

# Qualitative Analysis of Different ERP Evaluation Models

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**Abstract.** ERP systems help companies to manage their business processes. The simpler and more efficient the business processes in companies run, the more profitable these businesses can be. Therefore, the process of selecting and implementing an ERP system is an important success factor. The qualitative analysis of ERP evaluation models examines necessary phases and activities for selecting a new ERP system.

**Keywords:** Analyse · Business software · Criteria · Decision · Enterprise resource planning · Evaluation · ERP · Market information · Model · Negotiation · Project · Requirements · Selection · Solution · System

## 1 Introduction

An Enterprise Resource Planning (ERP) system is a business management software [1]. ERP software solutions usually include relevant modules for managing and executing business processes in a company such as financial accounting, controlling, cash management, human resource management, planning, marketing, customer relationship management, distribution, purchasing, manufacturing, service, maintenance, logistics, quality management, inventory management and so on. An ERP system helps various parts or departments of an organisation to share data, knowledge, reduce costs and improve the management of business processes [2]. Nowadays, ERP vendors and implementation partners offer roughly the same bundle of functionalities in their software-products: a set of application modules that fit together. Each module includes a variety of functions [2].

The ERP life cycle consists of three phases. These are acquisition, implementation and maintenance [3]. This paper considers distinctly of the ERP evaluation. Among the major phases of the ERP life cycle, the issue of ERP acquisition is important. The stage

preceding the implementation process presents the opportunity for both researchers and practitioners to examine all the dimensions and implications (costs, benefits, challenges, risks, etc.) of selecting, buying and implementing ERP software, prior to the commitment a large of amount of time, money and resources [3].

Many academic researchers as well as practitioners have worked internationally in the domain of software selection. Most of the proposed approaches are variants of the multi criteria analysis, aimed at defining the final value of every available selection based on a set of criteria [4]. The decision to implement a distinct ERP system may also be made due to strategic, political or economic reasons.

There are various ways of perceiving software evaluation; it may be about different parts of the software itself, its development process and its maintenance. Thus, software evaluation is not a simple technical activity. It is a decision process during which subjectivity and uncertainty are present with no possibility of arbitrary reduction [4].

The objective of ERP evaluation models is to choose “the right” ERP system, which includes the demanded requirements for an organization. Different evaluation models are available to support the evaluation process. Shakir [5] respectively to a Decision-Making Model including six dimensions (classic, administrative, incremental, adaptive, irrational and political) and describes the assumptions and the decision-making process for each dimension. As listed in the Appendix, several researchers developed individual evaluation models, used multi-attribute decision-making models or an AHP-(Analytic Hierarchy Processing) based approach to ERP. These models are structured in different phase sequences.

## 2 Methodology

The methodology approach is structured in two phases:

- Literature Analysis
- Qualitative Content Analysis

In the literature analysis, scientific papers in the domain of evaluating ERP Systems are identified and used as a basis to develop a new ERP evaluation model. 26 different ERP evaluation models have been identified (see Appendix).

In the next phase, all identified papers are used in the qualitative content analysis.

In this content analysis, sources, phases, activities and tasks are qualitatively coded. Identical or similar phrases are combined and derived [6] as shown in Table 1.

**Table 1.** Example word analysis

Source	Level	Phase	Original wording	Activity
Q037E01002	E01	Analysis	Examination of business requirements and constraints	Analyze requirements
Q054E01001	E01	Analysis	Requirement identification	Analyze requirements

Within the word analysis terms are summarized as shown in the following examples:

- “analyze” (analyze, check, determine, identify, verify).
- “define” (appoint, define, form, set up, organize).

Next the sequence of phases and activities is determined. A mean value is determined from the occurrence of the identified first and last phase or activities of the analyzed models. A further average value is given by the sum of the multiplication of nominations per phase/activity number, and the frequency of the mentions in this phase/activity, divided by the amount of nominations per phase/activities.

phase/activity	Nomination in phase	$\sum$	A	B	C	D
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$\sum$ : number of entries in the 26 papers

A: sum of (amount of nominations per phase \* phase number)/amount of nominations per phase

B: average of phase numbers (phases including nominations)

C: average A/B

D: ranking (column C)

### 3 Analysis

The number of phases within the different ERP evaluation models vary between three and nine. In this analysis, only phases which are listed in over 25% of the 26 papers mentioned before, were considered. On average 5.42 phases are present. Table 2 shows the considered phases.

