Source: Hevner et al., 2004, p. 80

5.1.2 Theoretical foundation of decision model and notation

The decision model is to be designed in a generally valid standard so that it can be applied in the same way for all companies. For this reason, the decision model was created in the DMN. The DMN is part of the Business Process Model and Notation (BPMN) which in turn was developed by the Object Management Group (OMG) (Object Management Group, n.d.). DMN is supported by Signavio, among others, that developed the first web-based BPMN modeler. Signavio was founded by alumni of the Hasso Plattner Institute (HPI) (SAP SE, n.d.-f). Hasso Plattner is a co-founder of SAP (SAP SE, n.d.-e). Meanwhile, Signavio has been purchased by SAP and is now made available to customers as part of the RISE with SAP strategy (see Chapter 4.7). The included licenses of the business process using BPMN but also to create and display decision models using DMN. In this thesis the DMN version 1.2 (release date: January 2019) is used because this is the version currently supported by Signavio. By now there is already version 1.4 available (release date: March 2022) but it is still in the beta phase. Version 1.3 was published February 2021 (Object Management Group, n.d.).

According to OMG, modeling organizational decisions in DMN helps all stakeholders (see DSR framework: People) understand even complex domains of the decision more easily through the graphical representation of diagrams. Moreover, DMN provides "... a natural basis for discussion and agreement on the scope and nature of business decision-making" (Object Management Group, n.d.).

The basic concept of DMN consists of three parts: the decision requirements level, the decision logic level, and the decision services. For a better understanding of the further procedure, the

decision requirements level is explained in more detail. For this purpose, the OMG defines a decision in the DMN specification as follows: "a decision is the act of determining an output value (the chosen option), from a number of input values, using logic defining how the output is determined from the inputs" (Object Management Group, 2019, p. 28). The input value can flow into a decision in form of input data or in form of an output of another decision. "[The] decision logic may [(but does not need to)] include one or more business knowledge models which encapsulate business know-how in the form of business rules, analytic models, or other formalisms" (Object Management Group, 2019, p. 28). "Source documents from which business knowledge models are derived, or sets of test cases with which the decisions must be consistent" (Object Management Group, 2019, p. 28) can be indicated by knowledge sources. These dependencies can be represented in a decision requirement graph which can be displayed in form of a decision requirements diagram (DRD) (Object Management Group, 2019, p. 29). A sample DRD is shown in Figure 13.



Figure 13: Sample DRD Source: Object Management Group, 2019, p. 29

Another important aspect of DMN are decision tables. "A decision table is a tabular representation of a set of related input and output expressions, organized into rules indicating which output entry applies to a specific set of input entries" (Object Management Group, 2019, p. 77). A sample decision table is represented in Figure 14.





In addition, decision tables usually consist of several rules (represented as rows in Figure 14). If rules overlap, i.e., more than one rule corresponds to the input values, a hit policy must be determined in order to clearly define the decision logic and output. Basically, hit policies can be classified into single hit and multiple hit policies. With single hit tables, the output of only one rule is returned, regardless of whether there are overlapping rules or not. Single hit policies are "unique" (this is the default value), "any", "priority", or "first". With multiple hit tables, the output order", "rule order", or "collect" (with the operators: sum, min, max, and count) (Object Management Group, 2019, pp. 87–88).

5.2 Practical design of the decision model

Within the practical design of the decision model, first, the application of the DSR framework is elaborated and second, the concrete usage of the DMN is explained.

5.2.1 Application of design science research

This section focuses on how the DSR framework supports the process of creating the artifact. The artifact created in this thesis is the decision model which is described in the next Chapter 5.2.2.

First, the knowledge base is examined. As already explained, the knowledge base regarding the decision of the appropriate deployment option for ERP systems and its decision criteria is rather limited. This is the reason why an explorative research design was chosen in this thesis. Nevertheless, methods that are available within the foundations of the knowledge base were selected and applied: Expert interviews, qualitative content analysis according to Mayring (2014) and the collection of data in form of a survey. As a basis for the creation of the semi-structured interview guideline, the classification of ERP system selection criteria according to Hecht (1997) was used.

Second, the focus is set on the environment. Here it was necessary to evaluate the business needs of the environment. For this work, it means evaluating the decision criteria that are relevant for the companies that are currently dealing with this decision process. For this purpose, the methods just mentioned were applied. In the first step, the criteria as such were evaluated (RQ1) and then, in a second step, their weighting was additionally determined (RQ2).

The IS research then involved the development and building of the artifact, i.e., the decision model (RQ3). In this process, the existing findings of the knowledge base and the newly gained insights from the environment were included in the design process. In addition to development and building of the artifact, justifying and evaluating the artifact was also part of the IS research. At this point, it must be stated that the finished artifact, the decision model, has not yet been tested in the environment, as this would have exceeded the scope of this thesis. However, an intermediate result of the research was verified. The decision criteria that were identified in the expert interviews and in the qualitative content analysis were confirmed with the help of the survey. It was thus possible to verify that all evaluated criteria are actually relevant in the decision-making process.

Nevertheless, the finished decision model should be evaluated and applied in the appropriate environment as part of a further study. This evaluation should take place in order to check to what extent the artifact actually contributes to solving the problem and to what extent it supports the companies in choosing the appropriate deployment option. For this purpose, the environment should define in advance what makes the artifact successful. The following methods serve as suggestions for evaluating the decision model:

- Provision of the decision model to companies that are currently in this decision-making process. Subsequently, conducting feedback discussions with the responsible employees.
- Organization of workshops in which both consultants and customers participate and in which the decision model is discussed.
- Observation of the decision process in several companies. Subsequently, checking to what extent the taken decision corresponds to the result of the decision model. This is followed by an analysis of the discrepancies.

In all cases, the test results must be worked into the decision model in order to improve it. This procedure can be done in several iterations until the environment is satisfied with the problem solving of the artifact.

Due to the exploratory research design, it is categorically difficult to generalize these findings and thus expand the general knowledge base. Nonetheless, the following two findings can be drawn from the research results: First, it has become clear through the research within this thesis that the decision, or the question of which deployment option is the appropriate one, is complex. On the one hand, this was directly addressed by an interview partner:

"As I said, the most important thing: It is a difficult question, an extremely complex question." (Transcript ID 7, pos. 292)

On the other hand, with 18 criteria, there are many aspects that influence the decision and contribute to the complexity.

The second finding relates to the evaluated criteria. It becomes apparent that some criteria have general applicability (e.g., data security). When it comes to other criteria, the experts were not as unanimous (e.g., innovations and updates). This means that these criteria should be assessed on a company-specific basis.

Therefore, one might draw the conclusion that these two findings can be generalized to the extent that they are fundamentally valid in the decision-making process between different deployment options of an IS. On the one hand, it does not matter from which vendor the products come from. It does not have to be SAP, but can also be e.g., Oracle. On the other hand, it does not matter whether it is specifically an ERP system, or any other IS such as human capital management (HCM) or customer relationship management (CRM) system. However, this generalization should be validated through further studies.

5.2.2 Application of decision model and notation

As previously mentioned, there are basically four elements available in DMN: decision, input data, business knowledge model and knowledge source. To create the decision model for selecting the appropriate SAP S/4HANA deployment option, it was decided to split this decision into two: The first decision is called "Check for hybrid approach" and is to decide whether a hybrid approach might be appropriate for the company. The second decision is called "SAP S/4HANA deployment option". It determines which of the four deployment options (hybrid approach excluded) is appropriate for the company. In addition, there are five knowledge sources that have an influence on the decision, as illustrated by the statement of one interview partner:

"Our customers need maximum consultation from us in this selection process." (Transcript ID 7, pos. 46)

The company should in any case seek the support of a consulting partner and not make the decision about the deployment option on its own. This means that the knowledge source "consulting partner" influences both decisions of the decision model. The knowledge sources "Business strategy", "Law or industry standard", "SAP Best Practices Explorer" and "SAP DDA" have an influence on the second decision. The business strategy has an influence on various aspects of the decision, as the following two expert statements demonstrate:

"This is more than just an implementation methodology. I would say it is already a business strategy." (Transcript ID 1, pos. 121)

"Well, that is of course strongly dependent on the business strategy, I would say." (Transcript ID 4, pos. 67)

For this reason, "Business strategy" is also modeled as a knowledge source. In addition, the company must comply with existing laws (e.g., the GDPR) and, if relevant, industry standards which may also have an impact on the decision. Last, "SAP Best Practices Explorer" and "SAP DDA" also serve as knowledge sources. Through these tools, the company can view the standard processes and check whether they can be used within their own business, and also check the industry and country coverage of each deployment option. Business knowledge models were not used in the context of this decision model, because there are no functions in this model that are reusable and should be encapsulated. The resulting DRD is shown in Figure 15.



Figure 15: DRD of the decision model

The focus now shifts from the DRD towards the two decision tables. At the beginning, the details of the first decision table "Check for hybrid approach" are explained. This decision table has one input and one output. The input is the decision criteria "Different needs at different sides". In order to be able to use the decision model easily and quickly in practice, the input expression was defined by allowed values (answer options). If open input expressions were used, the evaluation would have to be done manually. To keep the decision model as simple as possible, exactly two allowed values were defined: "There are different sites with different ERP needs" and "There are no sites that have different needs". The output is called "Hybrid" and also has two allowed values "Yes" and "No", which is then in turn an input for the second decision table. For each of the two input entries a corresponding rule was created. In total, the first decision table has two rules. Since these rules do not overlap and only one output entry is to be returned, the single hit policy "unique" (represented as "U") was used.

Next the details of the second decision table "SAP S/4HANA deployment option" are explained. The second decision table includes 18 input data. These are the 17 remaining decision criteria that were collected in the previous study and the output of the previous decision. For the output of the second decision, the following consideration was made: For each rule i.e., combination of inputs, one could return one best matching deployment option as output. However, this would have the disadvantage that the result is very one-sided and other deployment options, which might be almost as good as the best one, are completely excluded. Therefore, the output was done in fivefold

quantity. Each deployment option gets its own output component and returns the corresponding percentage value of how well the respective option fits on basis of the input entries. The second decision table therefore consists of 18 inputs (17 decision criteria and the output of the previous decision) and 5 outputs (5 deployment options).

As with the first decision, allowed values were used in the second decision. More precisely, exactly two allowed values were defined for each of the 17 input expressions. Example: Input expression "Implementation methodology" has the two allowed values "Greenfield" or "Brownfield". The allowed values of the input "Hybrid" were already specified in the first decision.

