UNIVERSITY OF GLOUCESTERSHIRE
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Development of a holistic early warning system (EWS) for German food production SMEs

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Comment

'Controlling' - meaning in the present work: "Controllers ensure the transparency of business results, finance, processes and strategy and thus contribute to higher economic effectiveness. Controllers co-ordinate secondary goals and the related plans in a holistic way and organise a reporting-system which is future-oriented and covers the enterprise as a whole. Controllers moderate and design the controlling process of defining goals, planning and management control so that every decision maker can act in accordance with agreed objectives. Controllers provide managers with all necessary company management data and information. Controllers develop and maintain controlling systems" (Vesper, 2014, p. 117).

Abstract

This research project, which is limited to German SMEs, deals with the development of a holistic early warning system (EWS) integrating both a quality management system (QMS) and controlling (CO).

Most of the concepts designed to identify company risks/crises are focused either on quantitative (operative) or qualitative (strategic) factors. Several authors point out the need for a more holistic approach including both quantitative and qualitative factors.

This research, therefore, sought to explore controlling and quality management tools for EWSs in the food production industry, which are appropriate for recognizing risk factors of company failure, outlined by interview and literature review. Concepts and relations were generated with the help of turnaround-, controlling-, and quality management-experts and then confirmed/refined and analyzed by considering how they can be implemented in practice through the application of case study research.

This research makes a contribution in the following areas: identification of requirements for an EWS; the exploration of appropriate QM and CO tools for EWS; the proposal of a holistic approach. The EWS, developed during this work, enables companies in the food production industry to tailor the framework for the specific needs of the company. Such a comprehensive, systematic approach (CO + QM) is currently unknown, both in research and also practice. Therefore, the work represents a new, innovative and implementable practical model.

Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. Any views expressed in the thesis are those of the author and in no way represent those of the University.

Larissa Dell

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Larissa Dell

Table of Contents

List of Figures

List of Tables

Abbreviations

ACCA	Association of Chartered Certified Accountants
AktG	Aktiengesetz
AR	Action Research
BSC	Balanced Scorecard
CEN	Comité Européen de Normalisation
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIA	Cross-Impact Analysis
CO	Controlling
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CS	Case Study
DCF	Discounted Cash-Flow
DIN	Deutsches Institut für Normung
Dr.	Doctor
EG	Europäische Gemeinschaft
e. g.	exempli gratia
EN	Europäische Norm
ERP	Enterprise Resource Planning
et al.	eta alii
etc.	et cetera
EWS	Early Warning System
ff.	following pages
FMEA	Failure Mode and Effects Analysis
FMECA	Failure Modes, Effects and Critical Analysis
FTA	Fault Tree Analysis
GDP	Gross domestic product
GM	General Management
HACCP	Hazard Analysis and Critical Control Points
HCI	Human Capital Index
IDW	Institut der Wirtschaftsprüfer
i. e.	id est

IfM	Institut für Mittelstandsforschung
IFO	Institut für Wirtschaftsforschung
InsO	Insolvenzordnung
ISO	International Organisation for Standardization
IT	Information Technology
KonTraG	Gesetz zur Kontrolle und Transparenz im Unternehmensbereich
KPI	Key Performance Indicator
LFGB	Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch
Mariks	Mindestanforderungen an das Risikomanagement
Mio.	Million
MS	Microsoft
OEE	Overall Equipment Effectiveness
p. a.	per anum
PDCA	Plan-Do-Check-Act
PESTLE	Political, Economical, Sociological, Technological, Legal, and Environmental
P&L	Profit and Loss
PMI	Purchasing Managers` Index
Prof.	Professor
QM	Quality Management
QMS	Quality Management System
R&D	Research & Development
RM	Risk Management
RMS	Risk Management System
ROI	Return on Investment
SBU	Strategic Business Unit
SME	Small and medium-sized enterprises
SWOT	Strengths, Weaknesses, Opportunities, and Threats
WACC	Weighted Average Cost of Capital
ZEW	Zentrum für Europäische Wirtschaftsforschung

1 Introduction

1.1 Problem and aim of work

The aim of this research project, which is limited to German SMEs, is to develop a simple early warning system (EWS) integrating both a quality management system (QMS) and controlling (CO) tools.

There are two main reasons why this thesis will only discuss small and medium enterprises (SMEs). The first is the value for the – in this case – German economy. Nevertheless, the SMEs – and this is the second reason for dealing only with SMEs – are the enterprises with a much higher probability of getting into a crisis situation or of getting hit by a crisis. The percentage of insolvencies of SMEs in comparison to big companies in Germany was 99.7% in 2012 (Bretz & Kobuss, 2012).

The European Commission defines SMEs as an enterprise with up to 250 employees and a turnover of up to € 50 million or a balance sheet total of up to € 43 million (Commission, 2017). In 2014 the German economy recorded 3,632 million SMEs with a total of about 16.44 million employees. These SMEs generated more than € 2,204 billion turnover, which is 35.3% of all turnover subject to VAT (IfM, 2016). Even during the Euro-crisis, SMEs have been crucial for Germany's lasting economic stability. Whereas the business climate in the more export - oriented big companies has shown only a slight increase lately, SMEs, which focus on the domestic market, are still stable and growing. Thus, they are an important pillar of the economic climate in Germany (Schönwald, 2011).

The IfM (2016) also analyzed the growth of the number of employees in the SMEs as well as the big companies. Between the years 2001 and 2009, the number of employees in SMEs grew by over 13.6% whereas the big companies' number of employees decreased by about 1.2% (IfM, 2016). These statistics underline the economic weight of SMEs and their economic perspective.

A company crisis does not automatically mean the death of the company. This is mainly connected with the time in which the management recognizes the crisis and initiates counteractions (Crone & Werner, 2012). To have the possibility of

seeing the symptoms at an early stage, the company has to have an early warning system, which includes Controlling and Quality Management as Management System.

The survey by Roland Berger, conducted in 2003, shows that in 2001 around 80%, and in 2003 around 70%, of the companies that got into a crisis, identified the crisis for the first time in the acute stage of a liquidity crisis, which is very late and costs valuable time (Welsch, 2010).

The beginning of a crisis lies a long time before the illiquidity - Crone & Werner (2012) describe in the book “Modernes Sanierungsmanagement” six parts of crisis: stakeholder, strategy, product, success, liquidity crisis and, finally, insolvency.

A successful leader has to know the company processes, constantly develop new goals, innovate, make sure that the organization is still true to its core values, and continues to nurture a culture that fosters continual learning (Frontiera & Leidl, 2012). To have the possibility of overseeing the whole area he has to have an appropriate management system.

Most of the concepts designed to identify company risk or crisis are focused either on **quantitative**, such as the operative EWS of Krystek & Müller-Stewens (1993) or Altman`s Z-Score model (Altman, 1968), developed further by others (Kurschus et al., 2015) and also the Fulmer`s H-Score model (Fulmer et al., 1984) etc., or **qualitative** factors, such as the “weak signals” of Ansoff (1976) or Argenti`s A-model (Kurschus et al., 2015). Several authors point out the need for a more holistic approach including both quantitative and qualitative factors (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015). This is the central rationale of this work: to develop an approach that entails an optimum consideration of both quantitative and qualitative factors.

1.1.1 Relevance of the research

An EWS can be defined as an information system designed to warn companies when problems arise or can arise (Löhneysen, 1982). Crönetz et al. (2009) state that EWS success factors comprise issues related to: market, company

background/identity, continuous improvement, resources, structure, processes, and competence – these factors are regulated in ISO 9001 (Hinsch, 2014) and can be monitored by a quality management system (QMS). However, additional factors that are related to corporate aims and strategy need to be included and can be monitored by a CO system.

This research, therefore, draws on the combination of an existing QMS approach (Foster, 2013), where the process is driven by customer expectation (Evans, 2014) alongside consideration and integration with a controlling system. As stated by Bruhn (2001), QM and CO are taken together to form a more holistic EWS than if a single system were to be used in isolation.

Companies within the food production industry need to demonstrate high quality, as its lack of quality management can lead to serious problems (Petersen & Nüssel, 2013); thus most have a quality management system (QMS) based on ISO 9001ff (Ruderer, 2009). This need and the evident use of QMS make the sector appropriate to the needs of this research.

1.1.2 Previous work within this topic

“In the context of early warning German literature first differentiates between the anticipation of risks and chances for the own organization and for other organizations“ (Kirschkamp, 2007, p. 7). Table 1 provides a summary of recent examples of EWS and regulations, dependent on their time of occurrence.

Year	Description	Source
Four generations of Early Warning System (EWS)		
1970 - 1975	1st generation of the EWS: focussing on handling threats by operative early warning, finance indicators, expansion and risks.	Hauser, 1989 Schulenburg, 2008
1975 - 1980	2nd generation of the EWS: operative early recognition indicators and potential chances and risks.	Schulenburg, 2008 Krystek & Müller-Stewens, 1993
1980 - 1990	3rd generation of the EWS: strategic early recognition of soft signals, strategic radar, potential chances and riks.	Welsch, 2010 Krystek & Müller-Stewens, 1993
1990 - present	4th generation of the EWS: strategic and operative early clarification, networking thinking, chances, risks and action.	Schulenburg, 2008 Krystek et al., 2007 Krystek & Müller-Stewens, 1993
Regulations		
1998	KonTraG (law for control and transparency in public limited companies – concern big companies!), requires a holistic approach for EWS, where it explicitly warns against only focussing on one area, such as for e.g. finance.	Woll, 2007
2007	BASEL II: requirement of an EWS.	Woll, 2007 Ruderer, 2009
2015	ISO 9001-2015, requires a risk oriented Quality Management System.	DIN EN ISO, 2015

Table 1 Previous work within this topic

Source: Compiled by author

The four generations of EWS differentiate between early warning methods by their date of introduction. The first generation was developed in 1973 and makes projections on the basis of past data (Hauser, 1989; Schulenburg, 2008). The second started in 1977 and tries to detect potential risks and chances by means of indicators (Schulenburg, 2008; Krystek & Müller-Stewens, 1993). The third generation began at the end of the 1970s by including the strategic early recognition of soft signals, strategic radar, potential chances and risks (Welsch, 2010; Krystek & Müller-Stewens, 1993). The last generation is characterized by networked thinking and helps to detect risks and chances, as well as a holistic approach of ‘operative’ and ‘strategic’ Early Enlightenment (Schulenburg, 2008; Krystek et al., 2007; Krystek & Müller-Stewens, 1993). The term “EWS” will be used as a synonym, as differentiation between Early Warning, Early Recognition and Early Enlightenment, is not really clearly delineated (Hauff, 2010).

It is evident that regulations have influenced EWSs (Woll, 2007), and it is becoming apparent that such rules now explicitly require an EWS to be in place; in particular this is evident through the recent ISO 9001:2015 regulations, which require a risk-oriented Quality Management System (Hinsch, 2014). Furthermore, BASEL II, which regulates finance and banking internationally, requires an EWS (Woll, 2007; Ruderer, 2009). KonTraG developed in 1998, as a law for control and transparency in public limited companies, and so is only concerned with big companies, requires a holistic approach for EWS, where it explicitly warns against only focussing on one area, such as e.g. finance (Woll, 2007).

1.1.3 Contribution

Following on from the literature review in chapter two, the development of EWS has grown historically and has been formulated in more detail and partly adapted to the circumstances. With the awareness that risks exist for companies and that they can mostly be detected even at an early stage in order to initiate adequate countermeasures, it was seen that it was necessary to come to a very detailed division between operational and strategic, qualitative and quantitative, internal and external areas and EWSs. Numerous tools, concepts and methods have also been developed in the literature, in order to identify individual risks and risk areas within a company, branch, etc. (Ruderer, 2009), but a holistic EWS, effected by including quantitative (operative) and qualitative (strategic) factors is missing. This is the main contribution of this study, based on the identified gap, in developing a holistic EWS by the combination of explored tools, as shown in chapter six. Furthermore, based on the answers to the research questions, a contribution to knowledge is also effected by identifying the requirements for a successful EWS and the exploration of appropriate QM and CO tools for an EWS which matches those identified requirements and are appropriate for the recognition of the risk factors of company failure. These contributions will be now described in detail.

The first contribution to knowledge was achieved through the first phase of this research, by the identification of requirements for a successful EWS from the literature review, followed by the semi-structured interview. The findings from the

theoretical and empirical area were compared, categorized and combined to form a unified list. The outcome helps to establish a basis from both points of view, theoretical and practical, for requirements which should be considered during the development of an EWS.

The second contribution to knowledge arises from the second phase of this research, where the unified list of the requirements from phase one, was used as a starting point for the exploration of the CO and QM tools, appropriate for the recognition of the risk factors of company failure, from the literature review and also from the semi-structured interview. The findings from both sources were also defined, categorized, compared and unified for the subsequent development of an EWS. The aggregated results from the literature and interviews can be used for integration into an existing system or combined to form holistic EWS, which are limited to German food production industry.

The third and main contribution was achieved through the sequential use of the data from the research phases by consideration of the requirements for an EWS, the inclusion and combination of explored CO and QM tools, which then proposes a holistic EWS for German food production industry.

The final contribution to theory within this research lies in the suggestion of its use as a holistic framework. This framework is developed through the synthesis of existing theoretical research on early recognition and CO and QM tools, with evidence gathered from the empirical study within the SME, in order to review how it could be implemented and used in practice.

There is no evidence in the literature from previous theoretical or empirical studies of the existence of a holistic EWS which includes CO and QM tools. The framework matches the phases of ISO 31000 (ISO, 2009) by starting from the 'Determination of Context', through 'Methods of Risk Identification', to 'Methods for Risk Monitoring and Review'.

Moreover, it fulfills the requirements of several authors, who point out the need for a more holistic approach including both quantitative (operative) and qualitative (strategic) factors (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015).

1.2 Research Questions

1. What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround / interim managers?
2. Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production industry and how can they be combined to form an integrated framework?
3. Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

1.3 Research Objectives

The objectives are:

1. to identify the requirements for EWSs in SMEs in the food production industry
2. to explore CO and QM tools appropriate for an EWS for a German food production SME and to combine them to form an integrated framework.
3. to analyze implementation issues and considerations relevant to EWS tools in the food production SME context.

1.4 Research Process

“Iterative Research is a methodology that focusses on multiple, short cycles between the field, development, and lab testing” (Pratt, 2009, p. 1). For Ryan (2016) the iterative design cycle consists of EXPLORE, CREATE and EVALUATE components. Pappas (2016), in contrast, states that iterative design involves developing and revising each element of a project before moving onto the next. However, this research process, shown in figure 1, starts with the Initial Literature Review. Afterwards, during Phase I, the requirements for EWSs are

identified, followed by Phase II where CO & QM tools are explored, according to the requirements, and then combined to form a holistic EWS. Furthermore, during Phase III, the practical and integrative approach of the developed EWS is analyzed by two Case Studies and, finally, refined accordingly during Phase IV.