**Table 2.** Considered phases

Phase	Nomination in phases	$\sum$	A	B	C	D
Project initialization	1, 2, 3	19	1,3	2,0	1,6	1
Analyze	1, 2	10	1,9	1,5	1,7	2
Requirement definition	1, 2, 4	7	2,1	2,5	2,3	3
Market information	1, 2, 3, 4, 5	21	2,8	3,0	2,9	4
Assessment criteria	1, 2, 3, 4, 6	22	3,0	3,5	3,3	5
Selection	2, 3, 4, 5, 6	19	3,6	4,0	3,8	6
Evaluation	1, 2, 3, 4, 5, 6, 7	22	4,2	4,0	4,1	7
Negotiation	3, 4, 5, 6, 8	8	5,1	5,5	5,3	8
Decision	5, 6, 7, 8, 9	12	6,8	7,0	6,9	9

Each phase is structured with a different number of activities. In this analysis, only activities which are listed at least two times in the phases mentioned before, are considered. In the 26 papers, these activities are called sub-phases or detail descriptions.

### P1 Project initialization phase

In P1 ten activities shown in the following table are identified. The activities are typical project management activities such as project initialization, examining conditions and project planning. Moreover, roles and project members must be decided, like appointing a project manager, the project team, and the steering committee with suitable competences and knowledge (business and IT) (Table 3).

**Table 3.** Activities Project initialization phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Draft the project	1	5	1,0	1,0	1,0	1
Define steering committee	1	3	1,0	1,0	1,0	1
Decide project start	1	2	1,0	1,0	1,0	1
Carry out planning	1	2	1,0	1,0	1,0	1
Constitute acquisition team	1, 2	3	1,3	1,5	1,4	2
Establish decision-making team	1, 2	3	1,7	1,5	1,6	3
Appoint project team	1, 5, 6	7	2,3	3,5	2,9	4
Define project objectives	2, 3, 5	3	3,3	3,5	3,4	5
Appoint a project manager	2, 4	2	3,0	5,0	4,0	6
Use employees with IT knowledge	1, 9	2	5,0	5,0	5,0	7

### P2 Analysis phase

In P2 four activities are identified. In the analysis phase, the requirements and business processes are collected, analyzed and documented. This also applies to the functionalities as well as the hardware and software infrastructure or the software support. Furthermore, restrictions are analysed and a potential analysis is carried out (Table 4).

**Table 4.** Activities Analysis phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Analyze requirements	1, 2	3	1,7	1,5	1,6	1
Analyze constraints	2	2	2,0	2,0	2,0	2
Analyze business processes	2, 5, 7, 8	6	4,8	5,0	4,9	3
Carry out actual analysis	2, 18	2	10,0	10,0	10,0	4

### P3 Requirement definition phase

In phase P3, requirements (business and technical needs), target processes and scope are defined (Table 5).

**Table 5.** Activities Requirement definition phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Define target processes	1, 2, 9	3	4	5	4,5	1
Define requirements	1, 2, 3, 9, 10	5	3,6	5,5	4,6	2

#### P4 Market information phase

In P4 needed information on suppliers, systems, customers and interview data is gathered and validated. Based on the results potential suppliers are identified (Table 6).

**Table 6.** Activities Market information phase

Activities	Nomination in phases	$\Sigma$	A	B	C	D
Conduct market analysis	1, 2, 4, 6	5	2,8	3,5	3,2	1
Identify potential suppliers	1, 2, 3, 4, 10, 11	6	5,2	6,0	5,6	2
Obtain information about systems	2, 5, 10, 12	4	7,3	7,0	7,1	3
Collect information	1, 2, 4, 5, 12, 20, 22	11	5,4	10,5	7,9	4
Evaluate market data	5, 21	3	10,3	13,0	11,7	5

#### P5 Assessment criteria phase

In P5 all valuation criteria and criteria attributes are formulated, defined and weighted. These criteria need to be assessed and released by the Steering Committee. The results are outlined in a valuation matrix (Table 7).

**Table 7.** Activities Assessment criteria phase

Activities	Nomination in phases	$\Sigma$	A	B	C	D
Determine assessment method	1, 4	12	2,5	2,5	2,5	1
Determine selection criteria	2, 3, 4	5	3,0	2,9	2,8	2
Weighting criteria	3	2	3,0	3,0	3,0	3
Formulate assessment criteria	2, 3, 4, 9,	2	5,5	4,5	3,5	4
Create valuation matrix	4, 6	2	5,0	5,0	5,0	5
Define main criteria for pre-selection	2, 10	2	6,0	6,0	6,0	6

#### P6 Selection phase

In the selection phase P6, the necessary selection tasks are planned, the selection strategy is defined and a preselection is conducted. The preparation of a mathematical evaluation and the tender (incl. questionnaire for suppliers and demographics for process workshops) is carried out. The selection of the selection itself is divided into pre-selection and the final selection. The results of the evaluation phase are considered within the selection phase (Table 8).