Next, the rules of the second decision table are shown in more detail. In each rule only one input expression or one input entry was specified, the remaining input entries were set to irrelevant. In addition, one rule was created for each of the two allowed values. This means that with 18 input expressions and two allowed values each, the decision table consists of 36 rules in total.

Since exactly 18 of the 36 rules always apply due to the structure of the rules (under the condition that one of the allowed values is specified for each of the input expressions), the second decision table is a multiple hit table. Moreover, in the final result the respective percentage values of the individual output entries are to be added up for each output component. Thus, the multiple hit policy "collect" with the operator "sum" (represented as "C+") proved to be the appropriate policy.

Depending on the input expression (decision criteria), the output component can be positively evaluated either at one or at both input entries. First example: input expression "Implementation methodology" and output component "Public cloud". Here the public cloud can only be evaluated positively with the input entry "Greenfield". With the input entry "Brownfield" it is evaluated negatively since a brownfield implementation is not possible with the public cloud. Second example: input expression "Implementation methodology" and output component "on premise". Here, on premise can be evaluated positively for both input entries, since greenfield and brownfield implementation is possible with on premise.

Subsequently, the calculation of the respective output entries and the consideration of the weighting of the individual input expressions (decision criteria) is described. As already explained in Chapter 3.6, the weighting of the criteria was evaluated. However, since the decision criterion "Different need at different sites" was examined in advance in the first decision, the weighting is now to be distributed among the remaining 17 criteria. To weight the remaining 17 criteria, the mean of the respective values was used. The sum of the 17 mean values (80.89) was set as 100%. Then the corresponding percentage distribution was calculated. Example for "Business focus": The mean is 5.0 (see Table 5). 5.0 / 80.89 = 6.18%. This results in the following percentage distribution for the weighting (sorted in descending order): Data security (7.14%), Industry, process and country coverage (7.14%), Business processes (7.01%), Interfaces (6.46%), Implementation methodology (6.46%), Extensibility and modifiability (6.32%), Business focus (6.18%), External and mobile access (5.91%), System latency (5.77%), Scalability (5.63%), Implementation period (5.49%), Innovations and updates (5.36%), Employees competence (5.36%), Costs and price model (5.08%), System performance (4.95%), Individuality of the service level (4.95%), Number of service providers (4.81%). These calculated percentages were entered at the respective output entries that are positively weighted.

If a valid input entry is entered for each input expression, the output is displayed, which is split among the five output components. Each output component can have an output value between 0 and 100 percent. The output of a possible result as displayed in Signavio is shown in the following Figure 16.

Calculated result				
On premise	On premise (by s	Private cloud	Public cloud	Hybrid approach
66.37%	73.65%	78.86%	89.71%	0.00%

Figure 16: Sample result of the decision model

The sample result shown in Figure 16 indicates that the deployment option "Public cloud" best fits the requirements of the customer (based on the selected input entries) with 89.71%. The second-best option is the private cloud with 78.86%. The hybrid option is specified as 0% in this case. This means that the customer does not have different needs for different sites and thus the hybrid approach does not seem advisable. However, it must be taken into account that the output "Hybrid approach" can only have the value 0% or 100% and should therefore rather be understood as an indicator. If the value 100% is returned, the decision model should be executed specifically for one site and on the basis of its own needs.

The two complete decision tables can be found in Appendix 9. The input mask of this decision model as displayed in Signavio is shown in Appendix 10. Appendix 11 contains an export of the decision model in DMN 1.2 Extensible Markup Language (XML) format. This code can be imported into DMN modeling tools, which support this format (e.g., Camunda or BPMN.io) in order to adapt it (e.g., adjust weighting of the decision criteria) and apply it.

6 Discussion and future research

The overall aim of this thesis was to support companies in making the right decision regarding the selection of the appropriate SAP S/4HANA deployment option. Since existing research is very limited an exploratory research design was used to gain initial insights in this area. During the research, initial answers to the three research questions could be found. Relevant decision criteria were collected, the weighting of these criteria was evaluated and based on these findings a decision model was created which is intended to support companies in their decision.

Unfortunately, due to the exploratory research design and relatively small sample size of ten interview partners and nine survey participants, subjectivity of the results could not be prevented. Consequently, these qualitative results were difficult to generalize. Future research should expand the scope of the survey. The results will then be more robust, have a quantitative claim, and thus be more transferable to the aggregate. In addition, the view of the deployment options should be considered more broadly. In contrast to this study, which refers to SAP and ERP systems, further studies can conduct research independent of the vendor and look at other IS besides ERP (e.g., HCM and CRM).

Another factor influencing the results of this thesis are the methods used. If, e.g., focus group interviews or workshops had been conducted instead of expert interviews, this might have led to different research results. Thus, in future research, other methods could be deliberately used to compare the results. In the context of expert interviews, the selection of experts is a particularly important influencing factor. Only experts with at least eight years of relevant professional experience were selected and additionally the experts come from different companies (ten experts from seven different companies) in order to include as versatile experiences as possible. Additionally, consultants as well as customers were selected to gather results from different perspectives. Nevertheless, due to the surroundings of the author, it could not be avoided that eight of the ten experts have their main focus on the manufacturing industry. This could have led to a predominance of decision criteria that are particularly relevant in this industry, e.g., a low latency to linked systems such as MES. In the future, research should therefore also be conducted in other industries, such as service industry, consumer goods industry and public sector.

The result is influenced not only by the data collection through expert interviews but also by the data analysis which was carried out on the basis of the qualitative content analysis according to Mayring (2014). An alternative would have been, e.g., the content analysis according to Krippendorff (2018). To verify the results of the content analysis, an intra-coder agreement check was successfully performed on a small scale, but an inter-coder agreement check could not be performed due to the lack of resources.

This was followed by a survey to determine the weighting of the criteria. The number of participants was deliberately kept low due to the complexity of the survey and in order not to blur the results. Nevertheless, the survey was very small, with 9 participants in the end. If the number of participants would have been increased, this would certainly have had an influence on the results. The results would then also have had a qualitative claim, but the quality of the answers could then no longer have been guaranteed. After the criteria and their weightings were collected, the design of the decision model followed. The design process was based on in the DSR framework according to Hevner et al. (2004). Using other frameworks, e.g., the one according to Peffers et al. (2007) or Vaishnavi & Kuechler (2004), would have had an impact on the results of this thesis. Moreover, the DSR framework has not been carried out in several iterations. Most importantly, the final artifact, the decision model, has not yet been applied and tested in the environment. Therefore, it cannot be definitively confirmed that the artifact provides the desired solution to the problem. The applicability and quality of the decision model must therefore be evaluated in practice as part of a further study.

In addition, it should be mentioned that only the deployment options of SAP S/4HANA were considered in this thesis. This is because SAP is the global market leader and S/4HANA is their most important product, so the relevance in this area is the greatest. Neither products from other ERP vendors were taken into account, nor were other ERP products from SAP, such as Business One (SAP SE, n.d.-d) and Business ByDesign (SAP SE, n.d.-c), included. However, this is due to the fact that these two SAP ERP products mentioned are primarily intended for smaller organizations.

Upon further consideration of the deployment options, two additional areas of research emerge for future studies: On the one hand, the deployment in the cloud leads to a trend towards standard processes which also reduces the effort required for consulting and development. In addition, the RISE with SAP offering removes areas of responsibility from SAP partners which SAP now takes over directly (see Table 6). This leads to the following research question for future studies: What impact does the deployment of an ERP system in the cloud have on IT consultancies and the role of the consultant within an ERP implementation project?

On the other hand, there is an important development of cloud deployment which is caused by the Russia-Ukraine war. SAP is reacting to it "... by stopping all sales and shutting down cloud operations in Russia" (SAP SE, 2022). This forces Russian companies to transfer their data from the cloud to their own system, otherwise the data will be deleted. As a result, the following research question for future studies arises: What influence does the Russia-Ukraine war and the resulting sanctions against Russia have on the willingness of companies to have their ERP system deployed in the cloud? A first study considering parts of this research question was already published by George & George (2022).

7 Recommendation for action

As part of this thesis, a decision model was designed to support companies in their decision-making process to choose the appropriate SAP S/4HANA deployment option. When applying the created decision model, the following aspects should be considered:

Since the decision model only includes SAP S/4HANA deployment options, this requires the company to have already decided in favor of SAP S/4HANA. Therefore, the company must check in advance to what extent SAP as a provider and S/4HANA as a product match the business strategy and the requirements for an ERP system of the company. This decision is linked to a certain minimum size of the company in which SAP S/4HANA can be implemented in a meaningful way.

As can be seen in the decision model, the industry and the prevailing processes of the company are an important aspect within the decision. The company should therefore consider the SAP Best Practices Explorer and the DDA tool to check the extent to which the industry and processes are available in the respective deployment options.

Moreover, no knock-out criteria were defined in the decision model. However, if the company sets particularly high priority on a criterion, this can be done by adjusting the weighting. The predefined weighting which is used within the decision model, should only be understood as a starting point anyway. Since every company has different priorities, the company should adapt the weighting to its own needs.

The result of the DMN should serve as a basis for discussion within the company and among the decision makers. The deployment option with the highest percentage match according to the decision model is not necessarily the best one for the company. The result must be verified carefully. To be able to carry out this verification, the company should know the various deployment options and their characteristic. Since the decision is very complex and has a great impact on the business, the company should never make the decision entirely on its own but should always seek the input and expertise of SAP, an SAP partner, or some other qualified consultant.

Lastly, the current and future development of ERP systems should also be taken into account (see Chapter 1.1). A replacement of the ERP system roughly takes place after five to twelve years. With the chosen system and the chosen deployment option, the company should therefore make a long-term and future-oriented decision.

8 Conclusion

ERP systems can be defined as the central IS of the company. This is where the majority and most important business processes take place. Such as other IS, ERP systems are changing and evolving from a monolithic system to a composable suite. In this development, the deployment in the cloud plays a crucial role. SAP, as the global market leader among ERP vendors, is responding to this development by bringing new deployment options to the market – the private cloud and the public cloud – which are available as part of the RISE with SAP offerings. Companies are therefore faced with the difficult challenge of making the right decision between the many products and deployment options. The market is not transparent and the differences between the products and deployment options are often not immediately obvious. To support companies with a decision model (RQ3), first the relevant decision criteria were evaluated (RQ1) and then the weighting of the criteria was determined (RQ2).