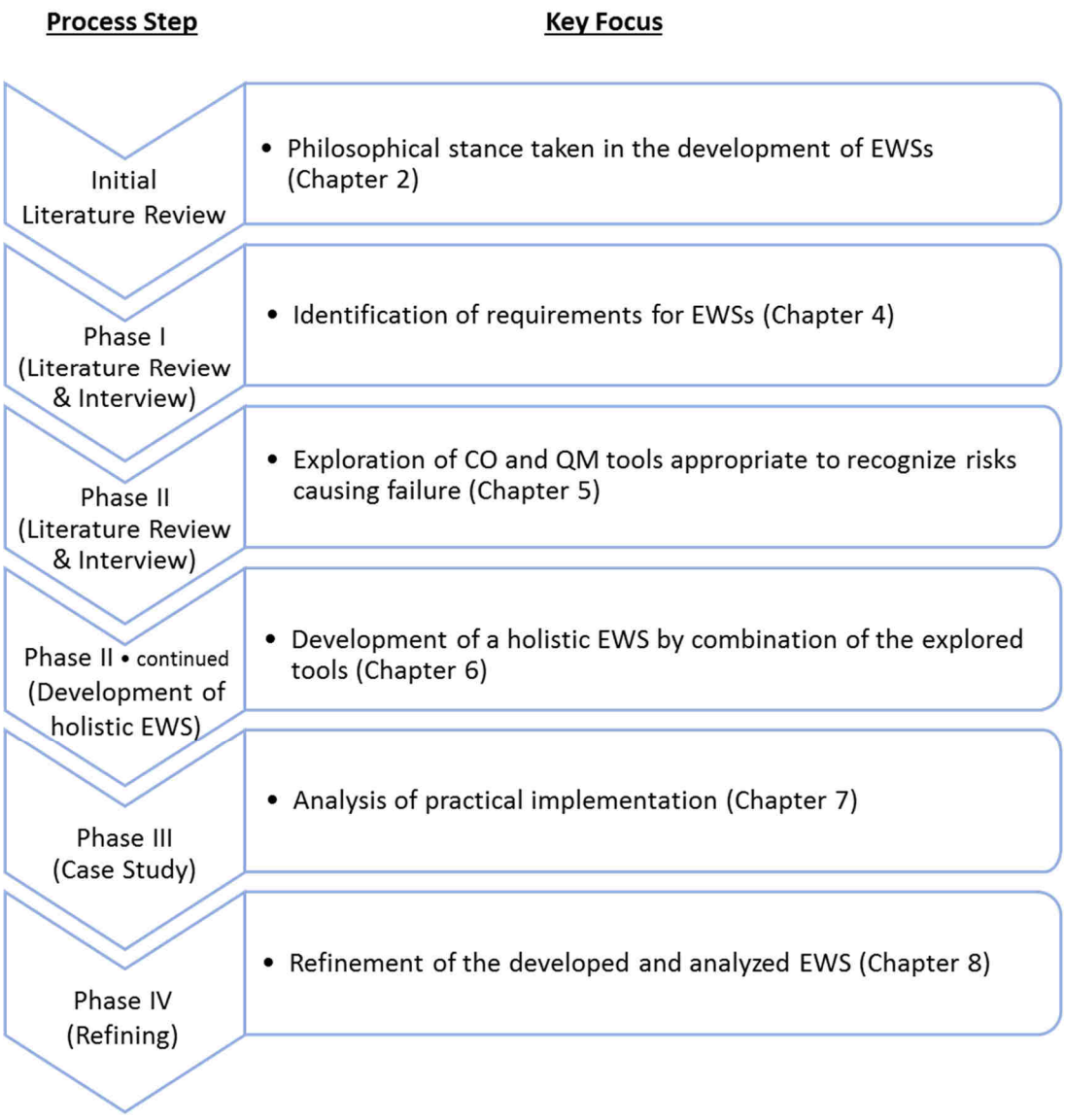

Figure 1 Iterative Research Process

Source: own illustration

Figure 1 illustrates the iterations and their relationship to each other. As the diagram shows, after identification of the philosophical stance taken in the

development of EWSs, the first phase, by identification of requirements, is then used to help to explore CO & QM tools during the second phase. These tools satisfy the requirements of the first phase and are also appropriate for the identification of risks which cause failure. A solution to the selected problem during the initial literature review, is the combination of the tools to form a model (holistic EWS) which, during the third phase is then analyzed for practical implementation and finally, during the fourth phase, is appropriately refined.

The stages and their intended outcomes, as well as the need for the chosen iterative research, will be now explained in more detail. The research starts in Chapter Two with the initial literature review, shown in figure 2 below, where the aim is to capture the theoretical and empirical aspects of the topic, as well as to indicate what gaps in knowledge exist and which of these gaps this work aims to fill. The intended Research Outcome of this chapter was to make explicit the philosophical stance taken in the development of the early warning system.

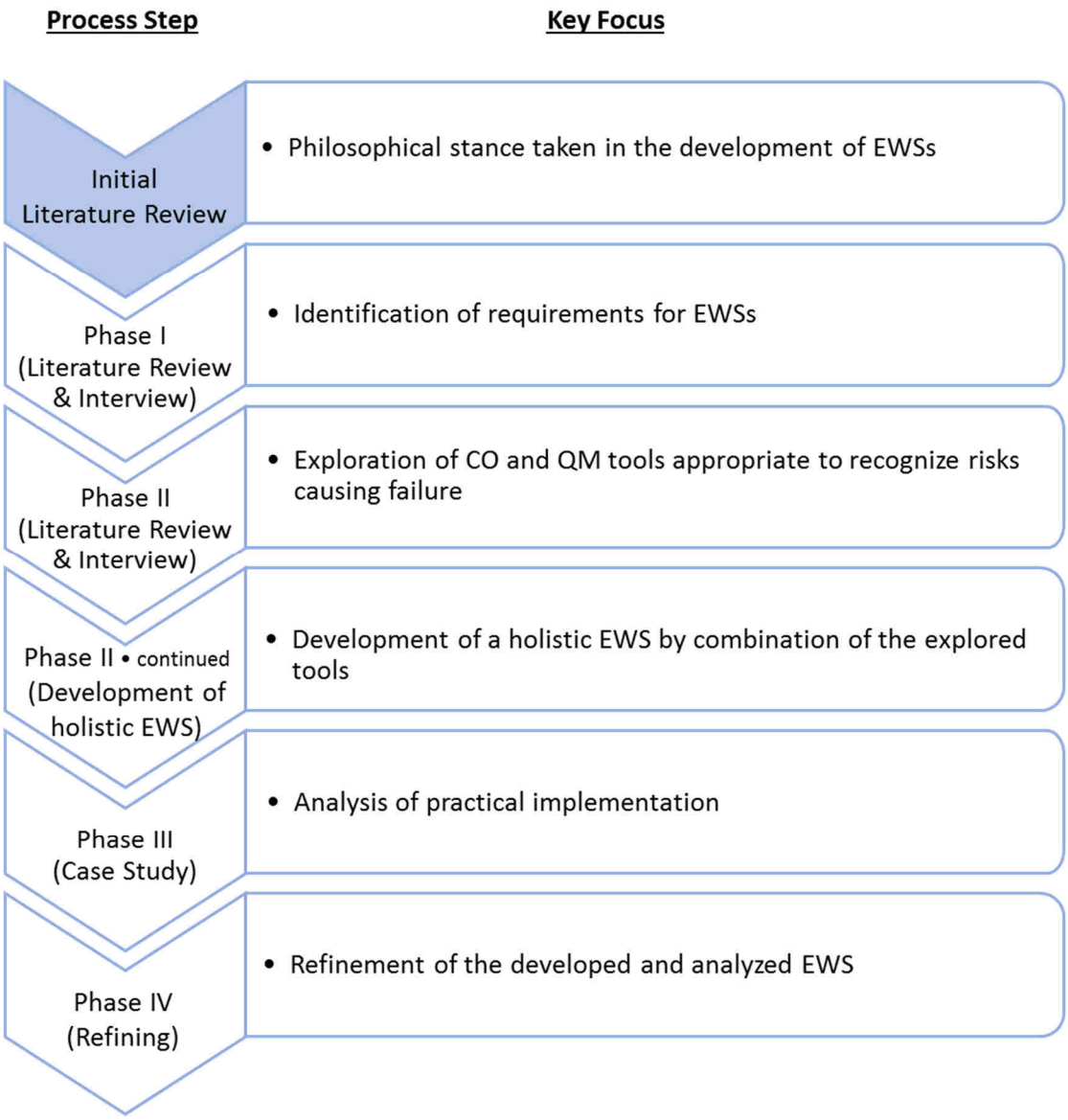

Figure 2 Initial Literature Review and intended Research Outcome

Source: own illustration

The main outcome is that most of the concepts designed to identify company risk or crisis are focused either on **quantitative**, such as the operative EWS of Krystek & Müller-Stewens (1993) or Altman`s Z-Score model (Altman, 1968), developed further by others (Kurschus et al., 2015) and also the Fulmer`s H-Score model (Fulmer et al., 1984) etc., or **qualitative**, such as the "weak signals" of Ansoff (1976) or Argenti`s A-model (Kurschus et al., 2015). Several authors point out the need for a more holistic approach including both quantitative and qualitative factors (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015). This is

the central rationale of this work: to develop an approach that entails an optimum consideration of both quantitative (operative) and qualitative (strategic) factors.

However, as the existing literature is very limited to the general, and thus relatively superficial, representation and, as the concepts were developed for the application to many, if not all, types of enterprises and companies, it is really not possible to fulfill the requirements of a holistic system, not even by linking already existing ‘strategic’ and ‘operative’ EWSs, especially when also trying to cover the practical aspect. This lack of depth in the descriptions and implementation approaches is one gap that ultimately leaves a lot of scope for individual interpretation or even intuition and is difficult to close for the SME. I would like to close this gap in this work, not by giving a "handbook" but at least a guide.

The bulk and generality of the literature shows that most criteria are quite strictly separated from one another. Among the most elementary separations in these focus-limited EWSs are, from my point of view:

- Theoretical and practical
- Operational and strategic
- Quantitative and qualitative

For a holistic and applicable EWS, however, it is impossible to avoid combining these sub-areas with one another, and even fusing them, so that a smooth transition from the strategic to operative area, including both quantitative and qualitative aspects, becomes possible. It is precisely this interplay and the linking of the quantitative and qualitative areas that are particularly important to emphasize. In the literature, these criteria are strictly and stringently assigned to operational (quantitative) and strategic (qualitative). It is a fact, however, that these factors are inseparable because (almost) every quality can be quantified and (almost) every quantity describes a certain quality. The qualitative or quantitative expression is therefore used, as quality can sometimes only be expressed by several quantities, and vice versa.

To be able to start the development of a holistic EWS, where all relevant factors and their interdependencies are able to be identified and dealt with (Kirschkamp,

2007), the requirements of an EWS will be identified, by answering the first research question:

1. What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround / interim managers?

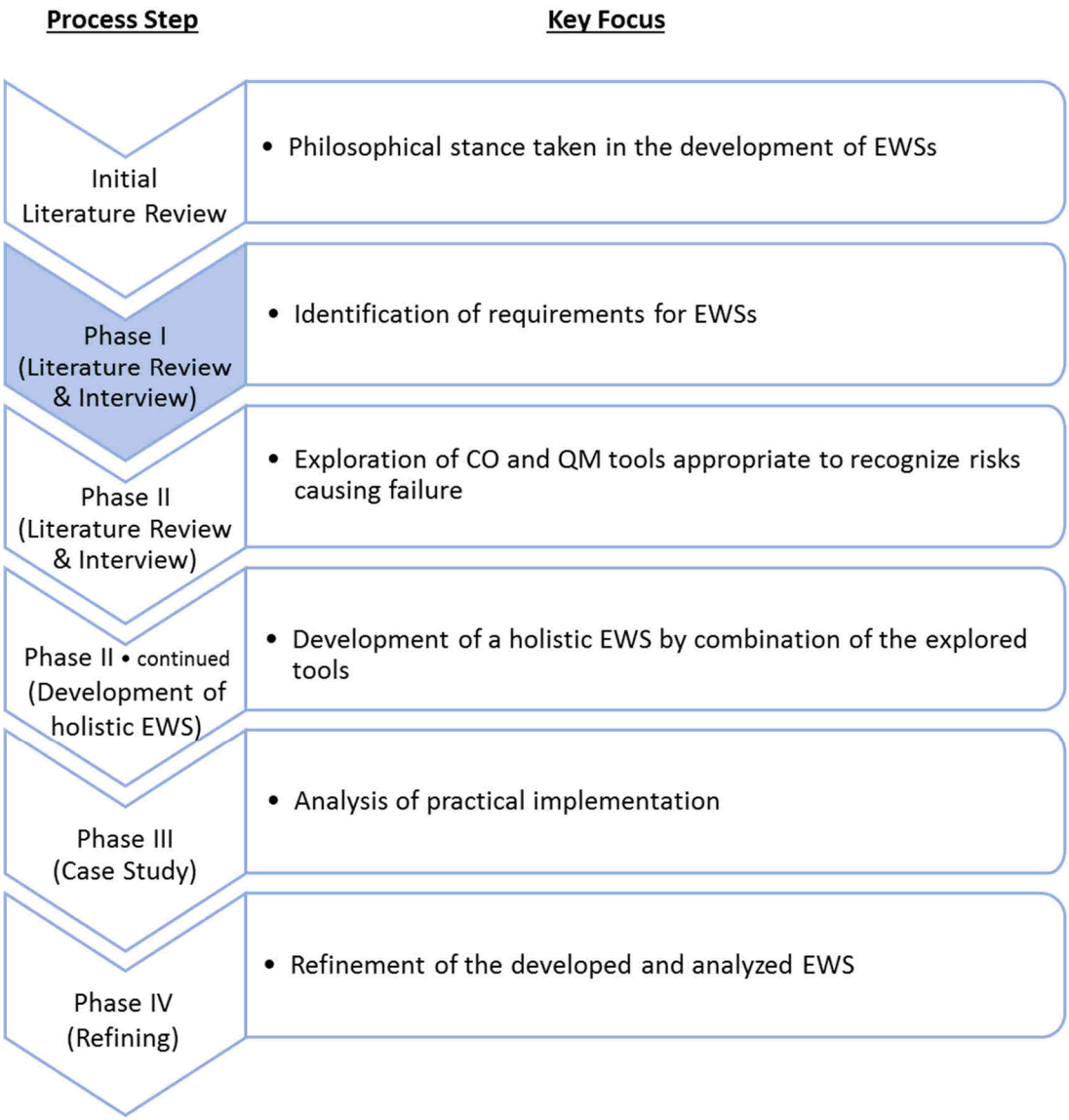

Figure 3 Identification of requirement and the intended outcome

Source: own illustration

This iteration is to make sure, that all relevant factors which build the basis/framework for an EWS are considered in the next research step.

The **first phase**, shown in figure 3, starts in Chapter Four with identification of the requirements for a successful EWS from literature review, followed by the semi-structured interview of three turnaround/interim management experts. The findings from the theoretical and empirical area are compared, categorized and combined to form a unified list. The outcome helps the author establish a framework from both points of view, theoretical and practical, for the requirements to be considered during the next stage, as shown in figure 4, of the exploration of CO and QM tools appropriate for an EWS for the German food production industry.