**Table 8.** Activities Selection phase

Activities	Nomination in phases	$\Sigma$	A	B	C	D
Carry out pre-selection	3	2	3,0	3,0	3,0	1
Prepare mathematical evaluation	3	2	3,0	3,0	3,0	1
Define selection strategy	2, 5	2	3,5	3,5	3,5	2
Perform selection	2, 3, 4, 5	14	3,7	3,5	3,6	3
Prepare a questionnaire for suppliers	2, 3,8	3	4,3	5,0	4,7	4

### P7 Evaluation phase

The evaluation considers technical, functional, non-functional and financial perspectives. Data and criteria are evaluated manually or (detailed) mathematically (Table 9).

**Table 9.** Activities Evaluation phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Carry out Evaluation	3, 4, 5	6	3,8	4,0	3,9	1
Carry out mathematical evaluation	3, 4, 5, 6, 7, 8	12	5,6	5,5	5,5	2
Discard unsuitable systems	2, 13	3	5,7	7,5	6,6	3
Carry out a detailed mathematical evaluation	7, 8	2	7,5	7,5	7,5	4

### P8 Negotiation phase

In P8 at the beginning, negotiating elements are identified and the negotiation strategy is defined. After successful negotiations, a contract is finalized (Table 10).

**Table 10.** Activities Negotiation phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Carry out negotiations	3, 4, 5, 6, 8, 19	9	6,7	11	8,8	1

### P9 Decision phase

In the decision phase the proper system is selected (Table 11).

**Table 11.** Activities Decision phase

Activities	Nomination in phases	$\sum$	A	B	C	D
Make a selection	5, 7, 8, 9	4	7,3	7,0	7,1	1
Make a decision	5, 6, 7, 9, 20	8	8,3	12,5	10,4	2

## 4 Future Work

The qualitative analysis of ERP evaluation models identifies nine phases including specific activities. In the next step, the results of this study will be used to develop an interview guideline to conduct domain expert interview. The results of these domain expert interviews will be in the form of a qualitative analysis.

## Appendix

Evaluation model description	Research methodology	Model origin	Phases
ERP selection framework [7]	Qualitative research and case studies	Adapted model from Stefanou [8]	3
A conceptual ERP procurement model [9]	Case studies	Own model based on review of the ERP literature	4
Our proposed assessment model (E-OSSEM) [10]	Use case	Own model	4
DEA Decision Making Model [11]	Use case	Multi-attribute decision-making model for ERP system selection based on data envelopment analysis	5
Evaluation Framework [12]	Use case	Own model	5
Proposed evaluation and selection process [13]	Use case	Own model	8
ERP selection Roadmap [14]	Use case	Own model	4
Acquisition process inside the ERP life cycle [3]	Expert interviews, data analysis	Own model	6
Comprehensive ERP project selection procedure [15]	Use case	Own model	9
A recommended map to successful ERP system implementation and operation in China (Selection part) [16]	Empirical study	Own model	3
Comprehensive ERP system selection framework [17]	Empirical study	Own model	6
ERP system selection procedure [18]	Use case	Own model	9
Model of the ERP acquisition process (MERAP) [19]	Use case	Own model	6
ERP system selection procedure [20]	Use case	Own model	7
Framework for evaluation [21]	Use case	Own model	6
Methodology steps [22]	Use case	Own model	5
Steps ERP evaluation and selection [23]	Empirical study	Own model	3
Software and Implementer Selection Phases [4]	Use case	Own model	4
Procedure of selection flow for ERP system [24]	Use case	Own model based on SVM (support vector machine)	5

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Evaluation model description	Research methodology	Model origin	Phases
ERP system selection flow chart – decision phase [25]	Use case	Own model	6
The proposed methodology for the selection of ERP system [26]	Use case	Own model	7
Procedure for optimal ERP software selection [27]	Use case	Own model	4
ERP Implementation methodology propose phases and description of phases [28]	Literature review	Own model	8
Vorgehensmodell zur Auswahl und Einführung von ERP-Systemen in KMU [29]	Interviews	Based on Hansmann and Neumann [30] and Pietsch [31]	3
ERP evaluation process [32]	Literature review	Own model	7
ERP selection process model [33]	Use case	Own model	4

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