As part of the qualitative semi-structured expert interviews and the subsequent content analysis, a total of 5 deployment options and 18 decision criteria were evaluated that are relevant within the decision for the appropriate SAP S/4HANA deployment option (RQ1). Due to the number of criteria and the content communicated by the experts, this research exploits that this is a complex and important decision for the company. Within the deployment options, the on premise and public cloud options were mentioned most frequently by the experts. This is due to the fact that these options are the ones most opposed to each other and are therefore frequently contrasted. Among the decision criteria, the costs and the price model as well as the extensibility and modifiability were most frequently addressed. The aspects of implementation duration and system performance were mentioned only rarely and exclusively by the consultants, but not by the customers within the expert group. This could be caused by customers not being aware that there are differences in these aspects between the options, or they may consider these aspects to be irrelevant.

As part of the survey, it cloud be confirmed that all evaluated decision criteria are relevant (RQ2). As a result, certain criteria should be assigned a higher weighting in the decision-making process (e.g., Data security as well as Industry, process and country coverage). In this case, there were only few deviations within the survey values. Other criteria, on the other hand, have a lower weighting (e.g., Number of service providers). Here, the experts had higher deviations in their answers. This means that certain criteria have a general validity and are relevant for all companies, while the weighting of other criteria depends on the company.

Based on the results of the interviews and the survey, a decision model was designed (RQ3). During the design process, the DSR framework served as a guideline and DMN was used as a modeling standard. The graphical representation in the DRD makes the individual decision criteria and other aspects that have an influence on the decision transparent for all stakeholders. In addition, the decision logic depicted in the decision tables was recorded in a way that is comprehensible to everyone. Which input factors result in which output factors is thus clearly visible. The weighting mentioned, which is partly company-dependent, can be adjusted as desired in the decision model provided. Nevertheless, the support of a consultant should also be sought and the result of the decision model can be used as a basis for discussion.

References

- Abd Elmonem, M. A., Nasr, E. S., & Geith, M. H. (2016). Benefits and challenges of cloud ERP systems – A systematic literature review. *Future Computing and Informatics Journal*, 1(1– 2), 1–9. https://doi.org/10.1016/j.fcij.2017.03.003
- Bender, B., Bertheau, C., & Gronau, N. (2021). Future ERP Systems: A Research Agenda. Proceedings of the 23rd International Conference on Enterprise Information Systems, 776–783. https://doi.org/10.5220/0010477307760783
- Bernroider, E., & Koch, S. (2001). ERP selection process in midsize and large organizations. *Business Process Management Journal*, 7(3), 251–257. https://doi.org/10.1108/14637150110392746
- Birkhoff, K. (2021, February 5). *Hyperscalers and managed services: what's the future*. Capgemini SE. https://www.capgemini.com/2021/02/hyperscalers-and-managed-services/
- Dresing, T., & Pehl, T. (2018). Praxisbuch Interview, Transkription & Analyse, Audiotranskription. In *Marburg: Dr. Dresing und Pehl GmbH* (8. Auflage).
- Duan, J., Faker, P., Fesak, A., & Stuart, T. (2013). Benefits and drawbacks of cloud-based versus traditional ERP systems. *Proceedings of the 2012-13 Course on Advanced Resource Planning*.
- Elbahri, F. M., Al-Sanjary, O. I., Ali, M. A. M., Naif, Z. A., Ibrahim, O. A., & Mohammed, M. N. (2019). Difference comparison of SAP, Oracle, and Microsoft solutions based on cloud ERP systems: A review. 2019 IEEE 15th International Colloquium on Signal Processing & Its Applications (CSPA), 65–70.
- Fesko, S. (2021, March 17). *What Is RISE with SAP?* SAP PRESS Blog. https://blog.sap-press.com/what-is-rise-with-sap
- Ganesh, K., Mohapatra, S., Anbuudayasankar, S. P., & Sivakumar, P. (2014). *Enterprise Resource Planning: Fundamentals of Design and Implementation*. Springer International Publishing.
- Gartner Inc. (2018). Market Share Analysis: ERP Software, Worldwide, 2017. https://www.gartner.com/en/documents/3879510
- Gartner Inc. (2021). Magic Quadrant für Cloud-Infrastruktur und Plattform-Services. https://www.gartner.com/technology/media-products/reprints/AWS/1-271W1OSP-DEU.html
- George, A. S. H., & George, A. S. (2022). Potential Risk: Hosting Cloud Services Outside the Country. International Journal of Innovative Research in Computer and Communication Engineering, 11, 5–11. https://doi.org/10.5281/zenodo.6548114
- Hecht, B. (1997). Choose the right ERP software. Datamation, 43(3), 56-59.
- Hevner, March, Park, & Ram. (2004). Design Science in Information Systems Research. *MIS Quarterly*, 28(1), 75. https://doi.org/10.2307/25148625

- Katuu, S. (2020). Enterprise Resource Planning: Past, Present, and Future. *New Review of Information Networking*, 25(1), 37–46. https://doi.org/10.1080/13614576.2020.1742770
- Krippendorff, K. (2018). *Content Analysis: An Introduction to Its Methodology* (4th ed.). SAGE Publications.
- Luther, D. (2021, March 3). 8 *ERP Trends for 2021*. Oracle Netsuite. https://www.net-suite.com/portal/resource/articles/erp/erp-trends.shtml
- Mayring, P. (2010). Design. In K. Mey Günter and Mruck (Ed.), *Handbuch Qualitative Forschung in der Psychologie* (pp. 225–237). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-92052-8 15
- Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures and software solution*. https://www.ssoar.info/ssoar/handle/document/39517
- Merriam-Webster. (n.d.). On premises. In *Merriam-Webster.com dictionary*. Retrieved February 18, 2022, from https://www.merriam-webster.com/dictionary/on%20premises
- Object Management Group. (n.d.). *Decision Model and Notation*. Retrieved May 24, 2022, from https://www.omg.org/dmn/
- Object Management Group. (2019). Decision Model and Notation (Version 1.2).
- Parthasarathy, S. (2013). Potential concerns and common benefits of cloud-based enterprise resource planning (ERP). In *Cloud Computing* (pp. 177–195). Springer.
- Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3), 45–77.
- Peterson, J. (2021, January 11). *Top 7 ERP Trends For 2021*. ERP News. https://erpnews.com/top-7-erp-trends-for-2021/
- Ratkevičius, D., Ratkevičius, Č., & Skyrius, R. (2012). ERP selection criteria: theoretical and practical views. *Ekonomika*, *91*(2), 97–116.
- Saaty, T. L. (1990). How to make a decision: the analytic hierarchy process. *European Journal of Operational Research*, 48(1), 9–26.
- SAP SE. (n.d.-a). *RISE with SAP*. Retrieved May 29, 2022, from https://www.sap.com/prod-ucts/rise.html
- SAP SE. (n.d.-b). *RISE with SAP Customer Presentations Repository*. Retrieved May 24, 2022, from https://partneredge.sap.com/en/library/education/solutions/rise/RISE_repository.html
- SAP SE. (n.d.-c). *SAP Business ByDesign*. Retrieved June 2, 2022, from https://www.sap.com/products/business-bydesign.html
- SAP SE. (n.d.-d). *SAP Business One*. Retrieved June 2, 2022, from https://www.sap.com/prod-ucts/business-one.html
- SAP SE. (n.d.-e). *SAP SE Corporate Governance*. Retrieved May 24, 2022, from https://www.sap.com/investors/de/governance/supervisory-board/hasso-plattner.html

- SAP SE. (n.d.-f). *The Story Behind Signavio*. Retrieved May 24, 2022, from https://www.signavio.com/story-behind-signavio/
- SAP SE. (2021a). SAP Quarterly Statement Q4 2021. https://www.sap.com/investors/en/investment-story/recent-results.html?pdf-asset=a29a2c2c-147e-0010-bca6c68f7e60039b&page=1
- SAP SE. (2021b). SAP S/4HANA Cloud, private edition: Solution Overview. SAP Partner Portal.
- SAP SE. (2021c). *Mapping Your Journey to SAP S/4HANA: A Practical Guide for Senior IT Leadership.* https://www.sap.com/documents/2019/05/44b3ebd5-4b7d-0010-87a3c30de2ffd8ff.html#page=2&zoom=50,-622,783
- SAP SE. (2022, March 24). *SAP Continues to Stand in Solidarity with the People of Ukraine*. https://news.sap.com/2022/03/sap-continues-to-stand-in-solidarity-with-ukraine/
- Saueressig, T., Gilg, J., Betz, O., & Homann, M. (2021). *SAP S/4HANA Cloud: An Introduction*. Rheinwerk Publishing. https://books.google.at/books?id=8hYvzgEACAAJ
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students*. Prentice Hall. https://books.google.de/books?id=u-txtfaCFiEC
- Seubert, H. (2018). SAP Cloud Platform: Services, Nutzen, Erfolgsfaktoren. Rheinwerk Verlag.
- Vaishnavi, V., & Kuechler, B. (2004). Design Science Research in Information Systems. *Association for Information Systems*.
- Verville, J., Palanisamy, R., Bernadas, C., & Halingten, A. (2007). ERP acquisition planning: a critical dimension for making the right choice. *Long Range Planning*, *40*(1), 45–63.
- Vikas, S., Gurudatt, K., Vishnu, M., & Prashant, K. (2013). Private vs public cloud. *International Journal of Computer Science & Communication Networks*, *3*(2), 79.
- vom Brocke, J., Hevner, A., & Maedche, A. (2020). *Introduction to Design Science Research* (pp. 1–13). https://doi.org/10.1007/978-3-030-46781-4_1
- Weinberg, N. (2021, February 5). *Die Top 7 der ERP-Trends 2021*. Computerwelt. https://computerwelt.at/news/die-top-7-der-erp-trends-2021/
- Yandong, Z., & Yongsheng, Z. (2012). Cloud computing and cloud security challenges. 2012 International Symposium on Information Technologies in Medicine and Education, 1084–1088. https://doi.org/10.1109/ITiME.2012.6291488

Appendix

Appendix 1: Interview guideline

A Information about the research

- This study will start by identifying the currently relevant SAP S/4HANA deployment options.
- Subsequently, the criteria that are relevant in the decision-making process for the suitable deployment options are evaluated.

B Information about the interview

- The interview guideline at hand is conducted with the interview partners in German, as they are more fluent in German than in English. Nevertheless, the results of the interviews will be translated into English and afterwards further processed.
- Within this guideline, the interview partner is addressed in polite language with the last name. If the relationship with the interview partner is appropriate, it is also possible to address the interviewee by his or her first name.
- The interview should promote a comfortable and open exchange on the topic. This requires, a friendly and professional attitude, active listening and questioning on the part of the interviewer.
- If the interview makes it necessary, the sequence of questions can be varied.
- The questions can be supplemented by further follow-up questions (suggestions can be found in the respective table).
- Interviewer instructions are formatted in italics in square brackets.