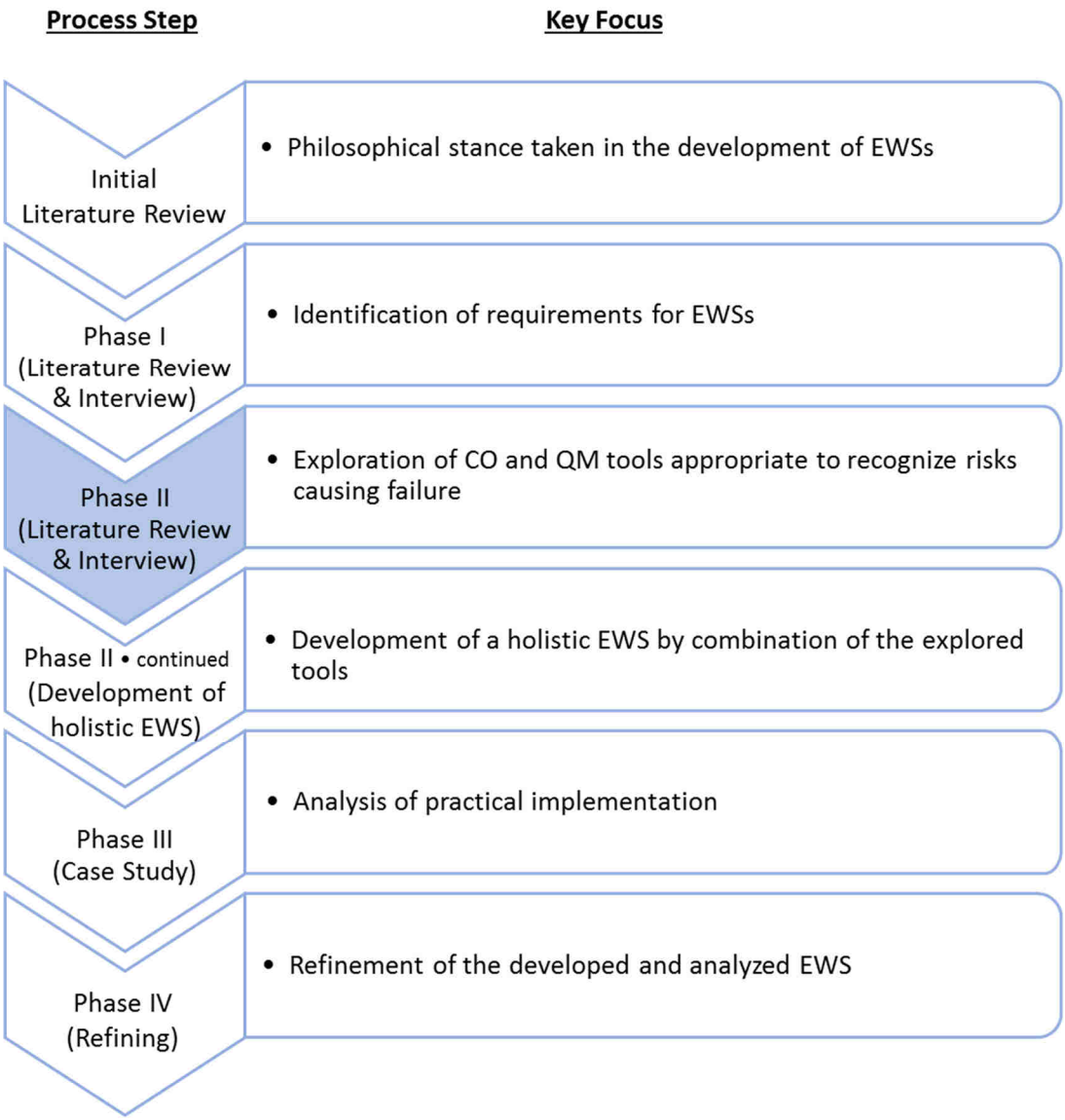

Figure 4 Exploration of CO and QM tools and the intended outcome

Source: own illustration

When dividing the EWS into the two major areas of "scanning" and "monitoring", according to Ansoff (1976), whereas the literature mostly covers the "monitoring" area to a large extent, if not completely. By being able to elaborate on the area of "scanning" in the form of a guideline approach, we find a gap in the current literature during the concepts for the use of tools for EWS. This is described in the literature as a complex area with a diversity of different risk areas, which reflects the quite incomplete elaboration. This work tries to address this gap by the use of **PESTLE**, named by Stewart & Rogers (2012) as a key tool for scanning

of the environment. Furthermore, a tool for the link from strategic to operative, which this work intends to solve by **BSC**, is completely missing in the previous concepts. Even Hammer (1998) himself names this as the most difficult part. This is, however, the main criticism of Concept of Hammer (1998), even though Bertram (1993) states that Hammer's concept is one of the most far-reaching considered, due to its detailed classifications and control function, as his concept covers most known requirements of the literature. However, the tools PESTLE and BSC, are only two of those tools which this work intends to include in the model as new elements. Although a part of the literature already contains chapters devoted to the tools and methods, these are often just listed and only briefly described. The precise application areas and possibilities for the respective instruments are missing. This fact, however, is understandable because of the focus on the "generality" of the literature as mentioned above.

However, the aim of this work is the use for a smaller range of enterprises, where I will close this existing gap by exploring more closely the most important tools and methods and how they can be integrated into the construct of an EWS. To be able to fulfill this aim, as stated by Bruhn (2001), QM and CO are taken together to form a more holistic EWS and it is necessary to answer the second research question:

2. Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production industry and how can they be combined to form an integrated framework?

For this purpose, I will give an overview of the instruments that can be used mainly in the German food production SMEs, which risk areas can be covered and scanned, and then elaborate and verify the best-practice elements, including the evidence from the interviews conducted.

If we now take a closer look at the gaps presented individually, it becomes clear that "black-and-white thinking" prevails in the literature. Attempts were made to divide the hard-to-grasp issue of an EWS into as many individual parts as possible. These, however, cannot, and do not, have smooth separation points, and an attempt was made to make these sub-areas individually transparent,

comprehensible and applicable. This is the correct approach in a complex situation, but the parts have to be reassembled afterwards, so that the end product is again interlocked and practicable as, otherwise, it becomes a non-applicable theoretical object. I intend to create a combination of the mostly theoretically described parts within a certain kind of enterprise, with an equally detailed practical recommendation. This is based on the two main areas of CO and QMS and is supported by a pool of common tools and methods that are relevant for this branch of business, which, as shown in figure 5, combine, during Chapter Six (Phase II continued), to form a practically applicable and effective EWS.

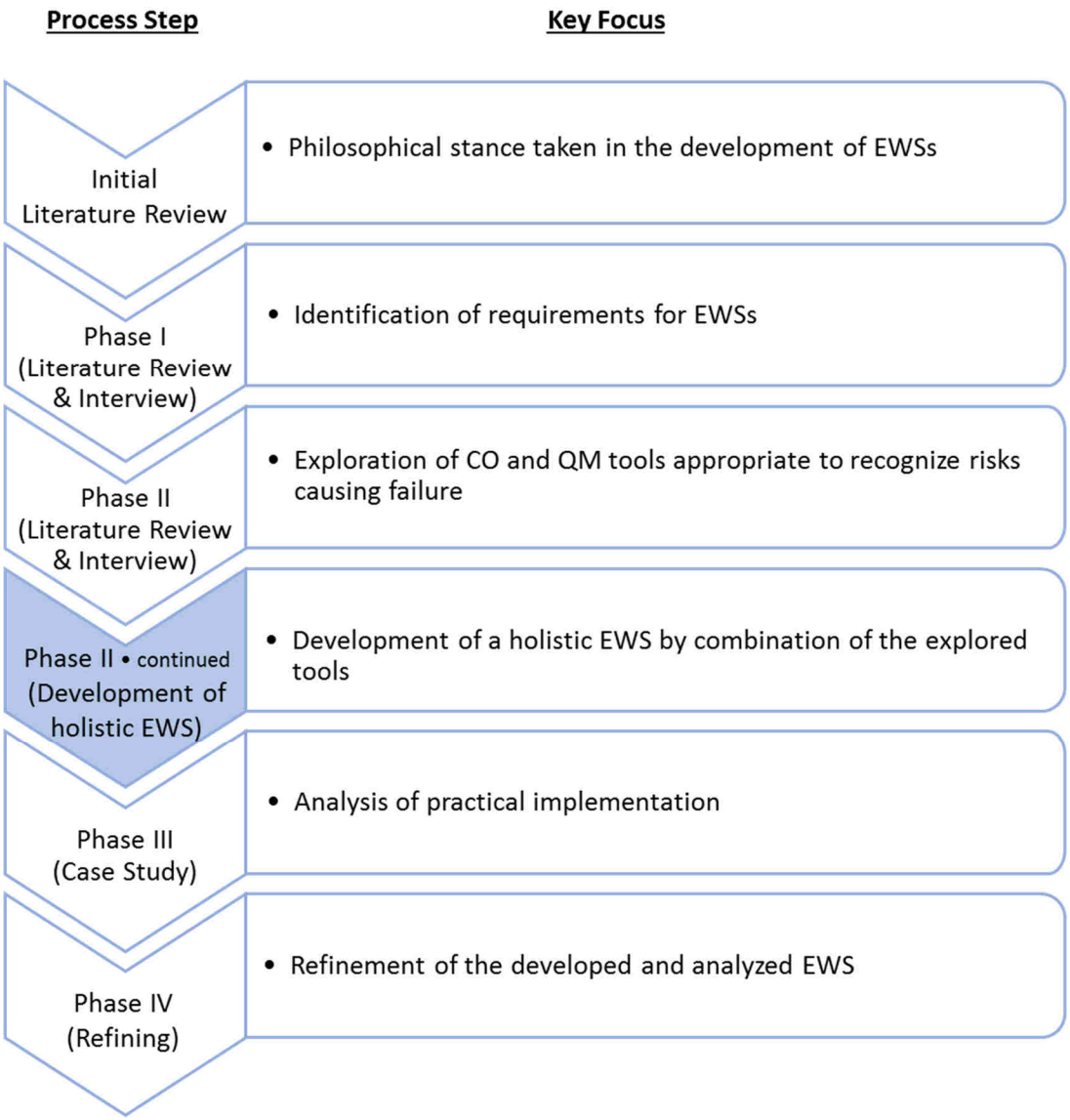

Figure 5 Development of a holistic EWS

Source: own illustration

Following this, Popper`s approach is used insofar as he suggests examining interview data informally and using it to derive conjectures (Wood & Welch, 2010). This links with the next step of Case Study, which is then used for analysing the appropriate implementation and use in SMEs as best-practice elements designed by Experts and literature review.

To be able to cover also the practical and integrative approach, it is necessary to address the third question:

3. Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

During **phase three** in Chapter Seven, as shown in the figure 6, the developed model is presented to the companies with the aim of analyzing the practical and integrative approach in SMEs, as well as for refinement. The two studies take place within two separate and independent medium-size companies. Both companies are German producers of food with QM and CO departments.

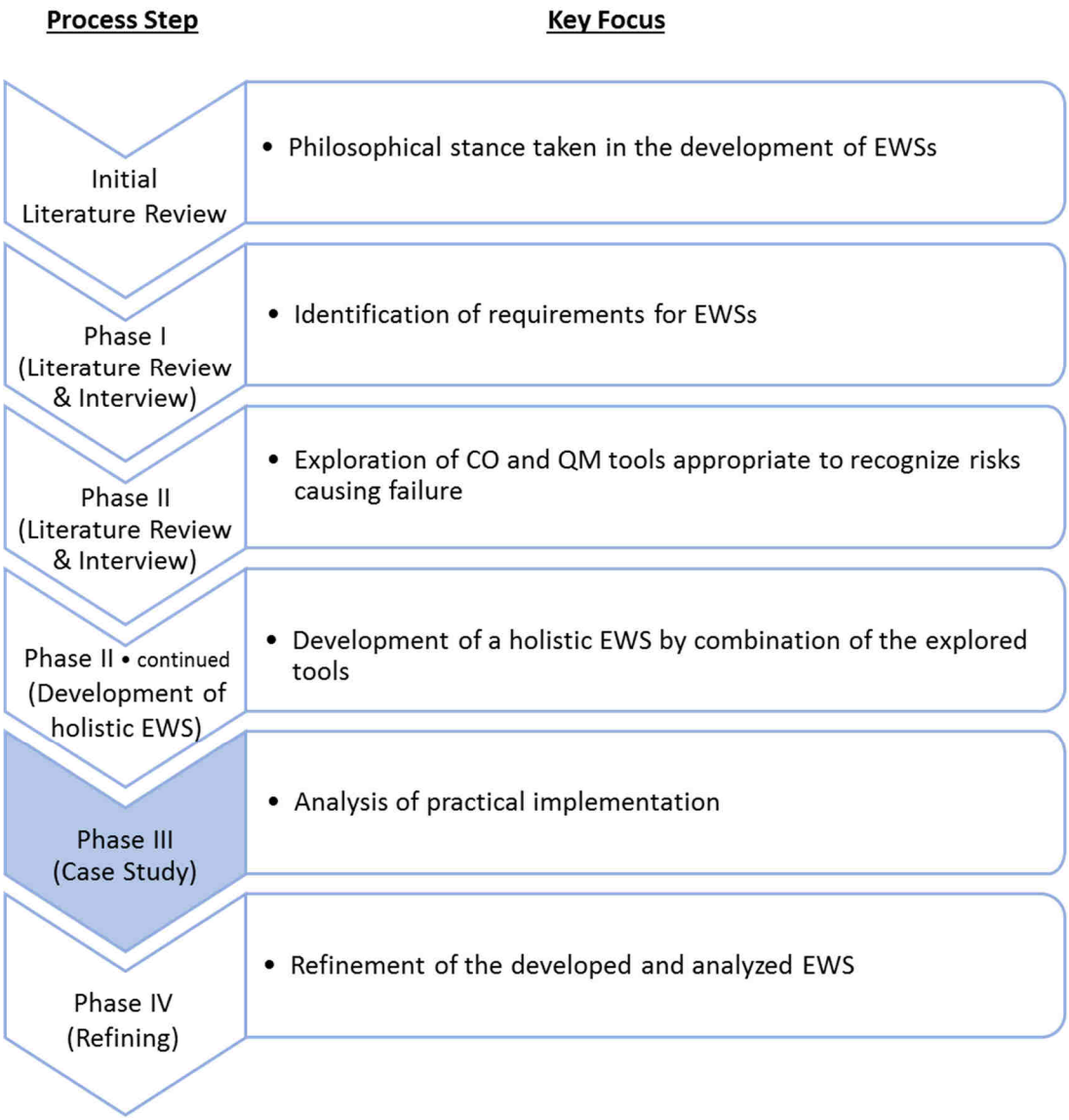

Figure 6 Case Study Approach

Source: own illustration

Additionally, Yin (2009) recommends further investigation and refinement of best practices. Consequently, the aggregated results of the interviews from the Case Studies, as shown in figure 7, were integrated during **phase four** in Chapter Eight, into the corresponding model by analytical consideration of the theoretical basis and integration with the statements from practice. For this reason, the technical, financial, organizational, and operational views were taken into account.