C Introduction

Hallo Frau/Herr [entsprechenden Nachnamen einfügen],

mein Name ist Philip Lonnemann. Ich möchte nun gerne, wie vereinbart, mit Ihnen das Interview im Rahmen meiner Masterarbeit im Studiengang Wirtschaftsinformatik der Universität Innsbruck durchführen. Vielen Dank, dass Sie sich für dieses Interview Zeit nehmen.

In meiner Arbeit befasse ich mich mit unterschiedlichen SAP S/4HANA Bereitstellungsoptionen. Für Unternehmen ist es häufig schwierig, sich dabei für die richtige Option zu entscheiden. Daher möchte ich die unterschiedlichen Bereitstellungsoptionen miteinander vergleichen und den Unternehmen eine Unterstützung bei der Entscheidungsfindung bieten. Um einen Vergleich durchführen zu können, sind Kriterien erforderlich. Um diese Kriterien, die bei dem Entscheidungsprozess für die passende S/4HANA Bereitstellungsoption relevant sind, geht es in diesem Interview.

[*Nachfrage, falls Einverständniserklärung noch nicht unterschrieben wurde*] Zur einfacheren Dokumentation möchte ich das Gespräch aufzeichnen. Sind Sie mit einer Aufzeichnung einverstanden? Haben Sie noch Fragen zur Durchführung? [*Fragen abwarten und ggf. beantworten*] Sofern Sie keine weiteren Fragen zur Durchführung haben, beginne ich jetzt das Interview mit Ihnen.

0 Introductory questions

Fragen	Nachfragen / Ergänzungen
Zu Beginn dieses Interviews starten wir mit allgemeinen Fragen zu Ihrem Beruf und Ih- ren Aufgaben.	
0.1 Wie lautet Ihre genaue Berufsbezeich- nung?	
0.2 Wie lange arbeiten Sie bereits als [zuvor genannte Berufsbezeichnung einsetzen]?	
0.3 Was ist das Kerngeschäft des Unterneh- mens, in dem Sie arbeiten bzw. welcher Branche würden Sie Ihr Unternehmen zu-	
ordnen?	
0.4 Welche beruflichen Aufgaben haben Sie im Kontext mit SAP Systemen bzw. ERP Systemen im Allgemeinen?	[Nachfrage, falls bisher noch nicht ausrei- chend beantwortet] Haben Sie in Ihrer Be- rufslaufbahn noch weitere Erfahrungen mit SAP gemacht? Wenn ja, welche bzw. in wel- chem Rahmen?

1 Deployment options

Fragen	Nachfragen / Ergänzungen
Kommen wir nun zu den unterschiedlichen	
Bereitstellungsoptionen von SAP S/4HANA.	
1.1 Welche Bereitstellungsoptionen von	
S/4HANA sind aus Ihrer Sicht relevant, wenn	
sich eine Organisation derzeit mit einer Neu-	
einführung von S/4HANA befasst oder die	
Bereitstellungsoption von S/4HANA ändern	
möchte?	
[falls Antwort auf 1.1 diesen Aspekt noch	[Nachfrage, wenn die Antwort positiv ist]
nicht abgedeckt hat]	Warum ist diese Bereitstellungsoption für Sie
1.2 Inwiefern halten Sie die Bereitstel-	relevant?
lungsoption " public cloud " für relevant?	

Appendix

[falls Antwort auf 1.1 diesen Aspekt noch	[Nachfrage, wenn die Antwort positiv ist]
nicht abgedeckt hat]	Warum ist diese Bereitstellungsoption für Sie
1.3 Inwiefern halten Sie die Bereitstel- lungsoption " private cloud " für relevant?	relevant?
[falls Antwort auf 1.1 diesen Aspekt noch	[Nachfrage, wenn die Antwort positiv ist]
nicht abgedeckt hat]	Warum ist diese Bereitstellungsoption für Sie
1.4 Inwiefern halten Sie die Bereitstel- lungsoption " on premise " für relevant?	relevant?
[falls Antwort auf 1.1 diesen Aspekt noch	[falls nötig, Folgendes ergänzen] Im Rahmen
nicht abgedeckt hat]	der hybriden Bereitstellungsoptionen gibt es
1 5 Inwiefern halten Sie hybride Bereitstel-	zwei Varianten: zum einen die Kombination
lungsontionen für relevant?	aus cloud und on premise und zum anderen
	aus public und private cloud.
	[<i>Nachfrage</i>] Halten Sie eine oder beide Vari- anten für relevant? Wenn ja, warum?

2 General criteria

Fragen	Nachfragen / Ergänzungen
Im Folgenden möchte ich näher auf die Ent- scheidungskriterien eingehen, die innerhalb der Wahl für eine Bereitstellungsoption rele- vant sind. Wir werden dabei auf die folgen- den Bereiche eingehen: allgemeine Kriterien, Funktionalität, technische Architektur, Kos- ten, Service und Support, und Ausblick des Herstellers	
Wie Sie gerade erläutert haben, gibt es bei der Wahl der Bereitstellungsoptionen verschie- dene Möglichkeiten, zwischen denen ent- schieden werden muss.	
2.1 Welche Kriterien spielen bei dieser Ent- scheidung aus Ihrer Sicht eine Rolle?	[<i>falls Relevanz nicht direkt deutlich wird</i>] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Entscheidungsprozess relevant?
2.2 Gibt es aus Ihrer Sicht Kriterien, die für die Wahl einer bestimmten Bereitstel- lungsoption sprechen?	[<i>Nachfrage, wenn die Antwort positiv ist</i>] Welche Kriterien sind das im Detail und für welche Bereitstellungsoption sprechen diese?

	T T
Wie Sie gerade erläutert haben, unterschei- den sich die Bereitstellungsontionen in eini-	
gen Punkten.	
2.3 Welche Punkte sind dabei für die Wahl	
der Bereitstellungsoption zu berücksichti-	
gen?	
2.4 Inwiefern halten Sie die Flexibilität bei	[Nachfrage] Können Sie kurz erläutern, wel-
der Einführungsmethodik für relevant? Da-	che Gründe für eine bestimmte Einführungs-
mit sind u. a. die Einführungsmethodik	methodik sprechen?
greenfield und brownfield gemeint.	
SAP liefert, abhängig von der Bereitstel-	
lungsoption, einen unterschiedlichen Um-	
fang von Scope Items (vordefinierte Pro-	
zesse) aus.	
2.5 Inwiefern halten Sie die Unterschiede der	
Scope Items im Entscheidungsprozess für relevant?	

Functionality

Fragen	Nachfragen / Ergänzungen
Kommen wir nun zum Bereich der Funk-	
3.1 Welche Kriterien sind aus Ihrer Sicht im Bereich der Funktionalität relevant?	[<i>falls Relevanz nicht direkt deutlich wird</i>] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Bereich der Funktiona- lität relevant?
[falls Antwort auf 3.1 diesen Aspekt noch	[<i>Nachfrage</i>] Spielt in diesem Rahmen die
 3.2 Inwiefern halten Sie die Anpassbarkeit bzw. Modifizierbarkeit für relevant? 	Eigenentwicklungen angepasst werden kann?
	[<i>Nachfrage</i>] Was genau ist bei Eigenentwick- lungen für Sie relevant?
	[<i>Nachfrage</i>] Warum ist für einige Organisa- tionen die Anpassbarkeit so wichtig?
[falls Antwort auf 3.1 diesen Aspekt noch nicht abgedeckt haben]	[<i>Nachfrage</i>] Was genau ist im Rahmen der Sicherheit und Vertraulichkeit für Sie rele- vant?
3.3 Inwiefern halten Sie die Sicherheit und	

die Vertraulichkeit der Daten im System	
beim Entscheidungsprozess für relevant?	

4 Technical architecture

Fragen	Nachfragen / Ergänzungen
Kommen wir nun zum Bereich der techni- schen Architektur.	
4.1 Welche Kriterien sind aus Ihrer Sicht im Bereich der technischen Architektur rele- vant?	[<i>falls Relevanz nicht direkt deutlich wird</i>] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Bereich der Erweiter- barkeit relevant?
[falls Antwort auf 4.1 diesen Aspekt noch nicht abgedeckt hat] 4.2 Inwiefern halten Sie die Erweiterbarkeit für relevant?	[<i>Nachfrage</i>] Inwiefern halten Sie die unein- geschränkte Erweiterbarkeit durch Add-Ons für relevant? [<i>Nachfrage, wenn die Antwort positiv ist</i>] Was genau ist bei der Erweiterbarkeit durch Add-Ons für Sie relevant?
[falls Antwort auf 4.1 diesen Aspekt noch nicht abgedeckt hat] 4.3 Inwiefern halten Sie die Möglichkeit der Anbindung von Drittsystemen an das S/4HANA System für relevant?	[Nachfrage, wenn die Antwort positiv ist] Können Sie genauer beschreiben, was für Sie bei der Anbindung von Drittsystemen rele- vant ist?
[falls Antwort auf 4.1 diesen Aspekt noch nicht abgedeckt hat]	
4.4 Inwiefern halten Sie den mobilen Zugriff aus dem Internet auf das System für relevant?	
[falls Antwort auf 4.1 diesen Aspekt noch nicht abgedeckt hat]	[<i>Nachfrage</i>] Wann genau ist für Organisatio- nen die Skalierbarkeit besonders wichtig?
4.5 Inwiefern halten Sie die Skalierbarkeit des Systems für relevant?	
[falls Antwort auf 4.1 diesen Aspekt noch nicht abgedeckt hat]	
4.6 Inwiefern halten Sie die direkte Zugriffs- möglichkeit auf die Hardware für relevant?	

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5 Cost

Fragen	Nachfragen / Ergänzungen	
Kommen wir nun zum Bereich Kosten.		
5.1 Halten Sie die unterschiedlichen Preis- und Lizenzmodelle bei der Entscheidung für ein relevantes Kriterium?	[Nachfrage, wenn die Antwort positiv ist] Zwischen welchen Preismodellen wird hier unterschieden und wie sind diese einzuord- nen?	
5.2 Welche unterschiedlichen Kostenfakto- ren sind aus Ihrer Sicht im Entscheidungs- prozess relevant?	[falls Relevanz nicht direkt deutlich wird] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Bereich Kosten rele- vant?	
[falls Antwort auf 5.2 diesen Aspekt noch nicht abgedeckt hat]	[<i>Nachfrage</i>] Wodurch werden diese Kosten Ihrer Meinung nach beeinflusst?	
5.3 Inwiefern halten Sie die Anschaffungs- kosten für relevant?		
 [falls Antwort auf 5.2 diesen Aspekt noch nicht abgedeckt hat] 5.4 Inwiefern halten Sie die Implementie- rungskosten für relevant? 	[<i>Nachfrage</i>] Wodurch werden diese Kosten Ihrer Meinung nach beeinflusst?	
[falls Antwort auf 5.2 diesen Aspekt noch nicht abgedeckt hat] 5.5 Inwiefern halten Sie die laufenden Kos- ten für relevant?	[<i>Nachfrage</i>] Wodurch werden diese Kosten Ihrer Meinung nach beeinflusst?	

6 Service and support

Fragen	Nachfragen / Ergänzungen
Nun kommen wir zum Bereich Service und Support.6.1 Welche Kriterien sind aus Ihrer Sicht im Bereich Service und Support relevant?	
6.2 Inwiefern halten Sie die regelmäßige Ver- sorgung mit Updates für relevant?	[<i>Nachfrage</i>] Inwiefern ist es relevant, ob die Updates im Preis inkludiert sind und ob es eine Wahlmöglichkeit für Upgrades gibt?

Appendix

6.3 Inwiefern halten Sie die Unabhängigkeit	[Nachfrage] Wann ist es für Organisationen
von externen Servicedienstleistern für rele-	sinnvoll den Service und Support durch einen
vant?	externen Servicedienstleister in Anspruch zu
	nehmen?
6.4 Inwiefern halten Sie die Systemverfüg-	[Nachfrage] Was ist aus Ihrer Sicht bei der
barkeit und Wiederherstellung aus Backups	Verfügbarkeit und Wiederherstellung ent-
barkeit und Wiederherstellung aus Backups für relevant?	Verfügbarkeit und Wiederherstellung ent- scheidend?

7 Vision of the vendor

Fragen	Nachfragen / Ergänzungen
Kommen wir nun zum Ausblick des Herstel- lers.	
SAP fokussiert sich bereits seit einiger Zeit auf die Bereitstellung in der Cloud und kom- muniziert, dass auch in Zukunft verstärkt auf das Thema Cloud gesetzt wird.	
7.1 Inwiefern spielt diese aktuelle und zu- künftige Ausrichtung von SAP im Entschei- dungsprozess eine Rolle?	[<i>falls Relevanz nicht direkt deutlich wird</i>] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Entscheidungsprozess relevant?

8 Round off

Fragen	Nachfragen / Ergänzungen
Wir sind bisher auf die Bereiche allgemeine Kriterien, Funktionalität, technische Archi- tektur, Kosten, Service und Support sowie	
 Ausblick des Herstellers eingegangen. 8.1 Sind Ihnen im Laufe des Interviews noch weitere Kriterien eingefallen, die bisher nicht genannt wurden? Welche sind das? 	[falls Relevanz nicht direkt deutlich wird] In- wiefern bzw. warum sind die von Ihnen ge- nannten Kriterien im Entscheidungsprozess relevant?

D Closing

Wir haben an dieser Stelle das Ende des Interviews erreicht. Haben Sie noch etwas zu ergänzen? Möchten Sie noch etwas sagen? [*Ergänzungen bzw. Fragen abwarten*] Sollten Sie nichts mehr zu ergänzen haben, möchte ich mich noch einmal herzlich bei Ihnen für die Zeit und die Teilnahme am Interview bedanken.

Im Folgenden werde ich die Ergebnisse aller Interviews auswerten und eine Liste aller genannten Kriterien aufstellen. Diese Liste würde ich Ihnen gerne zur Verfügung stellen und Sie bitten, die Kriterien je nach Relevanz zu gewichten. Im Anschluss werde ich die SAP S/4HANA Bereitstellungsoptionen unter Zuhilfenahme der evaluierten Kriterien vergleichen und daraus eine Entscheidungshilfe ableiten. Gerne kann ich Ihnen im Anschluss die Ergebnisse meiner Arbeit zur Verfügung stellen.

Ich wünsche Ihnen noch einen schönen Tag.

Appendix 2: Interview transcripts

Due to its size, this appendix can be found in a separate document:

"Masterthesis_Lonnemann (additional appendix).pdf"

Appendix 3: Coding system

Category	Code	Definition	Anchor sample
Deployment options	On premise	An SAP S/4HANA on premise in- stallation hosted by the customer.	"Eine ist es, alles selbst zu mana- gen. Sprich, als Firma ein eigenes SAP System zu haben und dies auch mit eigener IT Abteilung zu betreuen. Das ist so der Klassiker aus der Vergangenheit." (Transcript ID 1, pos. 14)
	On premise (by service pro- vider)	An SAP S/4HANA on premise in- stallation hosted by a service pro- vider.	"Dann gibt es die nächste Ent- wicklungsstufe, dass man die ganze technische Welt, also spricht, die SAP Systemland- schaft, Netzwerke und solche IT technischen Themen einem Part- ner übergibt." (Transcript ID 1, pos. 14)
	Private cloud	An SAP S/4HANA private cloud in- stallation	"Wenn ich diese Rahmenbedin- gungen nicht habe, dann ist für mich der Weg in die private cloud in jedem Fall schon mal nicht ver- kehrt. Weil bei der private cloud weiß ich im schlimmsten Falle auf welchem Rechner ich bin. []" (Transcript ID 10, pos. 16)
	Public cloud	An SAP S/4HANA public cloud in- stallation	"Und wir haben natürlich die Möglichkeit, die SAP public cloud zu nutzen." (Transcript ID 8, pos. 40)
	Hybrid ap- proach	A hybrid approach, where either the on premise installation is combined with a cloud variant (private or pub- lic) or the two cloud variants (private and public) are combined with each other.	"Vorstellbar wäre es ja zum Bei- spiel, dass du Tochtergesellschaf- ten im Ausland hast, die dann auch mit SAP arbeiten. Und die meinet- wegen dann aber auch mit der cloud Lösung arbeiten. Und dass meinetwegen die Muttergesell- schaft dann vielleicht mit einer on premise Lösung arbeitet. []" (Transcript ID 9, pos. 18)
Decision cri- teria	Business focus	Do I focus exclusively on my core business and am I willing to hand over other things? Is the ERP system and its specific processes part of my core business?	"Und das ist so etwa die Philoso- phie, der wir folgen. Dass wir sa- gen: All das, was uns nicht Vor- teile bringt, das müssen wir auch nicht unbedingt selber tun kön- nen." (Transcript ID 8, pos. 72)

Business pro- cesses	Do I gain competitive advantages through my ERP system and its pro- cesses? How complex are my business pro- cesses? Can I and do I want to change my business processes? Am I open to the use of standard pro- cesses and best practices?	"[]. Wenn ich jetzt hingehe und ich habe jetzt schon ein SAP Sys- tem, ein ECC und denke darüber nach eben S/4 einzuführen und ich habe sehr viele Prozesse, die ich jetzt schon angepasst habe, modi- fiziert habe. Und diese Prozesse brauche ich auch in einem nächs- ten System. Dann werde ich mit Sicherheit nicht eine public cloud wählen, weil dort die Anpassungs- möglichkeiten natürlich so gut wie nicht gegeben sind." (Transcript ID 9, pos. 38)
Implementa- tion methodol- ogy	Have I already decided to use the brownfield approach? Is it necessary to transfer historical data? Am I open to the greenfield ap- proach?	"Ja, wenn einer sagt, ich will defi- nitiv einen brownfield Ansatz ma- chen, um das System einfach nur auf S/4 zu heben, werden die nie in die cloud gehen." (Transcript ID 2, pos. 44)
Costs and price model	Do I want a subscription model? Do I want to "buy" the solution and pay regular maintenance fees? Can I cope with high investment costs?	"Und hab eine starke Kostenüber- sicht, wo ich genau weiß: Was muss ich zahlen? Weil ja, ich zahle jeden Monat meine Miete. Ich miete mir das. Und wenn ich es nicht mehr haben will, lass ich es außen vor." (Transcript ID 2, pos. 32)
Employees competence	Do I already have employees with SAP know-how? Do I want to build up SAP expertise in the company in order to have it available internally? Do I already have a department that can administrate the servers of an SAP system independently?	"Und nur wenn ich bereit bin, ei- nen sehr großen Overhead zu ha- ben, die Zeit und die Kosten zu in- vestieren und auch das Wissen im Haus zu haben. Erst in dem Mo- ment bin ich bei on premise." (Transcript ID 10, pos. 40)
Industry, pro- cess and coun- try coverage	Is my industry covered by the de- ployment option? Do SAP best practices fit my busi- ness? Is my country and language covered by the deployment option?	"Es ist aber so, dass eben oftmals oder / Nicht oftmals, aber im Ein- zelfall untersucht werden muss, ob die Abdeckung, also auch die In- dustrieabdeckung und die funktio- nale Abdeckung in der cloud reicht, ausreichend ist, um die

		Anforderungen zu erfüllen." (Transcript ID 5, Pos. 20)
Extensibility and modifiabil- ity	Do I need specific add-ons to extend my system? Are the add-ons I need available in the deployment option? Do I need to adjust and modify the system or the containing processes?	"Wenn der Kunde irgendwie be- stimmte Software Add-Ons ver- wendet, die noch nicht cloudfähig sind, da kann ich ihnen nicht sa- gen: Gehe zur cloud." (Transcript ID 3, pos. 50)
Implementa- tion period	Do I need the new system as soon as possible? Am I dependent on a short imple- mentation period? Does the implementation period matter to me?	"Ja mit der Implementierungszeit, genau. Das war der Punkt mit der Implementierungszeit. Das ist ei- gentlich schon charakteristisch für die cloud, also die public cloud, dass da die Implementierungszei- ten um einiges geringer sind, wie die von on premise. Das liegt ein- fach in der Natur der Dinge." (Transcript ID 5, pos. 76)
Scalability	Do I need a highly scalable system? Am I planning growth and acquisi- tions? Do I have a higher system workload in the future?	"Wenn ich eine Firma bin, die seit 20 Jahren nicht gewachsen ist und die auch nicht großartig plant zu wachsen, dann wofür muss ich mein System skalieren können? Wenn ich jemand bin, der sagt: Wir wollen wachsen in den nächs- ten Jahren, dann muss das System skalierbar sein. []" (Transcript ID 10, pos. 74)
System perfor- mance	Do I execute very demanding trans- actions? Do I need above-average system performance for certain processes?	"Also wenn es jetzt eben ein Kunde ist der, sag ich mal, sehr komplexe Produktstrukturen hat, sprich eben eine hohe Fertigungs- tiefe hat. Sehr komplexe Stücklis- ten mit Variantenkonfiguration und, und, und. Mit komplexen Pro- zessen oder mit Projektfertigung, Projektabwicklung. []. Wird man da sicherlich mit in der cloud dann an die entsprechenden Gren- zen stoßen. Und dann ist es eben ein Kriterium einfach." (Transcript ID 5, pos. 54-56)
Interfaces	Do I need interfaces to other sys- tems? Can I provide an interface to these systems in the deployment option?	"Wie leicht kann ich andere, kann ich neue Produkte auch wieder an- schließen?" (Transcript ID 4, pos. 27)