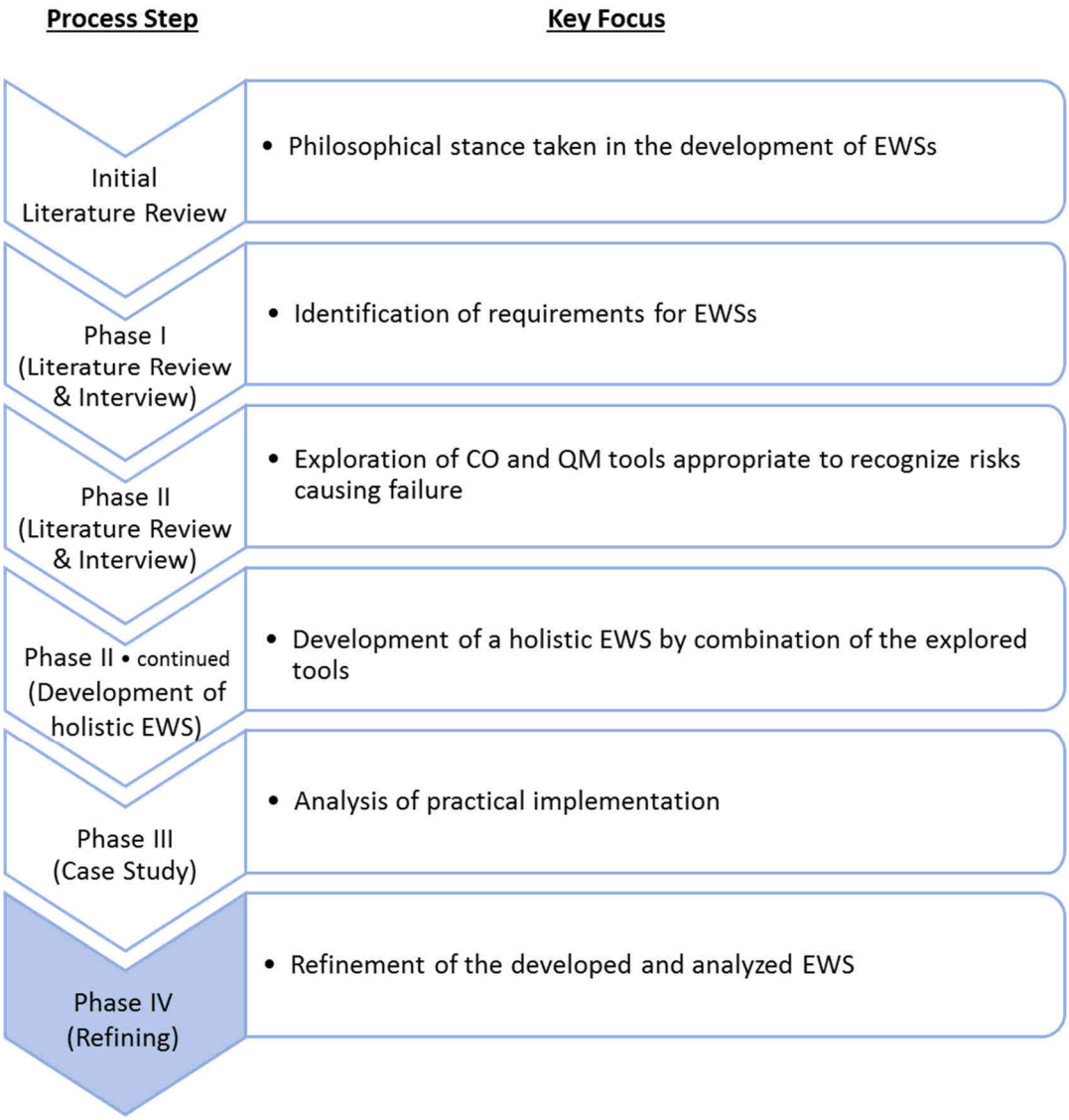

Figure 7 Refining

Source: Own illustration

Finally, this approach enabled the verification of a practicable EWS, which is compared, validated and refined appropriately following suggestions for the implications of its use.

1.5 Thesis Structure

The thesis structure is provided as an overview and includes a brief description of every section, including all of its chapters. This thesis starts with the introduction chapter, followed by the literature review. The next chapter includes methodology, which describes how the study is performed. The fourth chapter shows the identified requirements for an EWS, followed by the exploration of CO & QM tools, appropriate for recognizing risk factors of company failure. The subsequent chapter details the development of the EWS, which is analysed for practical use during the case study in chapter seven. The eighth chapter refines the developed model and leads to the ninth and final chapter which is the conclusion. Each of these chapters is shown in figure 2 and described below.

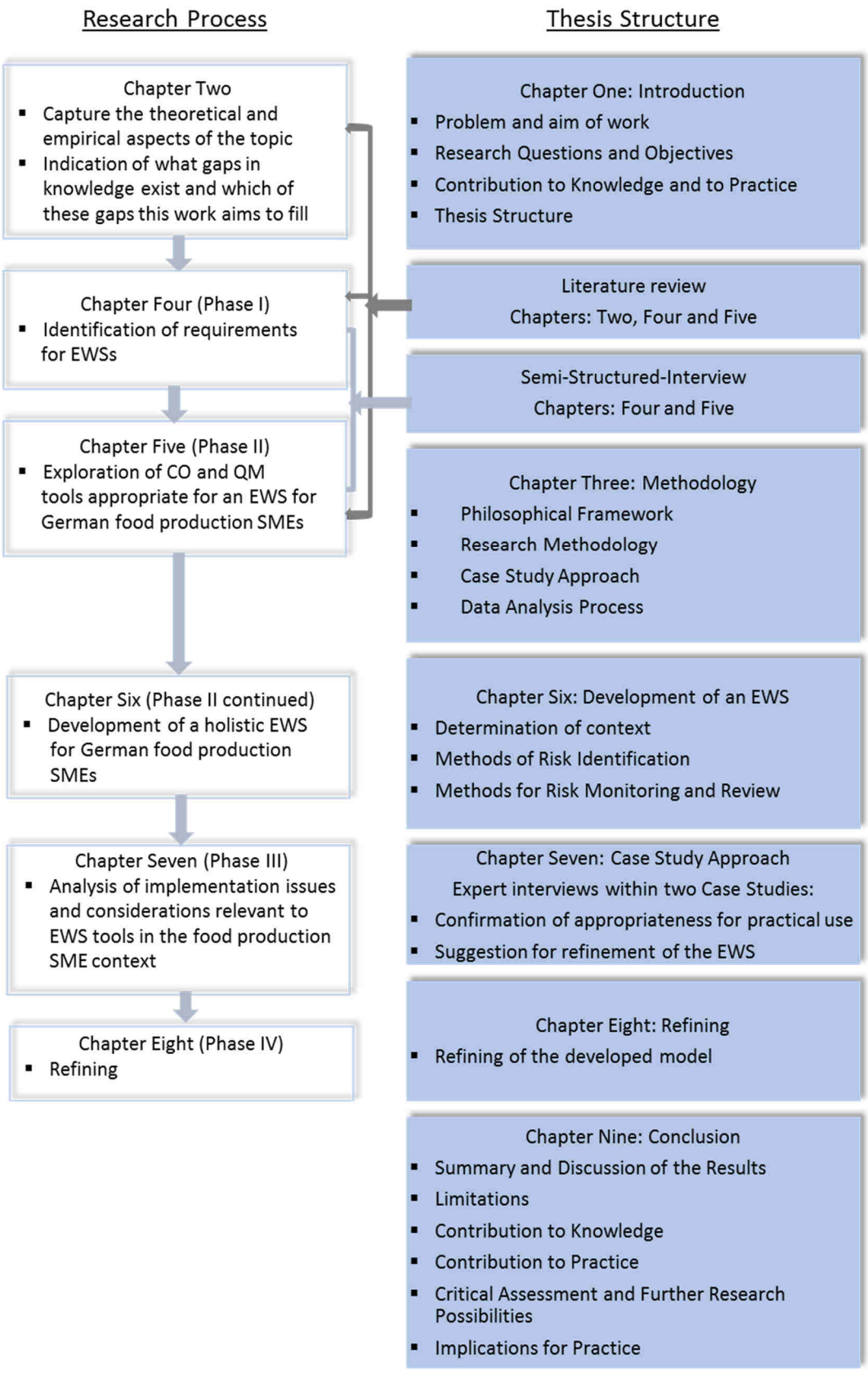

Figure 8 Research process and thesis structure

Source: Own illustration

Chapter One: Introduction

The first chapter outlines the research problem, research questions and objectives, research phases and their intended outcome, followed by the thesis structure. The thesis structure includes a map of the research process, which guides the reader through the research phases and their treatment in the thesis. Furthermore, it discusses the contribution to knowledge and practice, as well as provides background and rationale for the work.

Literature Review (Chapters Two, Four and Five)

Three chapters within the current study constitute the literature review. ***Chapter Two*** presents the initial analysis of the comprehensive literature review to facilitate the understanding of the previous studies of early risk and crisis recognition, which makes explicit the philosophical stance taken in the development of the Early Warning System. This captures both, the theoretical and empirical aspects of the topic. It starts with the development stages of EWS in the Business Economics literature, its forms of appearance, followed by the description of different models and finishing with EWS approaches. In addition, it includes a synthesis section, which demonstrates to what extent there is an agreement between workers and to what extent there is disagreement, summarized in a table with key literature sources and the contributions they have made. Finally, the literature review finishes with an indication of what gaps in knowledge exist and which of these gaps this work aims to fill. ***Chapter Four*** (Phase I) starts with the review of requirements for a successful EWS from literature, where the main points are described and afterwards contrast with the data from the interview. ***Chapter Five*** (Phase II) of the literature review extends the previous chapter exploring CO and QM tools, suitable for recognizing risk factors of business failure, which matches the requirements from the previous chapter.

Semi-Structured-Interview (Chapters Four and Five)

Two chapters in this study use the semi-structured interview. ***Chapter Four*** (Phase I) starts with the overview of requirements for a successful EWS from

literature, followed by the findings from interviews, which are compared with data from the literature review. ***Chapter Five*** (Phase II) shows and explains CO and QM tools from the literature review, suitable for recognizing risk factors of business failure. This is followed by the data from interviews and an unified list of the requirements, which were identified in the previous chapter. The findings were compared with data from the literature review.

Chapter Three: Methodology

The research methodology chapter provides an overview of how the research paradigm is described in relation to its ontology, epistemology, the selected research approach, research strategy employed and a justification of these choices. This is followed by the description of methods by which data were collected and analysed. The final part of this chapter describes the problems arising from bias and how it was attempted to avoid them.

Chapter Six: Development of EWS (Phase II continued)

This section on the elaboration of an EWS approach is divided into three stages: determination of the context, followed by risk identification and finished by risk monitoring and review. Each stage examines the recommended best-practice tools by an explanation of their uses and aims. The development of the EWS is based on the findings, worked out through theoretical results and interviews, conducted during this work.

Chapter Seven: Case studies (Phase III)

The EWS approach developed in Chapter Six was validated by two case studies. Chapter Seven starts with the description of the appropriateness of case study for this research and finishes with the results of the interviews obtained by the case study.

Chapter Eight: Refining (Phase IV)

Chapter Eight refines the EWS approach by integration of the aggregated results from the interviews into the corresponding model by analysis, consideration of the theoretical basis and recognition of the statements from practice. Technical, financial, organizational, and operational viewpoints were taken into account.

Chapter Nine: Conclusion

This chapter discusses the answers to the research questions and summarizes the empirical and literature review findings. It justifies the approach of EWS and explains the limitations of the present study, as well as giving suggestions for future research.

2 Definition of Terms and Literature Review

2.1 Introduction

This chapter presents a definition of terms relevant to this study and then moves on to the critical analysis of the literature review to facilitate the understanding of the previous studies of early risk and crisis recognition. The aim is to assist in identifying appropriate CO and QM tools for a holistic EWS approach.

2.2 Definitions

The aim of this chapter is the definition of terms. The defined terms below relate to the specific aims and problems of this work. The definitions originate from the literature, as well as from the author when no suitable source was found.

2.2.1 EWS

An Early Warning System (EWS) can be defined as an information system designed to warn companies when problems arise (Löhneysen, 1982) where companies have to initiate counteractions (Götze & Mikus, 2000). Kästner (2012) adds that an EWS should promptly predict factors, which are essential for the development of the company's success. The aim of an EWS is to identify risks/crisis in real time, where the company has enough time to handle them (Löhneysen, 1982). Trustorff (2012), in contrast, states that an EWS has to recognize the risk in the formation phase.

Ruderer (2009) goes one step further and claims that an EWS has, by exploitation of available information as early as possible, precisely and comprehensibly to predict the relevant variables of the company. Bedenik et al. (2012, p. 672) sum up by saying that: "The role of early warning systems as an instrument for crisis aversion is in: revealing weak signals, transferring relevant information about environmental changes, prevention of business crisis, and constructing a creative base for timely and appropriate response".

However, EWS is a valuable tool for risk identification, which informs its user in time about latent (which means invisible but existing) risks, thus optimizing company control (Romeike & Hager, 2013). It makes it possible for the companies to gain valuable time for an adequate response to imminent dangers or for explaining potential opportunities (Ruderer, 2009). Early warning can be used as a way of thinking, which accepts the decisions and the possibilities of changes as well as the uncertainties in the company and the environment (Kloss, 1984). The EWS is appropriate if it is able to recognize the risks both correctly and early enough (Hillebrand, 2005). Kloss (1984) states that both the environment and the company give out recognizable signs, which should be noticed.

Crisis identification and risk identification, according to Reimer & Fiege (2009), will be used in this work to mean the same, as the difference is not clearly defined in the literature. Ruderer (2009) assigns the EWS to the risk identification process phase and also includes the risk handling process for the reason that after the prediction and clarification activity it also initiates counteraction by the decision makers. Crönetz et al. (2009) state that the EWS is the initial form of risk identification. The phase of risk identification includes the collection of actual and future (potential and latent) risks, which is the most important stage of risk management, as the result of this stage is essential for all the following steps (Krystek & Fiege, 2015).

Breitkreuz & Lange (2011), in contrast, argued that EWS is a major tool of crisis management. EWS is a "Before Fact Approach", and crisis management is an "After Fact Approach" (Wiedmann, 1984). Crönetz et al. (2009) add that EWS works as a preventative in crisis avoidance whereas crisis management serves to overcome an already existing crisis. Krystek (2015) explains it in more detail, naming the avoidance of crisis as Active Crisis Management, subdivided into Accrual and Preventive Crisis Management, and the handling of crisis as Reactive Crisis Management, which is subdivided into Repulsive and Liquidative Crisis Management – which will be discussed in Chapter 2.3.