Innovations and updates	Do I always want to be up to date and use the latest innovations? Do I want to decide on new updates myself and schedule them inde- pendently?	"Wenn ich mich auf public cloud einlasse, also da kommt wieder dieser public cloud Mindset, dann ist das aus meiner Sicht einer der riesengroßen Vorteile, dass ich eben kontinuierlich Innovationen geliefert bekomme." (Transcript ID 7, pos. 236)
Data security	Do I have to comply with certain le- gal or industry-specific regulations in connection with data security? Do I agree to the storage of data on third-party servers?	"Das heißt also an der Stelle, glaube ich persönlich, dass meine Daten sicherer sind in einem exter- nen Rechenzentrum. Mit Sicher- heit. Mit Sicherheit sind die dort sicherer. []" (Transcript ID 6, pos. 100)
System latency	Do I run linked systems that require very low latency?	"Glaube ich, dass ich, egal ob es jetzt eine public oder private cloud halt ist, glaube ich, dass das von der Latenz her funktioniert? Ich habe gerade im Bereich unserer sogenannten MES Systeme und unserer Lagersysteme / Systeme, wenn die nicht binnen Millisekun- den den Rückping kriegen, ja, dann melden die: Keine Konnekti- vität und ich habe meinen Prozess- schritt verloren." (Transcript ID 6, pos. 114)
External and mobile access	Do I need mobile access to the sys- tem? Do I need system access from the In- ternet for mobile working staff or e.g. customers?	"Und daraus folgt, dass alle von Mobil auch heutzutage auf die ERP Instanz wollen. Alle wollen auch von draußen rein. []" (Transcript ID 7, pos. 170)
Individuality of the service level	Do I want to be able to individually design the service level of the sys- tem? How high are my demands on the availability of the system? Do I want to determine the mainte- nance windows myself? Do I want to run my own backup strategy?	"Sicherlich eine Frage von dem Servicelevel was angeboten wird. Da sind wir heute durchaus ein Stück weit verwöhnt. Dadurch, dass wir das hosten lassen, können wir im Prinzip sehr individuell vereinbarten, wie der Service dort aussieht. Und das ist mir im Mo- ment / Schlichtweg weiß ich nicht, wie weit da Spielräume sind in der private cloud oder wie weit das, was dort als Service angeboten wird, zu unseren Bedarfen passt." (Transcript ID 8, pos. 62)

Number of ser- vice providers	Is the number of my service provid- ers and the resulting coordination ef- fort important to me? How many different service provid- ers do I want to contract with?	"Sprich, der Nachteil der Lösung, die ich vorher geschrieben habe, ist ja, dass man als Kunde selber sehr viele Dienstleister koordinie- ren muss. Also sprich, man muss Verträge machen mit allen Dienst- leistern. Man muss das Ganze im Griff behalten. Und hat da in der Regel auch Abstimmungsbedarfe und solche Sachen. Und die SAP bietet ja an jetzt einen Großteil die- ser Leistungen zu übernehmen." (Transcript ID 1, pos. 20)
at different sites	gal entities with different requirements for an ERP system?Are these legal entities spread over different locations and different countries?Does this make a hybrid approach useful to me?	spiel, dass du Tochtergesellschaf- ten im Ausland hast, die dann auch mit SAP arbeiten. Und die meinet- wegen dann aber auch mit der cloud Lösung arbeiten. Und dass meinetwegen die Muttergesell- schaft dann vielleicht mit einer on premise Lösung arbeitet. Weil es zum Beispiel erforderlich ist, dass man dort Prozesse abbildet, die sich in der cloud nicht so ohne Weiteres abbilden ließen " (Trap
		Weiteres abbilden ließen." (Tran- script ID 9, pos. 18)

Appendix 4: Coded segments

Due to its size, this appendix can be found in a separate document:

"Masterthesis_Lonnemann (additional appendix).pdf"

Appendix 5: Translation of interview quotes

Transcript ID	Original quote in German	English translation	
and position			
ID 1, pos. 121	"Also das ist schon mehr als nur eine [Einführungs]methodik. Das ist schon Firmenstrategie, würde ich sagen."	"This is more than just an imple- mentation methodology. I would say it is already a business strategy."	
ID 1, pos. 179	"Ansonsten müsste ich ja selber auch die ganze Qualifikation dafür aufbauen, um Datensicherheit zu machen. Und das rechnet sich ja ein- fach nicht. Weil ich bin Spezialist für die Herstellung von irgendwel- chen tollen Maschinen, aber ich bin kein Spezialist für Datenschutz und überhaupt Cyberkriminalität und all sowas."	"Otherwise, I would have to build up all the qualifications myself to do data security. And that simply does not pay off. Because I am a special- ist in the production of some great machines, but I am not a specialist in data protection and cybercrime and all that kind of things."	
ID 2, pos. 90	"Also habe ich eine Transaktion ge- baut, die kein anderer hat und bin damit viel schneller als die anderen und spare damit Zeit ein."	"So I built a transaction that no one else has and I am much faster than the others and it saves time."	
ID 2, pos. 146	"Ja, bei der public cloud wirst du nicht gefragt, wann ein Update kommt, sondern das Update kommt."	"In the public cloud you are not asked when an update is coming, but the update comes."	
ID 3, pos. 30	"Oder dann private cloud, weil pri- vate cloud und on premise ist für mich eigentlich aktuell / Gibt es kei- nen großen Unterschied."	"Or private cloud, because for me there is actually not much difference between private cloud and on prem- ise."	
ID 3, pos. 78	"Also on premise kannst du ja […] alles tun was du willst. Das ist ja dein System. […] Du kannst entwi- ckeln bis zum nicht mehr geht. […] Bei der public cloud ist das mit der Entwicklung sehr gering […] und wird auch empfohlen, dass man bei der public cloud eher so wenig wie möglich hart entwickelt."	"So on premise you can do anything you want. This is your own system. You can develop till the end. In the public cloud, the amount of devel- opment is very low and it is also rec- ommended that you develop as little as possible in the public cloud."	

ID 4, pos. 67	"Gut, das ist natürlich ganz stark, würde ich jetzt mal sagen, von der Unternehmensstrategie auch abhän- gig."	"Well, that is of course strongly de- pendent on the business strategy, I would say."
ID 5, pos. 154	"Du hast nicht als Kunde diese ein- mal Investition, also diesen hohen Einstiegspreis. Sondern du zahlst ei- gentlich nur [] die Nutzung des Systems. Und das [] Maß hierfür sind sogenannte Full User Equiva- lent."	"As a customer, you do not have this one-time investment, i.e., this high entry price. But you actually only pay for the usage of the system. And the measure for this is the so-called full user equivalent."
ID 7, pos. 38	"Also hybrides Modell wäre für mich zum Beispiel: Ich habe ein S/4HANA private cloud und ein SuccessFactors."	"So for me, a hybrid model would be, for example: I have a S/4HANA private cloud and a SuccessFactors."
ID 7, pos. 46	"Unsere Kunden brauchen eine ma- ximale Beratung in diesem Aus- wahlprozess von uns."	"Our customers need maximum consultation from us in this selection process."
ID 7, pos. 116	"Natürlich gibt es Anpassungsre- geln, Anpassungsfähigkeiten auch in der public cloud. Aber diese An- passungsfähigkeiten sind sehr stark eingeschränkt im Vergleich zur pri- vate cloud."	"Of course, there are customization rules, customization capabilities in the public cloud as well. But these customization capabilities are very limited compared to the private cloud."
ID 7, pos. 236	"Wenn ich mich auf public cloud einlasse [] dann ist das aus meiner Sicht einer der riesengroßen Vor- teile, dass ich eben kontinuierlich Innovationen geliefert bekomme."	"If I move to public cloud then from my point of view one of the huge ad- vantages is that I get innovations de- livered continuously."
ID 7, pos. 292	"Also, wie gesagt, das Wichtigste: Es ist eine komplizierte Frage, eine äußerst komplexe Frage."	"As I said, the most important thing: It is a difficult question, an ex- tremely complex question."
ID 9, pos. 14	"Es gibt natürlich jetzt auch noch die Bereitstellungsoption das in der cloud zu machen. Einmal in der public cloud oder in der private cloud."	"Of course, now there is also the de- ployment option to do that in the cloud. Either in the public cloud or in the private cloud."

Appendix

ID 9, pos. 18	"Gehört habe ich das schon. Aber ich habe da eben noch keine Erfah- rung mit."	"I have heard of that. But I do not have any experience with it yet."
ID 10, pos. 16	"Es liegt ein bisschen auch an der Philosophie. Also möchte ich all die Leute bei mir im Unternehmen ha- ben, die von der Pike auf das System verstehen. [] Nun habe ich auch die Kontrolle. Und dann möchte ich auch die Kontrolle."	"It is also a bit about the philosophy. So do I want to have all the people in my company who understand the system from the ground up. Now I also have the control. And then I also want the control."

Appendix 6: Survey

Gewichtung der Kriterien für die Wahl der passenden SAP S/4HANA Bereitstellungsoption

Diese Umfrage ist Teil meiner Masterarbeit im Fach Wirtschaftsinformatik an der Universität Innsbruck. Im Rahmen meiner Masterarbeit habe ich bereits Experteninterviews durchgeführt, um jene Kriterien zu evaluieren, die bei dem Entscheidungsprozess für die passende SAP S/4HANA Bereitstellungsoption relevant sind:

- on premise,
- on premise bei einem Serviceanbieter,
- private cloud,
- public cloud oder
- hybrider Ansatz.

In dieser Umfrage geht es um die Gewichtung dieser evaluierten Kriterien. Wie relevant sind die einzelnen Kriterien im Entscheidungsprozess?

Hinweis:

Im Folgenden wird die Relevanz einzelner Kriterien abgefragt. Unter der zu beantwortenden Frage (z. B.: Für wie relevant halten Sie das Kriterium "Geschäftsfokus"?) sind hilfreiche Fragen (z. B.: Konzentriere ich mich ausschließlich auf mein Kerngeschäft und bin ich bereit, andere Dinge abzugeben?) formuliert. Diese Hilfestellungen sollen NICHT beantwortet werden, sondern dienen dazu, das Kriterium (in diesem Fall "Geschäftsfokus") näher zu beleuchten.