However, the main point here is to identify the correct problem, especially with the aim that the EWS can be used by SMEs. "In the SME sector, the company's crisis identification is specific because of the nature of SME business

management which creates the strong reliance of business results on human resources and environmental factors" (Kurschus et al., 2015, p. 152).

Furthermore, the information search and information processing expenditure is enormous, so that it is not manageable for SMEs for the reason of lack of sufficient technological and human resources, to overview the whole area, in contrast to big companies (Schlüter, 2004). The management has to start with the company policy and strategic plan, reducing complexity, so that the exploration of information can be found close to the symptoms, without an endless search for alternative problems (Kelders, 1996). It means that EWS should be able to recognize risks and an ongoing crisis (Reimer & Fiege, 2009).

2.2.2 Risk

“Risks are events with the potential to have a significant negative impact on the organization“ (Hopkin, 2013, p. 1). Schaper (2010) adds that risk is an economic action combined with risk of loss. The standard dictionary definition, in contrast, gives “risk” as an opportunity, where something unpleasant may happen, which gives rise to further questions associated with the opportunities (or likelihood) of the event occurring and the nature of the unpleasant outcomes (impact or consequences) (Hopkin, 2013).

ISO 31000 explains risk as “Risk: effect of uncertainty on objectives

- NOTE 1: An effect is a deviation from the expected – positive and/or negative.
- NOTE 2: Objectives can have different aspects such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product, and process).
- NOTE 3: Risk is often characterized by reference to potential events, consequences, or a combination of these.
- NOTE 4: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

- NOTE 5: Uncertainty is the state, even partial, of deficiency of information related to understanding or knowledge of an event, its consequence, or likelihood" (ISO, 2009, p. 1-2).

The Oxford English Dictionary (2016) definition of 'risk' is: "the possibility that something unpleasant or unwelcome will happen" and the definition of 'at risk' is 'exposed to danger'. In this context, 'risk' is used to signify negative consequences (Hopkin, 2013). In addition, "the Concise Oxford English Dictionary (2011) defines 'risk' as, 'hazard a chance of bad consequences, loss or exposure to mischance" (McNeil et al., 2015, p. 3).

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) describes 'risk' as "Internal and external events affecting achievement of an entity`s objectives which must be identified, distinguishing between risks and opportunities" (COSO, 2014).

Allenspach (2006) describes 'risk' as the possibility that, in the context of goal achievement processes – due to success factors as interference processes – the result of the underlying expectations deviate. The success factors of a company shown by Crönetz et al., (2009) comprise market, business background/identity, continuous improvement, resource, structure, processes, competence, aims and strategy, which all have to be monitored.

2.2.3 Concept of risk

The risk in an organizational context is usually defined as anything that can have a significant impact on the fulfillment of corporate objectives, which can also be an opportunity (Hopkin, 2013). Krystek et al., (2007) describe risk as a companion for each business activity.

"However, it is helpful to clarify two issues: 1) whether risk can be attached to features of the organization other than corporate objectives; and 2) whether risk should always be considered as a negative" (Hopkin, 2013, p. 15). To bring clarity to the purpose of the initiative, the word 'risk' is used, throughout this work, to indicate negative events and/or those events with an unacceptable level of uncertainty.

2.2.4 Types, Stages, and Process of Crisis

Company Crisis is a serious problem which often gets ignored. It can be described as an economic difficulty or as a threat to the company which will reach unto the border of its existence (Krystek, 1987). The Strategy crisis e. g. can be seen as the lack of competitiveness, market share, unclear market and product position (Mayer, 2008). The Profit Crisis follows the product and selling crisis when the countermeasures have not been taken (Crone & Werner, 2012) and in the Liquidity Crisis stage, the company suffers from insufficient Working-Capital Management, the complexity of finance structure as well as the relation between equity and debt capital (Hohlberger & Damlachi, 2010). In this stage, Crisis Management will still be effected out of court.

The final stage of a crisis is Insolvency, which involves judicial proceedings (Crone & Werner, 2012). The obligation in Germany for an insolvency form is, according to §§ 17 – 19 InsO, when the Company is Illiquid, Illiquidity is threatening, or the organization is deeply in debt (InsO, 2012).

Crisis is a process, and knowledge about the stages helps recognition of the signs and facilitates their better handling in an appropriate manner, which can be either active or reactive (Krystek et al., 2007). The crisis process can be of varying length, where extreme forms of long-lasting, only gradually accelerating crisis processes are found as well as abruptly - occurring crisis processes, with rapid acceleration and extremely short processing time (Löhneysen, 1982). Krystek et al. (2007) state that for the determination of appropriate starting points for crisis prevention and crisis management, a subdivision of the crisis process into different phases can and must be made.

The beginning of the crisis can be described as a combination of the efficiency factors, which are not workable anymore for the reason that one or more factors are no longer available (Bratschitsch & Schnellinger, 1981). It could be calculable as well as incalculable, differing in the reaction time during which the management has the opportunity to react (Krystek et al., 2007). The calculable crisis sends warning signals, and the organization would be well advised to react immediately to the crisis with management and communication process (Löhneysen, 1982).

The incalculable crisis, in contrast, does not send any warning signals and the company has to conduct simulation scenarios for the recognition of them (Reineke, 1997). The establishment, growth, or maturity of crises are parts of the Life Cycle Stage and can cause suffering within the company if the counteractions do not work - it could be the beginning of stagnation, shrinking, or growth-crisis, which attack the development of a Company (Hohlberger & Damlachi, 2010).

Furthermore, the selling-, management-, purchasing-, technological- or organizational crisis brings about the imbalance of the company and leads, at the end, to failure (Ackemann, 1986). To get to know the signals of the failure, it is important to know about the CRISIS STAGES.

The crisis stage marks the degree of the threat to the company, and it is indisputable that a crisis is at hand, when the company is over-indebted or illiquid and for this reason has to file for insolvency (Crone & Werner, 2012). This part is clearly defined by law (Hauschildt & Leker, 2000), but the aim of this thesis is to recognize the risks before a crisis arises and if it does so, then it is better to realize the crisis at the beginning of the process, which begins with the **potential crisis** (shown in the figure below), where the company does not really realize that it has a problem (Krystek et al., 2007).

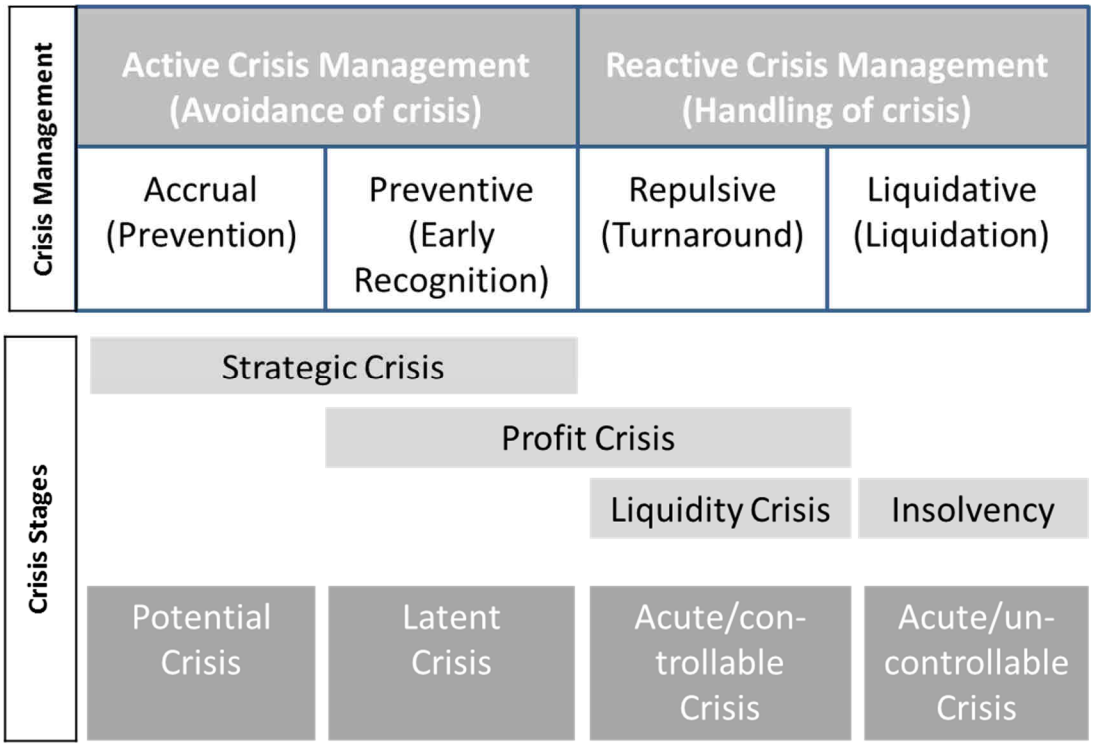

Figure 9 Crisis Stages and Crisis Management

Source: Welsch (2010)

The reason for this stage is that the symptoms of a crisis are difficult to see (Crone & Werner, 2012). This means that the company has to analyze the state of their health continuously (Krystek et al., 2007).

When the company can clearly recognize a long-standing crisis, it is already **acute**. The target is to counteract this with proper measurements (Ackemann, 1986) before the **manifest crisis** arises, wherein the impact of time on the progression of the crisis will be shorter and the need for avoidance of insolvency greater (Hauschildt & Leker, 2000). Following this stage, the decision about asset stripping or continuation of the company will be made (Leker, 1993).

The avoidance of crisis can be called Active Crisis Management and subdivided into Accrual and Preventive Crisis Management (Krystek et al., 2007). Accrual Crisis Management has as reference point the Potential Crisis, during which the aim is to avoid the onset of a crisis by specific prognosis (Leker, 1993). At the stage of Latent Crisis, the company should recognize the crisis in time and initiate appropriate measurements for Avoidance of Crisis (Krystek et al., 2007).

The handling of crisis will be called Reactive Crisis Management, subdivided into Repulsive and Liquidative Crisis Management (Leker, 1993). At the acute/controllable crisis stage, the Repulsive Crisis Management is responsible for taking all actions to effect Turnaround (Crone & Werner, 2012). The acute/uncontrollable crisis is no longer manageable and the company should be liquidated to achieve the best creditor satisfaction (Krystek et al., 2007). Strategic, Profit and Liquidity Crisis, as well as Insolvency, have already been discussed above.

However, the aim of this thesis is to recognize the risks, explained in the above chapter, before a crisis arises, and if it does, then it is important to identify a crisis at the beginning of the process e. g. during the **potential crisis** (shown in figure 1 above), where the company usually has valuable time for counteraction (Krystek et al., 2007).

2.2.5 Quality Management

The success of many German Companies is due to the quality of their products and services. Experience shows that these are companies which set quality as a company aim as well as the strategy and philosophy, which is led by employees and management (Brüggemann & Bremer, 2012).

Quality Management Systems began in 1987 with DIN EN ISO 9000 ff. The important years were between 1994 and 1996 when many companies implemented their first QM-System. Today we have a lot of different norms relating to specific industry sector, such as Automotive, Medical Technology, Telecommunication, etc. (DIN, 1997).

Most businesses have a top-down structure. Individual divisions or departments operate in parallel and are responsible for distinct functions like procurement and production. The main focus is neither on customers nor orders, but on a specific function (Faulhaber & Landwehr, 2006).

Welsch (2010) analyses three companies in difficulty in the form of a case study and arrives at the conclusion that they have a non-transparent and inadequate structure of processes, top-down communication, authoritarian leadership,

centralised structure of decisions and low experience of change, which can be related to human error, irrespective of the industry.

Krystek et al. (2007) suggest motivating employees in the style of an evangelist for alertness to crises, willingness to change and to think of the unimaginable such as “what if …”. The requirement of Krystek & Müller-Stewens (1993) for strategic forecasting is its spread throughout the whole company and not its delegation to a few experts. The influence and control of processes like Quality Management make the whole overview of the company possible (Wolf, 1996).

IBM has proved that by Business Reengineering, where the areas of costs, quality, service and time were improved, they recognized that in many areas the structure was too old and inapplicable (Weber, 1995) and they had to rethink the strategies and reinvent the operating models before debilitating stalls set in (Nunes & Breene, 2011). Brüggemann & Bremer (2012) add that the above components are regulated in ISO 9001 and include Continuous improvement; Internal customer-contractor-relationship; Process-driven organization and working structure; Involvement and motivation of all employees.

ISO is the International Standards Organisation. It established a worldwide basis, ISO 9001, that focuses on the documentation of a company’s quality system. Therefore companies have to have a series of manuals about the structure and implementation of the quality system (Brüggemann & Bremer, 2012).

As soon as the quality system is documented, the company is registered as a company with a working quality system in place (DIN, 1997). This helps to facilitate trade because of the Supplier’s conformance. ISO 9001 is one of the most significant and popular Quality Management Systems (more than 40,000 companies are registered with this standard) (Bruhn, 2011).

To satisfy ISO 9001, a company has to get their processes under control; they have to plan them, follow them, ensure that they are effective, correct them if they are deficient and constantly improve the existing processes (Tricker, 2014). The requirements of the main points for ISO 9001:2015 are in the following areas:

- Quality Management System as process approach
- Consideration of Quality Aims and Policy

- Strategy and Stakeholder Orientation
- Resource Management and Knowledge Management
- Customer Approach
- Product Development and Realization
- Measurement Analysis, Risk Prevention, and Improvement (Hinsch, 2014).

In general, it can be said that Quality Management has the following stated principles, which a company has to prove and improve:

- The company has to focus on the customer
- The company is led by a leadership which involves people
- The management has to follow a systems approach while the company has to apply the process approach and the decision making the factual approach
- One of the most important principles is the continual improvement and last but not least the mutually beneficial supplier relationship (Tricker, 2014).

The advantage of a QM-System is that you have a clearly defined process flow, clear company structures, high transparency, increased efficiency, traceability of products, sustainable quality consciousness, better image, reduction of mistakes and cost cutting (Seghezzi et al., 2007). QMS is a Management System for the conduct and control of a company in terms of quality, which in turn, determines the policy and aims as well as the achievement of those aims (Giebel, 2011). The ISO 9001 is appropriate as the basis for using the company flow chart for integration of additional management systems (Wagner & Käfer, 2010).

To maintain the effectiveness of an organization, its activity must be identified, linked, conducted and controlled, as the control loop of the model includes the customers as well as the interested party and therefore goes beyond corporate boundaries – only the Finance component is excluded (Giebel, 2011). This work aims to remedy this deficiency of CO, which will be explained below and leads to

the connection of this to a suitable model of the effective relationships through a process model.

2.2.6 Controlling

Controlling is a management subsystem and has the role of supporting the management. The management has the task of planning, controlling, organizing and leading the staff. In this case, Controlling ensures the necessary supply of data and information. A Controller can be compared with a doctor who is struggling to keep his patient in lifelong health, just as the Controller is seeking a permanent positive development of the company (Fiedler, 2001).

To stay with this comparison, the necessity of a Controller is because of the individual nature of the decisions in every part of the company as in a human body, where every part has its individual purpose. A Controller/Doctor has to check if all parts of the company/body are working together towards the main goal and if not, to analyze which part is not and what the reasons may be (Küppler et al., 2013).

Weber & Schäffler (2008) state that Controller is responsible for business results, finance, processes and strategic transparency. Horváth & Gleich (2012) go a step further and state that the corporate Vision and Mission are the cornerstones of Strategic Controlling.

The Operative Controlling, in contrast, brings its aims and plans for measures into line with Strategic Controlling (Weber & Janke, 2013), which means it analyzes and detects the market share, price development and so on. The task is to produce operational budgets, which include the finance plan, projected balance sheet, etc., followed by cost planning and operative control (Fiedler, 2001).

However, "Controllers ensure the transparency of business results, finance, processes and strategy and thus contribute to higher economic effectiveness. Controllers coordinate secondary goals and the related plans in a holistic way and organize a reporting-system which is future-oriented and covers the enterprise as a whole. Controllers moderate and design the controlling process

of defining goals, planning and management control so that every decision maker can act in accordance with agreed objectives. Controllers provide managers with all necessary company management data and information. Controllers develop and maintain controlling systems" (Vesper, 2014, p. 17).

2.3 Literature Review

2.3.1 Development Stages of EWS in the Business Economics literature

Early Warning Systems are not a new development in business, but were, long before their application to business subjects, used especially in the military field. Here, for example, they report enemy attacks significantly in advance so that effective countermeasures can be taken at an early stage, and surprises can be avoided (Rieser, 1980). Krystek (1987) adds that in other fields such as medicine, biology, meteorology and geology early warning systems are long-established. In the field of Economics, Aguilar's (1967) concept of "Environmental Scanning" was mentioned by Hauff (2010).

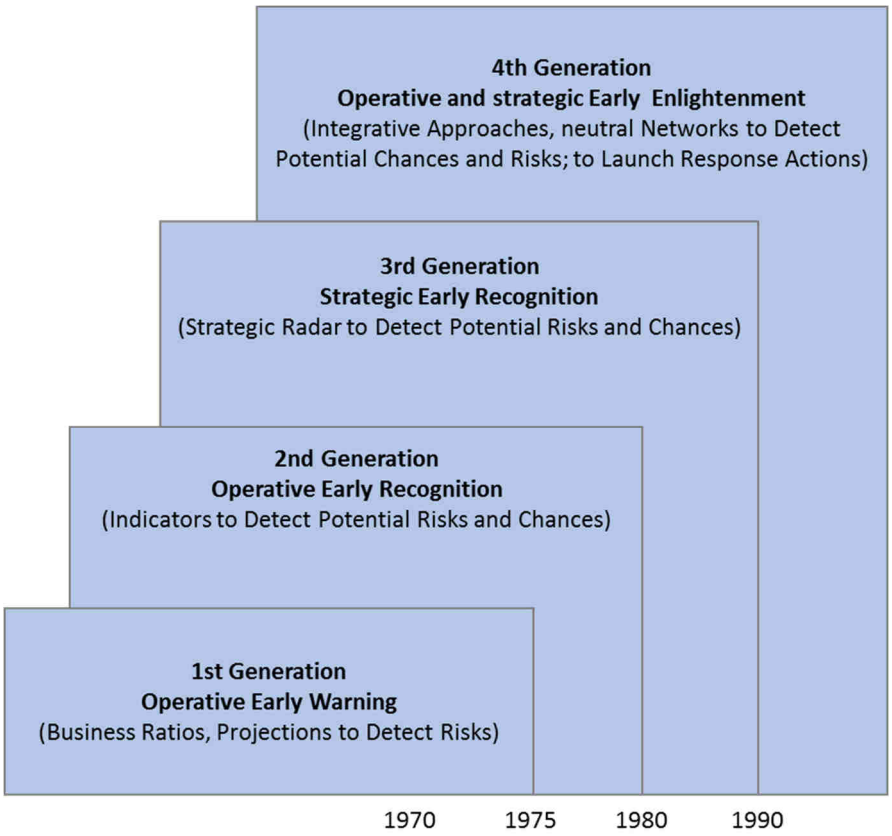

Figure 10 Development Stages of EWS in Business Economics literature

Source: Kirschkamp (2007)

Figure 10 shows a possible differentiation of early warning methods with reference to their time of occurrence. In the early 1970s (1973-1977) the **first generation** was developed: the so-called (operative) early warning. This generation only focused on determining and identifying latent risks or threats (Kirschkamp, 2007). The aim, however, was to detect them so early that there still remained sufficient time to plan, implement and control appropriate counteractions (Krystek et al., 2007). The basis for early warning was especially forecasting on the basis of historical values (Kirschkamp, 2007). This means that reporting procedures were developed on the basis of key performance indicators, which sent signals by the exceeding or falling below of defined thresholds (Hauff, 2010), where the early recognition was carried out in the classic bookkeeping way. In addition, KPIs do not really work efficiently in showing discrepancies, because there is only a signal for the internal orientation, and so the external environment is missing (Hauser, 1989). At the same time, so-called 'planning

forecasts' were developed, in which it was possible to make a comparison between the planned or target data and the extrapolated actual data, and, at the discovery of any discrepancies to take appropriate countermeasures in time (Hauff, 2010).

The development of the so-called **second generation** took place from 1977 to 1979 (Hauff, 2010). Characteristics of the second generation, were the extension to chances and opportunities (Krystek et al., 2007), as well as the extension of the planning horizon of the (operative) early recognition (Hauff, 2010). While the first generation only worked with annual plans and the appropriate (internal) working indicators, in the second generation, indicators were developed, which were designed to identify longer-term, internal and external changes (Hauser, 1989). Hauser (1989) adds that the determination of indicators is often difficult, as well as being impractical. This development led quickly to the recognition that this system can recognize not only risks and dangers but also latent opportunities and chances (Krystek et al., 2007).

The (strategic) forecasting is mentioned as the **third generation** when describing an additional development (Krystek et al., 2007). This has the additional goal of early detection of risks and opportunities, as well as the initiation of appropriate counteractions (Schlüter, 2004). Krystek et al. (2007) add that the Ansoff (1976) Concept of "Weak Signals" is useable in this stage for the identification of Threats and Opportunities from both the internal and external environment.

The **fourth and last generation,** so-called ‘operative and strategic early enlightenment’, is based on a holistic approach by integration both ‘operative’ and ‘strategic’ early recognition (Krystek et al., 2007). This stage is also characterised by networked thinking and builds the basis of response actions (Kirschkamp, 2007). Janßen & Riediger (2015) state that companies today have to identify risks which were scarcely considered in the past. They add that due to globalization companies are much more affiliated with each other (the figure of multinational companies has increased in the last 50 years from 7,000 to 104,000; it is estimated that it will reach 140,000 by 2020) and this increases the complexity of risk. “Indicators and EWSs are becoming more important as they can predict

possible future changes in their early stages and thereby reduce the time needed to make adequate decisions" (Bedenik et al., 2012, p. 672).

2.3.2 EWS – forms of appearance

The historical stages of development for early warning approaches are very diverse and can be divided therefore into several different forms of appearance (Krystek, 1987):

Cross-organizational framework

One of the first and fundamental differentiations is the differentiation between the microeconomic and the macroeconomic early warning, where the macroeconomic early warning is not limited to just one company, but also pursues the development of whole regions or countries (Hauff, 2010). The focus here is on the early detection of cyclical development and changes (Nerb, 2001).

For this purpose, various forecasting methods and indicator analyses were applied in the economic research (Krystek, 1987). An example of such indicators can be given by the "Geschäftsklima", developed by the IFO institute, which has been successfully applied for several decades (Nerb, 2001).

The microeconomic early recognition, in contrast, is focused on a single company, but there is an incremental variance between these two poles within the meaning of cooperation for several companies (e. g. the same industry) (Hauff, 2010). Looking at the individual economic early recognition, many different dimensions can be seen.

Application purpose

During the application purpose, it is determined whether the management system is self-oriented or externally-oriented (Klausmann, 1983). The self-oriented early recognition is looking for the "classic" early identification of threats and opportunities for their own company (Hauff, 2010). The externally-based early warning, in contrast, focuses on the threats and crises of other market

participants, such as competitors, customers or suppliers (Klausmann, 1983). In practice, this is of interest, for example, for the credit assessment of credit institutions (Krystek et al., 2007) or for the examination of equity or potential investors (Krystek, 1987).

Organizational reference area

In organizational terms, the area is divided into a holistic business-related and a division-related early recognition (Hauff, 2010). In the holistic business-related early recognition all internal and external threats are always taken into consideration (Krystek, 1987). The division-related early recognition focuses on (core) areas of the company, such as sales, procurement or personnel management (Hauff, 2010).

Sponsorship

The characteristic sponsorship divided early warning systems into company level, intercompany and cross-company, early recognition. Whilst company level early warning systems are only considered in relation to a single company, in the intercompany early recognition several companies cooperate. If this cooperation is supplemented by another (independent) institution such, as e.g. a research institute, then one speaks about a cross-company recognition system (Krystek, 1987).

Performance

In performance, a distinction is made according to by whom early detection is performed (Bertram, 1993). This can be carried out both by the company itself (self-reference) or be purchased from third parties, e.g. by a service provider or an institution (Hauff, 2010).

Signal source

With the signal source, a distinction is made by early detection information source (Löhneysen, 1982). While corporate sources are based on internal KPIs and statistics or also information from its own employees, there also exist the Official Publications of statistics, reports, and analyses or external-company signals (Bertram, 1993).

Phenomenon area

The phenomenon area of an early warning system considers the breadth of the analysis (Hauff, 2010). While the mono-oriented phenomenon early recognition considers only a single phenomenon, such as the economic, ecological or technological development the multi-phenomenon related early warning system focusses on several phenomena (Krystek, 1987).

The figure below shows a summarized overview of EWS – forms of appearance.

Characteristic	Possible specificity			
Cross-organizational framework	microeconomic		macroeconomic	
Application purpose	self-oriented		externally-oriented	
Organizational reference area	holistic business-related		devision-related	
Sponsorship	company	intercompany	cross-company	early recognition
Performance	self-reference		purched	
Signal source	internal signals		external signals	
Phenomenon area	mono-oriented phenomenon		multi-oriented phenomenon	

Figure 11 Overview of EWS - forms of appearance

Source: Hauff (2010)

As shown, there is a variety of distinct forms. A description of all features at this point is not helpful and would go beyond the scope of this work. The items listed here, are the most important (Hauff, 2010).

As shown in the figure 11, this approach can only cover sub-areas and can only work within an integrative system. However, the main differentiation in both practice and literature is between the Operative and Strategic Early Warning, which will be now explained in more detail.

2.3.3 Operative Early Warning and Early Recognition

2.3.3.1 Characteristics and differentiation of operative early warning system

In describing the characteristics and specifics of operative early warning systems, the majority of the literature refers to the concept of Krystek & Müller-Stewens (1993). This distinguishes the operative early recognition from the strategic by using the following features:

- System-relation: The operative system is early in comparison to the more system-oriented strategic. This means that it operates on the basis of specific information systems, which are predominantly of a quantitative nature (Krystek et al., 2007).
- Conceptually close to "patterns" from, for example, military or medicine, which use previously-established early warning systems (Hauff, 2010).

The suitability of these features, however, is questioned by Geissler (1995), when he states that they have insufficient selectivity. This is justified by the fact that both the operative, as well as the strategic, early warning, can use special information systems and therefore both are system-oriented, even though they have different emphases. Furthermore, it is argued that “patterns” for the strategic early warning systems already exist (Hauff, 2010). On the other hand, the characteristic of the time-distinguishing mark makes a difference (Krystek et al., 2007). During the operative early recognition, a time horizon of up to 2 years is used as a basis, whereas the strategic early recognition ranges from 2 to 5 years (Hauff, 2010).

The methods and tools of early warning systems were mentioned as the primary distinguishing features, even if the strategic EWS still left a lot scope for guesswork in the selection/identification of appropriate tools. The tools of operative early recognition, comprise KPIs, projections, and indicators (Krystek et al., 2007), are shown in figure 12, and are then described with their related concepts, if any, in detail.

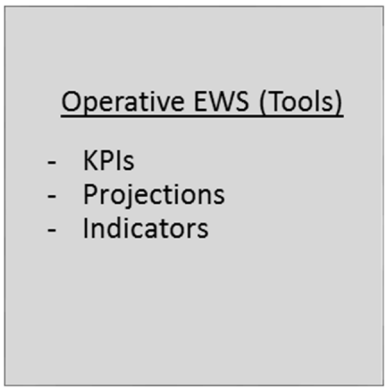

Figure 12 Tools of operative early recognition

Source: own illustration

2.3.3.2 KPI oriented early recognition

KPIs are quantitatively-expressed information, understood as conscious information compacting the complex reality onto numerically ascertainable, business-relevant, and directly ascertainable, situations (Weber & Janke, 2013). Their objectives are operationalization, animation, and encouragement, allegation, regulation and control (Kirschkamp, 2007). Weber & Janke (2013) add that business ratios help executives to be informed about the situation of their business. Kirschkamp (2007), in contrast, states that they simplify complex circumstances and enable communication between departments and different levels of hierarchy. He adds that business ratios are absolute values and are compared to others, using the classic **bookkeeping** method.

The accounting data can be used for a variety of financial ratios that are indicative of the company's financial characteristics – solvency, liquidity, the contributions of debt in relation to equity in financing operations, the asset cover for the equity

interests, rate of return, the interest cover given by the level of profits, the financial implications of the relationships between the separate and aggregated amounts of the different classes of assets and between the different classes of liabilities (Leker, 1993). In this context, Deppe (1992) analyzed the EWS forecast models of BEAVER, ALTMAN, WEIBEL, BEGHARDT and PERLITZ, some of which are described below, and came to the conclusion that each of them uses the balance sheet as the basis. Krystek (1984) adds that such forecasting models are appropriate not only for the assessment of one's company but also for the evaluation of competitors, customers, and suppliers. This concept, however, is only able to recognize crisis or insolvency (insolvency is the last stage of crisis, as described at the beginning of this chapter), where counteractions are often difficult or already impossible (Kurschus et al., 2015).

2.3.3.2.1 Approach of Beaver

The approach in the form of a univariate discriminant analysis was developed in 1966 by William Beaver. Beaver (1966) examined 79 both crisis-affected and also successful companies, based on 30 indicators. The research period was done over a period of 5 years before any entrance into insolvency (Krystek, 1987). He pointed out the ratio of cash flow to total capital/debt capital as the most appropriate indicator for prediction of insolvency risks and states that it possesses a success rate of 78% for 5 years in advance (Acca, 2008). Even if such a simple review can seem elegant, it very soon becomes clear that insolvency risk cannot easily be described by a single parameter. Firstly, this would be contrary to the complex nature of a company and its financial situation (Acca, 2008). Secondly, it could lead to very contradictory statements, when the results of meaningful indicators are compared with this figure (Töpfer, 1999). The success rate of Beaver’s formula is high and due to the fact that its evaluations took place after the announcement of the results from researched companies and therefore it was "tailored" in accordance with these results (Acca, 2008).