Beurteilen Sie folglich, ob bzw. wie relevant die genannten Kriterien im Entscheidungsprozess sind.

Vielen Dank für die Teilnahme an dieser Umfrage!

Teilnehmer ID

Bitte tragen Sie hier Ihre Teilnehmer ID ein, die Sie per Mail erhalten haben. Sollte Ihnen keine Teilnehmer ID vorliegen, nehmen Sie bitte NICHT an dieser Umfrage teil. Die Teilnehmer ID wird anonym behandelt und dient dem Zweck, dass nur berechtigte Personen an dieser Umfrage teilnehmen und dass die Umfrage nur einmal abgesendet wird.

Antwort: Freitext

1. Für wie relevant halten Sie das Kriterium "Geschäftsfokus"?

Folgende Fragen können als Hilfestellung dienen: Konzentriere ich mich ausschließlich auf mein Kerngeschäft und bin ich bereit, andere Dinge abzugeben? Gehört das ERP System und seine spezifischen Prozesse zu meinem Kerngeschäft? Verschaffe ich mir durch mein ERP System und seine Prozesse Wettbewerbsvorteile?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

2. Für wie relevant halten Sie das Kriterium "Geschäftsprozesse"?

Folgende Fragen können als Hilfestellung dienen: Wie komplex sind meine Geschäftsprozesse? Kann und will ich meine Geschäftsprozesse ändern? Bin ich offen für den Einsatz von Standardprozessen und den SAP Best Practices?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

3. Für wie relevant halten Sie das Kriterium "Einführungsmethodik"?

Folgende Fragen können als Hilfestellung dienen: Habe ich mich bereits für den Brownfield Ansatz entschieden? Ist es notwendig, historische Daten zu übertragen? Bin ich offen für den Greenfield Ansatz?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

4. Für wie relevant halten Sie das Kriterium "Kosten und Preismodell"?

Folgende Fragen können als Hilfestellung dienen: Möchte ich ein Abo-Modell? Möchte ich die Lösung "kaufen" und regelmäßig nur Wartungsgebühren zahlen? Kann ich hohe Investitionskosten verkraften?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

5. Für wie relevant halten Sie das Kriterium "Mitarbeiterkompetenz"?

Folgende Fragen können als Hilfestellung dienen: Habe ich bereits Mitarbeiter mit SAP Knowhow? Möchte ich SAP Expertise im Unternehmen aufbauen, um sie intern zur Verfügung zu haben? Habe ich bereits eine Abteilung, die die Server eines SAP Systems selbstständig administrieren kann?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

6. Für wie relevant halten Sie das Kriterium "Abdeckung von Branchen, Prozessen und Ländern"?

Folgende Fragen können als Hilfestellung dienen: Wird meine Branche von der Bereitstellungsoption abgedeckt? Passen die SAP Best Practices zu meinem Unternehmen? Sind mein Land und meine Sprache von der Bereitstellungsoption abgedeckt?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

7. Für wie relevant halten Sie das Kriterium "Erweiterbarkeit und Modifizierbarkeit"?

Folgende Fragen können als Hilfestellung dienen: Benötige ich bestimmte Add-ons, um mein System zu erweitern? Sind die von mir benötigten Add-ons in der Bereitstellungsoption verfügbar? Muss ich das System oder die darin enthaltenen Prozesse anpassen und verändern?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

8. Für wie relevant halten Sie das Kriterium "Einführungsdauer"?

Folgende Fragen können als Hilfestellung dienen: Spielt die Einführungsdauer für mich eine Rolle? Brauche ich das neue System so schnell wie möglich? Bin ich auf eine kurze Einführungsdauer angewiesen?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

9. Für wie relevant halten Sie das Kriterium "Skalierbarkeit"?

Folgende Fragen können als Hilfestellung dienen: Brauche ich ein hoch skalierbares System? Plane ich Wachstum und Übernahmen? Habe ich in Zukunft eine höhere Systemauslastung?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

10. Für wie relevant halten Sie das Kriterium "Systemleistung"?

Folgende Fragen können als Hilfestellung dienen: Führe ich sehr anspruchsvolle Transaktionen durch? Benötige ich für bestimmte Prozesse eine überdurchschnittliche Systemleistung?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

11. Für wie relevant halten Sie das Kriterium "Schnittstellen"?

Folgende Fragen können als Hilfestellung dienen: Benötige ich Schnittstellen zu anderen Systemen? Kann ich in der gewählten Bereitstellungsoption eine Schnittstelle zu diesen Systemen herstellen?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

12. Für wie relevant halten Sie das Kriterium "Innovationen und Updates"?

Folgende Fragen können als Hilfestellung dienen: Möchte ich immer auf dem neuesten Stand sein und die neuesten Innovationen nutzen? Möchte ich selbst über neue Updates entscheiden und sie selbstständig einplanen?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

13. Für wie relevant halten Sie das Kriterium "Datensicherheit"?

Folgende Fragen können als Hilfestellung dienen: Muss ich im Zusammenhang der Datensicherheit bestimmte gesetzliche oder branchenabhängige Vorschriften einhalten? Bin ich mit der Datenspeicherung auf fremden Servern einverstanden?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

14. Für wie relevant halten Sie das Kriterium "Systemlatenz"?

Folgende Frage kann als Hilfestellung dienen: Betreibe ich angebundene Systeme, die eine sehr geringe Latenzzeit erfordern?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

15. Für wie relevant halten Sie das Kriterium "Externer und mobiler Zugriff"?

Folgende Fragen können als Hilfestellung dienen: Brauche ich einen mobilen Zugriff auf das System? Brauche ich einen Systemzugang aus dem Internet für mobil arbeitende Mitarbeiter oder z. B. Kunden?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

16. Für wie relevant halten Sie das Kriterium "Individualität des Servicelevels"?

Folgende Fragen können als Hilfestellung dienen: Möchte ich den Servicelevel des Systems individuell gestalten können? Wie hoch sind meine Ansprüche an die Verfügbarkeit des Systems? Möchte ich die Wartungsfenster selbst bestimmen? Möchte ich meine eigene Backup-Strategie definieren?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

17. Für wie relevant halten Sie das Kriterium "Anzahl der Dienstleister"?

Folgende Fragen können als Hilfestellung dienen: Ist die Anzahl meiner Dienstleister und der daraus resultierende Koordinationsaufwand für mich von Bedeutung? Mit wie vielen verschiedenen Dienstleistern möchte ich einen Vertrag abschließen?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

18. Für wie relevant halten Sie das Kriterium "Unterschiedliche Bedürfnisse an verschiedenen Standorten"?

Folgende Fragen können als Hilfestellung dienen: Hat mein Unternehmen verschiedene Gesellschaften mit unterschiedlichen Anforderungen an ein ERP System? Sind diese Gesellschaften auf verschiedene Standorte und Länder verteilt? Ist dadurch ein hybrider Ansatz für mich sinnvoll?

Antwort: Sechsstufige Skala von 1 (nicht relevant) bis 6 (sehr relevant)

Mir haben in der bisherigen Aufzählung noch folgende Kriterien (mit entsprechender Gewichtung) gefehlt:

Format: Beschreibung des Kriteriums (Relevanz zwischen 1 und 6). Beispiel: Die Kosten und das Preismodell (5), Die Skalierbarkeit des Systems (3)

Antwort: Freitext

Hier ist Platz für Anmerkungen und Feedback:

Antwort: Freitext

Appendix 7: Survey results

1. Für wie relevant halten Sie das Kriterium "Geschäftsfokus"? (9 Answers)



2. Für wie relevant halten Sie das Kriterium "Geschäftsprozesse"? (9 Answers)



3. Für wie relevant halten Sie das Kriterium "Einführungsmethodik"? (9 Answers)





4. Für wie relevant halten Sie das Kriterium "Kosten und Preismodell"? (9 Answers)





6. Für wie relevant halten Sie das Kriterium "Abdeckung von Branchen, Prozessen und Ländern"? (9 Answers)







8. Für wie relevant halten Sie das Kriterium "Einführungsdauer"? (9 Answers)



9. Für wie relevant halten Sie das Kriterium "Skalierbarkeit"? (9 Answers)





10. Für wie relevant halten Sie das Kriterium "Systemleistung"? (9 Answers)





12. Für wie relevant halten Sie das Kriterium "Innovationen und Updates"? (9 Answers)



13. Für wie relevant halten Sie das Kriterium "Datensicherheit"? (9 Answers)



14. Für wie relevant halten Sie das Kriterium "Systemlatenz"? (9 Answers)



15. Für wie relevant halten Sie das Kriterium "Externer und mobiler Zugriff"? (9 Answers)



16. Für wie relevant halten Sie das Kriterium "Individualität des Servicelevels"? (9 Answers)



17. Für wie relevant halten Sie das Kriterium "Anzahl der Dienstleister"? (9 Answers)



18. Für wie relevant halten Sie das Kriterium "Unterschiedliche Bedürfnisse an verschiedenen Standorten"? (9 Answers)



Mir haben in der bisherigen Aufzählung noch folgende Kriterien (mit entsprechender Gewichtung) gefehlt: (1 Answer)

 "Vertrauen in den ERP-Anbieter. Beispiel: Wie wirkt sich die strategische Ausrichtung des Anbieters auf meine langfristige Planung aus? Beispiel: Habe ich das Gefühl, meine Geschäftsbedürfnisse werden langfristig unterstützt und es soll nicht nur die eigene Marktmacht ausgenutzt werden (Gier)? => Dies Kriterium ist 5. Ich entferne mittlerweile "Partner" AddOns weil diese gierig werden, bin im extremsten Fall aber auch bereit eine ERP Alternative (oder Module wie das CRM) zu betrachten, falls die Einschränkungen durch die Vorgaben zu groß werden."

Hier ist Platz für Anmerkungen und Feedback: (3 Answers)

- "Viel Erfolg bei der weiteren Auswertung der Ergebnisse"
- "Teilweise verstehe ich die Fragen nicht, da eigentlich fast alle mit 6 hätten bewertet werden müssen, da natürlich JEDES Thema bis Punkt 14 eigentlich sehr relevant ist (bis auf die Updatefrequenz). Wenn ich z.B. bei 14 Systemlatenz "nur" eine 4 gebe, dann heißt das für mich immer noch: Es gibt keine Abbrüche in der Verbindung wo es notwendig ist. Selbiges gilt für Systemleistung. 4 ist nach meinem Verständnis "normales Arbeiten ist gegeben", 5=es gibt ein wenig Puffer für Spitzen, 6=wir sind auf große Spitzen und Schwankungen eingestellt und akzeptieren dafür hohe Mehrkosten."
- "Es i8st sehr wichtig in welcher Branche man tätig ist, da z.B. Im Automotive noch nicht alles was benötigt wird in der Cloud zur Verfügung steht. Was in einer anderen Branche z.B. Dienstleistung keine Rolle spielen kann."