2.3.3.2.2 Altman's Z-Score

In order to take account of this complexity, a bankruptcy diagnostics model based on linear multivariate discriminant analysis was developed by Altman (1968) (Kurschus et al., 2015). Altman (1968) examined 33 company pairs (solvent and insolvent, within the same industry sector and as far as possible with equal balance sheets) based on 22 KPIs (Deppe, 1992) and finally came to the conclusion that the following 5 KPIs provide the best results (Acca, 2008; Kurschus et al., 2015):

- Working capital / total assets = working capital over assets (X1)
- Retained earnings / total assets = return on assets (X2)
- Profit before interest and tax / total assets = profitability of assets (X3)
- Market value of equity / book value of debt = equity coverage ratio (X4)
- Sales / total assets = income to assets (X5)

These indicators formed Altman's function and read as follows:

$Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$

The calculated KPI ‘Z’ of a company, can now be classified as follows: (Deppe, 1962):

- Companies with a Z of more than 2.99 are not in danger of insolvency
- Companies with a Z of less than 1.81 are in acute danger of insolvency
- Companies with a Z of 1.81 to 2.99 are in the "gray zone", which means that in the overlap area, errors of the first kind (insolvent companies are classified as solvent) and of the second type (solvent companies are classified as insolvent), may occur.

“The first formula of Altman (1968) for company bankruptcy diagnosis faced criticism for omitting the specifics of a sector, company size, geographical area and other important criteria, but this model was used in parallel as the background for company’s financial state analysis and for further development of company crises assessment models” (Kurschus et al., 2015, p. 154). Eidleman (1995) adds

that especially the index "sales / total assets", which is highly dependent on the industry, was criticized during this model. Later Altman (2002), adjusted his formula as follows:

$$Z = 6.56X1 + 3.07X2 + 6.72X3 + 1.05X4$$

The range must be specified, due to the above information and in this formula is from 1.1 to 2.6.

A further criticism of Altman's Z-score, made by Eidleman (1995) was the focus on large companies with an average value of about $ 100 million (no company had a value below $ 20 million). Despite criticism, his method is still used, especially by shareholders, as balance sheet analysis and, as a "rule of thumb" approach, he is unsurpassed nowadays. However, "he also had some active followers of his ideas (Fulmer et al., 1984; Taffler & Tisshaw, 1977; Springate, 1978), who developed different models using the same linear discriminant analysis methodology but financial ratios and different data for identification of weightings for every criteria" (Kurschus et al., 2015, p. 154).

These additional forecasting models which have been developed, e.g. by Fulmer et al. (1984), Springate (1978) or Taffler & Tisshaw (1977), will not be discussed in detail as they all have one thing in common: they are purely quantitative and relate only to historical values. An overview of each underlying KPI of the respective models is summarized in the following table (Kurschus et al., 2015):

Models\ Criteria	Altman classic, 1968	Altman modified for Ltd's, 2000	Fulmer, 1984	Taffler & Tisshaw, 1977	Springate, 1978
Net working capital/ Assets	+	+			+
Retained earnings / Assets	+	+			
Retained earnings from previous years / Assets			+		
Profit before interests and taxes / Assets	+	+			+
Profit before taxes / Short-term liabilities				+	+
Profit before taxes / Assets			+		
Market value of equity / Liabilities	+				
Book value of equity / Book value of liabilities		+			
Sales / Assets	+	+	+		+
Cash flow / Liabilities			+		
Liabilities / Assets			+		
Short-term liabilities / Assets			+	+	
Long-tangible assets			+		
Working capital / Liabilities			+		
Long-profit before interests and taxes			+		
Short-term assets / Liabilities				+	
(Fast-moving assets – Short-term liabilities) / Operating expenses				+	

Table 2 Comparison of the criteria used in models for crisis identification

Source: Kurschus et al., 2015

The early recognition of risks of insolvency by calculated KPIs based on balance sheets has, however, been strongly criticized. Schneider (1997), for example, believes that backward-looking indicators for forecasting future insolvency risks may be applied only if the following points are fulfilled:

- It can be proven that a valid probability of this indicator is existent both in the past and in the future
- This probability is constant over time
- There is a stochastic independence of bankruptcies, that is to say, that no bankruptcies can be caused by bankruptcies

But these criteria cannot be met and will also not be fulfilled (Deppe, 1992).

Müller-Merbach (1977) comments on this as follows: "In fact, the global financial indicators (as key indicators) of performance measurement systems for early warning possess the same value as equipment for measuring the average temperature of a forest for forest fire early warning. When the average temperature in a forest has significantly increased, so that the event of a forest fire should be considered as fulfilled, then the fire is already burning to its heart's content, so that any message from an early warning system can be dispensed with. It is much more useful to observe individual trees or small forest areas to detect the fire directly at its source, which can then be fought successfully. "Since performance measurement systems generally have a pyramid structure, it is important for early recognition to look at details, e.g. to look at the bottom of the pyramid, at the non-aggregated KPIs (Krystek, 1987). It can be said that KPIs are past or present-based and are purely analytical in character, using quantitatively-expressed information, but the future view is missing.

However, a summary can be taken from Hauschildt & Leker (2000), who also used the balance sheet as the basis for different KPIs to analyze how far they were appropriate for crisis diagnosis, within the given time frame. The analyses were carried out by using different authors and 6638 crisis cases from 3809 companies. The definition of the crisis, measurements and the tools of the balance sheet were clearly stated, only the time necessary for handling the crisis was not made clear. They state that when the result of the analysis shows the

manifest crisis, shortly before insolvency, there is no space for a turnaround. Derived from the above, it is mostly the relationship with the bookkeeping for the balance sheet and indicator system, which is described by Hauschildt (2001), Leker (1993) and Crone & Werner (2012), to mention but a few. This system shows problems which have already occurred and brings in the disadvantage of time lag. The problems are manifested in the company a long time before they are viewable in the figures from bookkeeping (März, 1983). Furthermore, the content of the balance sheet can be adapted by an interested party to influence the decision (Bötzel, 1993). Management is not able to estimate the company situation, in order to help them to make the right decisions (Berndt et al., 2011).

To try to solve the problem of time, Hauschildt & Leker (2000) analyzed the usage of controlling analyses. They did not really give advice as to which way **Controlling** should be used (this will be analyzed later in this account), but the answer was clear: that the crisis will be recognized much sooner by controlling analysis. The result of the survey of Institut für Unternehmensplanung also shows Controlling as the most appropriate location for Early Recognition (Krystek et al., 2007).

Figure 13 Chinese Character for Crisis

Source: Löbig (2010)

Furthermore, the Chinese Character for Crisis, shown above in figure 13, is made up of the signs for Chance and Threat (Hornstein, 2009), the idea of which is also expressed by an old Chinese proverb: “When the wind of change is blowing, some people build walls and other build windmills” (Löbig, 2010, p. 64), where the time plays a big role. Arlinghaus (2007) adds that risk and opportunity go

together – he who does not risk will not win. It is important that the whole organization recognizes that Risk should not only be seen as a negative but can also have the potential to force improvement and lead the company into (more) success. Furthermore, it is an opportunity to have the possibility of seeing weaknesses throughout the system and of implementing the improvement process (Arlinghaus, 2007). In this way, it is important to evaluate how high the risk is (Löhneysen, 1982).

Company crises are connected to economic action by economic activity and companies will not be able to eliminate them completely (Arlinghaus, 2007). To manage risks the company has to foresee, identify, evaluate and control both the Risk and the Opportunity (Reimer & Fiege, 2009). The company has to be aware of the past and the future in terms of Strength and Weakness as well as Opportunity and Threat analysis, which supports the leadership in decision making (Arlinghaus, 2007). However, an Early Warning System does not focus on the solution to the problems, when they have already reached a certain level, but it aims to discover them early, before they have a disadvantageous impact on the company (März, 1983). “To finish first, you first must finish” (Pocalyko, 2011, p. 1). Most companies do not die because they are wrong; most die because they do not commit themselves. They fritter away their valuable resources (Kautt, 2013). In this context Projection as a feed-forward tool, which belongs to Controlling, can be named and will be explained in chapter 2.3.3.3.

2.3.3.2.3 Argenti’s Model

One of the best-known crisis forecasting models, based on purely qualitative data, as opposed to those described above, is the A-Score model of Argenti (1976). For Argenti (1976) the primary measurement of data is not quantitative, based on information of a financial nature, but qualitative data, such as the quality of the management or the market structure (Kurschus et al., 2015). He developed a total of seventeen criteria, which he divided into three groups: management weaknesses, management errors and crisis symptoms (Kurschus et al., 2015), which also included the building of sequential stages (Acca, 2008). To each of these criteria, Argenti (1976) gives a specific code, on which basis the criteria

should be evaluated. The management weaknesses can be awarded a maximum of 45 points and an assessment up to a maximum of 10 points is satisfactory. At a higher rating, it can be assumed that it is management weaknesses that lead to management errors, which may only become apparent after several years. Management errors are awarded a maximum of 15 points (Argenti, 1976). The last group consists of those which are already showing visible signs of crisis, triggered by weaknesses and mistakes. The maximum awarded here is 26, covering any signs of acute problems and high risk (Acca, 2008).

To sum up, it could be said that it seems to be very subjective, and so open to attack, as the quantitative area is completely missing and for this reason, in comparison to BSC, for example, which tries to break the qualitative factors down to make them quantifiable, the data are unmeasurable. In addition, Argenti's model, as described, is not really appropriate as an EWS, since most of the facts that are shown through performance measurement systems, are past-, or at best, present-, based and so have a purely analytical character and are therefore problematic for the gaining of relevant information for early recognition (Krystek et al., 2007). Kirschkamp (2007) states that the most appreciated advantage of performance measurement systems is the consolidation and related compressed significance, which can, in terms of early recognition, result in a disadvantage.

2.3.3.3 Extrapolation-oriented early recognition

To counteract the disadvantage to key systems of the past relatedness above, early recognition based on extrapolations were developed (Hauff, 2010). Hauser (1989) describes extrapolations as a form of anticipatory control. The operation consists of the comparison of the periodical plan data with the extrapolated actual, or rather, future data (Klausmann, 1983). Therefore the extrapolation is a feedforward tool, which opens up for early risk and opportunity recognition, a significantly greater action period for the initiation of counteractions (Hauff, 2010).

However, during the extrapolation-oriented early recognition, there are also risks, since this is based on historical experience and therefore unexpected events, which have not been seen in the past, cannot be integrated into the extrapolation (Krystek et al., 2007). Kirschkamp (2007) adds that, especially in terms of

breaking trends, the risk of misinterpretation is therefore very high. To address this criticism Péter Horváth (Bratschitsch & Schnellinger, 1981) spoke at the Pfingsttagung Innsbruck 1979 about Zero-Base-Budgeting as a Crisis-Management Tool. He came to the conclusion that it would be appropriate as prophylaxis for the company, supplying detailed information for crisis planning. The company policy will be articulate; communication, motivation, coordination and control will be improved. The difference of "zero-base-budgeting" in comparison to traditional planning is, that the costs from the past years will not be projected, but will be planned completely afresh from the base. The advantage of this approach is the 'Strategic Alignment', where the company has to examine their mission, policy, etc., and the systematic planning throughout the whole company. The disadvantage could be that this approach is complex and time-consuming – which is particularly difficult for SMEs.

However, Löhneysen (1982) tried to design an EWS as a conceptual framework which shows the internal and external dangers at an early stage. Her opinion was that the level of threat would be measurable if the company establishes a basis with indicators which show it. The development of the system should include people, plants and the combination of people and plants in a certain relationship, as well as the determination of the internal and external monitoring area. The features have to show the gap between the aim and the actual features of the company. The gap can be described as an aim, as normal, as crisis or as insolvency. She tries to achieve the quantification of crisis features, but the concrete result of the way in which the company has to recognize the crisis, is missing. The basic question is how the crisis situation is distinguishable from the normal situation.

In summary, it can be said that the above-mentioned arguments support the appropriateness of Controlling as EWS but, as already explained above, the information including operational results, such as plan figures, operative key figures, projections, possibility of query and informal information search by Controlling is not enough. A further tool, which was identified for the operative EWS, is the indicator-based early detection.

2.3.3.4 Indicator-based early detection

Hauff (2010) states that while KPIs are quantitative by nature and, therefore, show facts directly, indicators, in contrast, are auxiliary quantities that help to understand facts that are not directly observable phenomena (Kirschkamp, 2007). Brockhoff (1999) adds that, in this form of detection, indicators send signals of relevant events/developments with sufficient regularity and sufficient notice.

For distinction or division of external and internal indicators, Rieser (1980) gives the following leading indicators:

External Early Indicators

- Macroeconomic indicators
- Indicators of market development
- Technological indicators
- Social indicators (Social and Demographic Trends)
- Political indicators

Internal Early Indicators

- Financial analysis KPIs
- Economic Indicators
- Employee-related Indicators

2.3.3.4.1 Concept of Krystek & Müller-Stewens

Early warning indicators can be considered as diagnostic signs for detection of hidden events, which could be various kinds of positive and negative trends or developments in the environment (Rothwell, 2010). Krystek et al. (2007) explain that early warning indicators have to fulfill certain demands and demonstrate the following attributes: singularity, completeness, timely availability of information and economic justification. “These are the measures which, after surpassing certain previously-set boundaries, indicate the occurrence of change and development of new trends; they represent signals of possible upcoming crises,

but cannot predict the magnitude and time of indicator materialization and impact on the firm" (Bedenik et al., 2012).