Appendix 8: Comparison of the deployment options

Deployment	On premise	On premise	Private cloud	Public cloud
option		(by service		
		provider)		
Decision criteria				
Business focus	Customer is re-	System hosting	Entire responsi	bility and all
	sponsible for en-	is sourced out.	tasks of the syste	em is sourced
	tire system.	Further tasks are	out	
		individual.		
Business processes	Greatest flexibil	ity in the imple-	Same flexibility	Application
_	mentation of bus	siness processes.	as on premise	of standard
			but stronger fo-	processes
			cus on standard	and best
			processes.	practices of
				SAP.
Implementation	Gre	eenfield or brownfi	eld	Greenfield
methodology				
Costs and price	High investment	High investment	Subscription	Subscription
model	costs due to li-	costs due to li-	model (from 60	model (from
	cense purchases,	cense purchases,	FUEs)	35 FUEs)
	low ongoing	low ongoing		
	maintenance	maintenance		
	costs. Internal	costs. Costs for		
	costs for the de-	the deployment		
	ployment of the	of the system by		
	system.	the service pro-		
		vider.		
Employees compe-	SAP compe-	Required in-	SAP competen	ce is neither
tence	tence is needed	house compe-	mandatory no	r required.
	in-house.	tence depends		
		on the service		
		agreement.		
Industry, process		Greatest coverage		Required
and country cov-		C		coverage
erage				must be
				checked.
Extensibility and	No rest	rictions	Extensions are	Extensions
modifiability			unrestricted.	are only pos-
Ŭ			Modifications	sible using

			are unrestricted,	SAP certified
			but not recom-	add-ons.
			mended.	Modifica-
				tions are re-
				stricted.
Implementation	Depends on impl	ementation method	dology and extent	Short period
period	of modifications.	May result in long	periods.	due to stand-
				ard pro-
				cesses.
Scalability	Difficult to scale	Depends on the	High scalability	due to the in-
	due to the ad-	offering of the	frastructure of th	e hyperscaler.
	justment of li-	service pro-		
	censes and hard-	vider.		
	ware.			
System perfor-	Depends on	Depends on hard	dware configura-	Due to shared
mance	hardware con-	tion of the service	e provider. No up-	infrastruc-
	figuration of the	per li	imits.	ture, system
	customer. No			performance
	upper limits.			may be tem-
				porarily lim-
				ited.
Interfaces	Configuration of interfaces is unrestricted. Direct			BTP is man-
	setup in t	he system or using	the BTP.	datory. In
				some cases,
				this can lead
				to interfaces
				becoming
				uneconomi-
				cal.
Innovations and	Only security	Only security	All updates are	All Updates
updates	updates and	updates and	included.	are included
	patches are in-	patches are in-	Scheduling is	in the fee.
	cluded. Sched-	cluded. Sched-	done together	Updates are
	uling is done by	uling is done to-	with SAP. The	performed
	the customer.	gether with the	update can be	automatically
		service pro-	postponed for a	every six
		vider.	maximum of	months. Cus-
			five years to en-	tomer has no
	•		guro mointo	influence.
			sure manne-	influence.
			nance.	Latest inno-

Data security	Data is stored in the customer's own data center. Responsibility for data security is with the cus- tomer.	Data is located in sibility for data so the service	an external data co ecurity must be coo provider (or hyper	published in the public cloud first. enter. Respon- ordinated with rscaler).
System latency	Possibility to connect other systems with low latency.	Must be considered in more detail, depending on where the connected system is hosted.		
External and mo- bile access	Customer needs to set up this ac- cess and ensure the appropriate security which requires an in- creased effort.	Depending on the service pro- vider the system is already availa- ble via the Inter- net. Setting up this access is therefore likely to require little effort.	System is alread the Internet, sett cess requires	y available via ing up this ac- little effort.
Individuality of the service level	Is under control of the customer.	Depends on the offering of the service provider.	Individuality is customer is restr fering of	limited as the icted to the of- f SAP.
Number of service providers	Everything is performed in- house.	Depends on whether different service providers are selected for different tasks.	SAP is the only vider and coor partners if r	y service pro- dinates other necessary.
Different needs at different sites	If the customer hat tw	as different needs at different sites, a combination of vo deployment options is conceivable.		

Appendix 9: Decision tables

Appendix 9.1: Decision table "Check for hybrid approach"

Chec		
U	Inputs	Outputs
	Different needs at different sites	Hybrid
	{There are no sites that have different needs. , Ther	{Yes, No}
1	There are no sites that have different needs.	No
2	There are different sites with different ERP needs.	Yes

Appendix 9.2: Decision table "SAP S/4HANA deployment option"

For reasons of size, the following decision table is divided into five sections. These sections complement each other on the right side of the predecessor.

SAP	S/4HANA deployment of	option			
C+			Inputs		
	Business focus	Business processes	Implementation	Costs and price model	Employees
			methodology		competence
	{Focus on core busines	{Processes are complex	{Greenfield, Brownfield	{One-time purchase of	{Competence should be
1	Focus on core business	(non-IT), other tasks ar	e outsourced.		
2	ERP system is part of c	ore business. IT is mana	aged in-house.		
3		Processes are complex	. Standard processes are	e not applicable.	
4		Processes are not com	plex. Open to standard p	processes.	
5			Greenfield		
6			Brownfield		
7			Or	e-time purchase of lice	nses (and regular fees)
8				Subscription model	
9				Competen	ice should be in-house.
10				Compe	tence can be external.
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
20					
27					
20					
30					
31					
32					
32					
34					
35					
36					
	1		1		

		Inputs		
Industry, process and	Extensibility and	Implementation	Scalability	System performance
country coverage	modifiability	period		
{Requirements are cov	{Required add-ons are	{As short as possible. ,	{Is important (e.g., gro	{Above-average require
Requirements are cove	red in public cloud.			
Requirements are not o	covered in public cloud.			
	Required add-ons are a	available in public cloud	. No need to modify syst	tem.
	Required add-ons are r	not available in public cl	oud. Need to modify sys	stem.
		As short as possible.		
		Period does not matter	r.	
			Is important (e.g., grov	vth, acquisitions)
			Not important	
			Above-average re	quirements at any time
				Average requirements

Appendix

Appendix

Inputs				
Interfaces	Innovations and updates	Data security	System latency	External and mobile access
{All required interfaces	{Latest innovations are	{Only own data center	{Above-average require	{Is relevant. As little ef
All required interfaces	can be set up in BTP.			
Not all required interfa	ces can be set up in BTI	D.		
	Latest innovations are	to be used. No influence	e on the update time is i	irrelevant.
	Influence on the update	e time is necessary. Rer	nouncing of latest innova	ations.
		Only own data center i	s acceptable.	
		Data does not necessa	rily have to be stored in	own data center.
			Above-average require	ments (e.g., MES)
			Average requirements	
			Is relevant. As li	ittle effort as possible.
			Effort does not matter	or access is irrelevant.

Inputs					
Individuality of the service level	Number of service providers	Check for hybrid approach			
{Individual requirement	{As few as possible, Do	{Yes, No}			
Individual requirement	l s must be fulfilled				
Standard offer is suffic	ient.				
	As few as possible				
	Does not matter				
		Yes			
		Νο			

	Outputs			
On premise	On premise (by service provider)	Private cloud	Public cloud	Hybrid approach
[0%100.00%]	[0%100.00%]	[0%100.00%]	[0%100.00%]	[0%100.00%]
0%	6.18%	6.18%	6.18%	0%
6.18%	6.18%	0%	0%	0%
7.01%	7.01%	7.01%	0%	0%
7.01%	7.01%	7.01%	7.01%	0%
6.46%	6.46%	6.46%	6.46%	0%
6.46%	6.46%	6.46%	0%	0%
5.08%	5.08%	0%	0%	0%
0%	0%	5.08%	5.08%	0%
5.36%	5.36%	0%	0%	0%
0%	5.36%	5.36%	5.36%	0%
7.14%	7.14%	7.14%	7.14%	0%
7.14%	7.14%	7.14%	0%	0%
6.32%	6.32%	6.32%	6.32%	0%
6.32%	6.32%	6.32%	0%	0%
0%	0%	0%	5.49%	0%
5.49%	5.49%	5.49%	5.49%	0%
0%	0%	5.63%	5.63%	0%
5.63%	5.63%	5.63%	5.63%	0%
4.95%	4.95%	4.95%	0%	0%
4.95%	4.95%	4.95%	4.95%	0%
6.46%	6.46%	6.46%	6.46%	0%
6.46%	6.46%	6.46%	0%	0%
0%	0%	0%	5.36%	0%
5.36%	5.36%	5.36%	0%	0%
7.14%	0%	0%	0%	0%
7.14%	7.14%	7.14%	7.14%	0%
5.77%	0%	0%	0%	0%
5.77%	5.77%	5.77%	5.77%	0%
0%	5.91%	5.91%	5.91%	0%
5.91%	5.91%	5.91%	5.91%	0%
4.95%	4.95%	0%	0%	0%
4.95%	4.95%	4.95%	4.95%	0%
4.81%	0%	4.81%	4.81%	0%
4.81%	4.81%	4.81%	4.81%	0%
0%	0%	0%	0%	100%
0%	0%	0%	0%	0%

Appendix 10: Input mask of Signavio

Inputs				Wildcard mode:	Off
Business Focus		Business Processes		Costs And Price Model	
Focus on core business (n	=	Processes are not complex	:=	No Selection	:
Data Security	:=	Different Needs At Different Sites		One-time purchase of licer Subscription model	าร
No Selection	-	No Selection		NO SELECTION	-
Extensibility And Modifiability		External And Mobile Access		Implementation Methodology	
No Selection	:=	No Selection		No Selection	
Implementation Period		Individuality Of The Service Level		Industry, Process And Country Coverage	,
No Selection	:=	No Selection		No Selection	
Innovations And Updates		Interfaces		Number Of Service Providers	
No Selection	=	No Selection		No Selection	
Scalability		System Latency		System Performance	
No Selection		No Selection		No Selection	:

Appendix 11: DMN 1.2 XML export of the decision model

Due to its size, this appendix can be found in a separate document:

"Masterthesis_Lonnemann (additional appendix).pdf"

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June 20, 2022,

Date, Signature