Indicator-based detection already belongs to the second generation of early warning systems and is a further development to the KPI- and extrapolation-oriented systems (Krystek et al., 2007), where the steps are as follows:

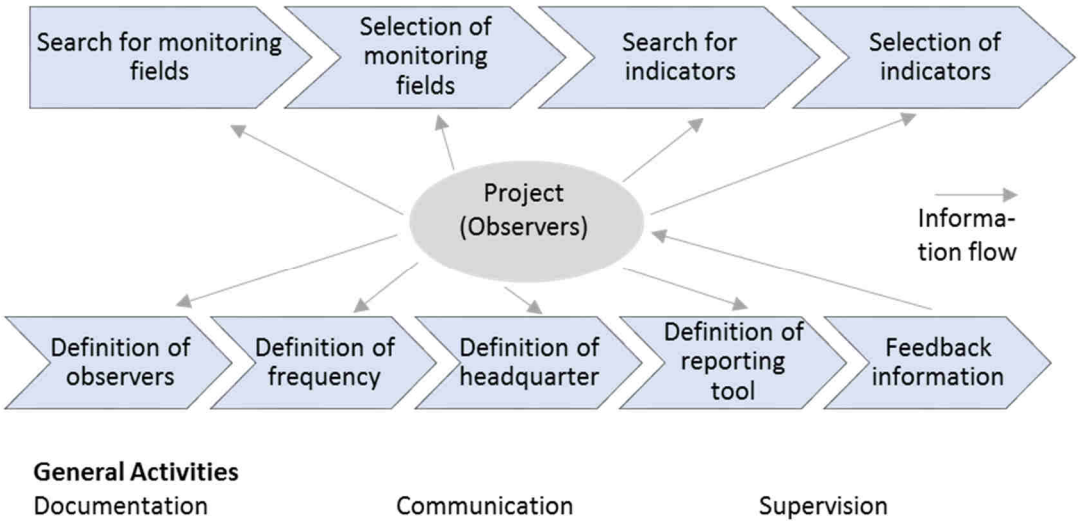

Figure 14 Indicator-based EWS

Source: Krystek et al. (2007)

The indicator-based EWS starts with the search for monitoring fields (external/internal), followed by the selection of monitoring field. In the third step the search for indicators appropriate for the defined monitoring field begins, and these are selected during the fourth step (Hauff, 2010). Once all observation areas and indicators have been set, the indicator values must be observed. This will be done during the fifth step by definition of observers, followed by the definition of frequency and reporting tool. The definition of headquarters and their tasks will be done during step seven, where the main task is information sampling and processing (Krystek et al., 2007). Additionally, to be able to recognize deviation from the target value, which should be determined and defined during

the previous steps, the areas where the indicator is allowed to move without triggering a signal must now be defined (Hauff, 2010), during the ninth step. The last step includes the design of information exchange between observer and central office in the form of channels of communication and also the feedback from the observer (Krystek et al., 2007).

The described basic model for the indicator-oriented early recognition is often adopted in science and literature, and it also seems that it is recognized in practice (Schlüter, 2004; Geissler, 1995). However, the problems and/or weaknesses should be not left unmentioned. One of the fundamental problems is due to the definition of appropriate indicators/indicator catalogues, which should be based on causal relationships, where indicator-based early warning systems are founded on the concept of a directed search for changes (Hauff, 2010). Here, there lies the danger that relevant changes will not be recorded and that existing causal chains will break down (Geissler, 1995).

Another point of criticism lies in the fact that (many) indicators should be calculated and created on the basis of intuition and experience (Schlüter, 2004). People tend to avoid costs associated with (comprehensive) information seeking and thus, perhaps unwittingly, accept solutions that are not of maximum usefulness, but are only adequate or acceptable (Hauff, 2010).

Krystek et al. (2007) also point out that due to the definition of indicators in predefined monitoring areas, potentially relevant developments in unrecognized observation areas will not be recorded. Hauff (2010) adds a further criticism by stating that during the indicator-based early recognition, target values and tolerances must be specified. However, this is very difficult and often not possible, especially for SMEs, which can lack sufficient technological and human resources, as many of these values and tolerances are based on difficult to measure, qualitative data, and therefore, the objectivity, reliability, and validity of indicators are questionable.

2.3.4 Differentiation between ‘operative’ and ‘strategic’ Early Recognition

Bedenik et al. (2012) describe ‘operative’ as short- term oriented and ‘strategic’ early warnings as long-term settings. Krystek & Müller-Stewens (1993) explain it in more detail by differentiating between operative early warnings, which are followed by short-term measures of success and are mainly aimed at detecting risks, and strategic early warnings which have long-term objectives, profit potentials and try to detect risks and chances. There exist two ways of detecting the signals: by monitoring, which is the analysis of the environment limited to a single phenomenon and by scanning, which is the activity of acquiring information (Kirschkamp, 2007).

Kunze (2000, p. 40) describes "environmental scanning" as "(…) the acquisition and use of information about events and trends in an organization's external environment, the knowledge of which would assist management in planning the organization's future courses of action". Hillebrand (2005) states that scanning is the informal scanning of the environment and the company with the aim of identification of the „weak-signals", which afterward will be analyzed and completed by monitoring. Monitoring analyses the supposed changes in detail and describes them together with the forecast of the potential consequences (Kunze, 2000).

The operative EWS tries to prevent crises by frequently using instruments such as business ratios, projections, and indicators (Kirschkamp, 2007). They are past-oriented, which has the disadvantage, that some risks cannot be recognized in a timely way (Hillebrand, 2005). The recognition of strategic risks, in contrast, will be realized by locating the signal of the discontinuous change, analysis and subsequent evaluation of its relevance (Trustorff, 2012). With strategic EWS it is more or less impossible to recognize the signs by indicators, which is the reason for the use of discontinuous factors and the advantage of more time for counteraction (Hillebrand, 2005).

The discontinuity can be described as "unpredictable, unforeseen, natural or man-made sudden change, consequence, event, or force that confounds or disrupts earlier expectations or estimates" (Business Dictionary, 2015). Kunze (2000) describes it as radar, which is oriented to "shadows" or "weak signals",

which signal changes in the company environment. Kirschkamp (2007, p. 12) states that, "In this context, discontinuities are most important and therefore, it is the first aim of strategic early warning to detect ANSOFF's weak signals to inform the management and to initiate change". Ansoff (1984, p. 483) describes "weak signals" as "(…) a development about which only partial information is available at the moment when a response must be launched if it is to be completed before the development impacts on the firm".

Ruderer (2009) states that an EWS should be in use for both operative and strategic areas. “Operational early warning deals with data of high concreteness whereas strategic early warning deals with data of low concreteness” (Kirschkamp, 2007, p. 13). Trustorff (2012) warns about examination of operative and strategic risks in terms of reference parameter (potential for success versus operative success), time horizon (long-term versus short-term) and target dimension (strategic versus operative) independently. At long distance, the threats of success potentials will affect the success and the liquidity situation of the company by wrong strategic decisions or ignored changes in the company environment. Conversely, a high operative risk potential denotes a significant restriction of the scope of action for handling strategic risks.

Bedenik et al. (2012) add that a global economic crisis should motivate the companies to the use of operative early warning system as well as strategic, which according to Ansoff (1976) means “when a threat/opportunity first appears on the horizon, we must be prepared for very vague information, which will progressively develop and improve with time”.

2.3.5 Concepts of Strategic Early Warning Systems

In general, the strategic EWSs are less system-based than the operative EWSs, however in practice it is much easier to introduce such methods by a basic principle / schematic diagram. In addition, according to the literature review, the appropriateness for practical use shows some gaps, so the regulations will push the future development of having to demonstrate a Risk Management System not only for public limited companies, which are engaged by KonTrag to do this, but also for SMEs, as since October 2015 according to DIN EN ISO 9001:2015 they

also have to extend their QMS by risk orientation. However, the first research work about “environmental analysis” came from Aguilar in 1967, where he constitutes the need for external review and monitoring by dividing company environment into the following subsystems: Economic, Technological, Politico-legal, Socio-cultural, Physical-ecological terms (Kunze, 2000). Thus, both the concept of Aguilar (1967) and, especially, the concept of Ansoff (1976) can be named as the origins of early detection. Below are presented and outlined only some representative selected concepts, all of which are based on weak signals. Basically, the structure and operation of the concepts, discussed in the literature, are essentially very similar (Hauff, 2010). The fundamental idea of Ansoff-Concept (1976) is the impulse of weak signals for strategic discontinuity from the corporate environment (Löhneysen, 1982). At centre stage is the strategic discontinuity gathering from vague information, which does not explain, what the content and the reception of the signals are. Ansoff (1976) does not give a definition of "Weak Signals". For this reason, the interaction of theory and early recognition require critical analysis of their suitability (Hauser, 1989).

However, Ansoff (1976) distinguishes between five uncertainty levels (States of Ignorance), where each has a different information content. As shown in the figure below, the first uncertainty condition (Sense of Threat/Opportunity) represents the highest level of ignorance in which it is only known that a threat or opportunity is present. Neither its form nor its source can be determined. In the second stage (Source of Threat/Opportunity) it is now possible to identify the source of the change, but the precise characteristics of the threat or opportunity are not yet determined. This is achieved only in the third stage of uncertainty (Threat/Opportunity Concrete). Only here it is possible to determine the exact nature of the impact and the timing of the threat or opportunity. Based on this, during the fourth stage (Response Concrete) the counteractions and strategies can be developed. Finally, in the fifth stage (Outcome Concrete) the consequences of the proposed measures and their impact on the company's success can be determined (Ansoff, 1976).

States of Ignorance / Info Content	1 Sense of Threat/ Opportunity	2 Source of Threat/ Opportunity	3 Threat/ Opportunity Concrete	4 Response Concrete	5 Outcome Concrete
Conviction that discontinuities are impending	YES	YES	YES	YES	YES
Area of organization is identified ,which is the source of discontinuity	**NO**	YES	YES	YES	YES
Characteristics of threat, nature of impact, general gravity of impact, timing of impact	**NO**	**NO**	YES	YES	YES
Response identified: timing, action, programs, budgets	**NO**	**NO**	**NO**	YES	YES
Profit impact and consequences of responses are computable	**NO**	**NO**	**NO**	**NO**	YES

Figure 15 Knowledge-State of Discontinuity

Source: Kirschkamp (2007)

2.3.5.1 Tools used during strategic Concepts

However, tools, which were explicitly named during strategic early warning concepts, especially by Battele Institut (1978) and Hammer (1998), are Diffusion Theory, Creativity Methods, Trend Landscape, Cross-Impact-Analysis, Scenario Analysis, SWOT Analysis, Strategic Planning and Portfolio Analysis, as shown in the figure 16.

Figure 16 Tools used during strategic concepts

Source: own illustration

The description of these tools can be found in Chapter 5.

In summary it can be said that the well-known tools provide the basis, according to the described need, for a strategic EWS, however there is still a lack of a tool for scanning as a starting point, which this work tries to solve by **PESTLE**. Although the concepts of Battele Institute (1978) and Hammer (1998) state the need for environmental analysis, it is indisputable that, especially for SMEs, it will be much easier to do it by a systematic tool like PESTLE. Furthermore, a tool for the link from strategic to operative, which this work intends to solve by **BSC**, and which even Hammer (1998) himself names as the most difficult part is completely missing from the previous concepts. This is the main criticism of Concept of Hammer (1998), even if Bertram (1993) states that Hammer's concept is one of the most far-reaching considered, due its detailed classifications and control function, as his concept covers most known requirements from the literature.

2.3.5.2 Concept of Kirsch and Trux

One of the first concepts of Strategic Early Warning Systems was developed in 1979 by Kirsch and Trux. This characterizes strategic early recognition as a multi-paradigm problem and describes it metaphorically as "Disperse-Suck-Filter-System with systematic recycling and automatic filter check" (Krystek et al., 2007). For Kirsch and Trux (1979) the active search for early-clarifying information with strategic relevance in the company and its environment is not

sufficient, as this would only be performed by those institutions which are responsible for it. The search for such signals should rather be done by as many positions at different levels of management as possible (Hammer, 1998). He adds that the signals obtained by this "purposeless Exploration", speaking pictorially, are dispersed downwards and sucked in (Krystek et al., 2007).

Due to the low precision of the dispersed and sucked signals they have to be filtered - the more signals, the better they must be filtered, as it could otherwise lead to "queuing effects" or to information overload at the management level (Hammer, 1998). The next area of responsibility for this system is the check of the filtered information for relevance (Krystek et al., 2007). Here, however, depending on how the evaluation criteria are designed, errors can occur, so that information and signals will be incorrectly evaluated and eliminated as irrelevant (Hammer, 1998). Hammer (1998) states that in order to avoid this error and correct it, a so-called ‘recycling' should be installed in the system offering the possibility of bringing back these filtered signals into circulation in order to be able to pick up them again when the context changes. Due to its potential usefulness, the assessment criteria and relevance criteria need to be checked regularly as they may change quickly (Krystek et al., 2007). Recycling and verification of the relevance criteria can be seen according to Müller (1986) as the main characteristic of strategic early recognition. His opinion is that it is not possible to go away "... from the fiction of an always secure foundation of interpretation and evaluation ..." (Hammer, 1998). However, this concept is rather vague – especially with respect to the procedure and the action – and due to the fact that it is mainly theoretical, it leaves a lot of scope for individual interpretation or even intuition.

2.3.5.3 Concept of Battelle Institute

The Battelle Institute developed the first system to have a practical approach, even if the description still has a theoretical and indistinct consistence, for strategic early recognition in the early 1980s, and this is also represented by Krystek (1987). Hauff (2010) states that this system is understood as based on dynamic-based environmental analyses, which is a whole business-related

monitoring system. It already recognizes changes in its peripheral system at the time of their content, which is of unstructured development; explores the causes and interrelations; predicts their long development; sends signals of serious deviations and determines and evaluates alternative strategies for response to these deviations (Krystek et al., 2007). It is divided into the following five sub-functions of early recognition (Hauff, 2010):

Sign-oriented environment analysis

In this stage, the weak signals will be primarily located in the strategic, relevant observation areas and there subsequently follows the diagnosis of the reasons in connection with sign-specific effect prognosis (Krystek et al., 2007). Battelle Institut (1980) explained it in more detail: that this stage is based on **Diffusion Theory** and the potential impact will be predicted by deviated **Trend Landscape.** Afterwards, based on the prognosis results, appropriate **Scenarios** will be built (Hauff, 2010).

Comparison between the premises of the strategic planning and the sign specific scenario results

The statement derived from the sign-specified scenario will be compared with the strategic planning, where only if there is sufficient deviation between premises of the strategic planning and scenario results, will the next step follow (Hauff, 2010).

Evaluation of the deviation determination

Before alternative treatments are sought, the relevance of weak signals and the urgency of possible action should be determined (Krystek et al., 2007). Does it show enough relevance for the development of the company? Can the process of the strategic early recognition at this point be stopped or started with a new search for weak signals (Hauff, 2010)?

Search for strategic treatment alternatives

After selection of the company-relevant discontinuity, there follows, by the use of known planning techniques (Hammer, 1998), the development of **strategic** treatment (Strategic Planning) alternatives for the handling of the imminent change (Hauff, 2010).

Evaluation and decision about strategic treatment alternatives

During the final stage, the selected treatment alternatives will be evaluated according to their effect (Krystek et al., 2007). The EWS according to the Battelle concept (1980) as well as to Krystek (1987), can be understood as a linear sequence of part functions. The summary of the different activities during the first stage of sign-oriented environment analysis and the possibility of a break during the second or third phase makes this concept particularly special (Hauff, 2010).

2.3.5.4 Concept of Hammer

Another concept of strategic early warning, which is not completely different from the concept of the Battelle Institute, especially when looking at the linear prerequisites phases of strategic recognition, has been formulated by Hammer (1998), divided into five phases, as follows:

As a first process step Hammer (1998) describes the observation of defined early clarification of relevant corporate and environmental areas, and the recording of weak signals. Hammer (1998) says that the observation of weak signals should be via "scanning", e. g. on the basis of directed and undirected observation, then recorded and afterwards monitored via "monitoring" (Hauff, 2010). The literature mostly focuses on the “monitoring” area to a large extent, if not completely, at the expense of “scanning”. This is described in the literature as a complex area with a diversity of different risk areas, which reflects the rather incomplete elaboration and description of the numerous tools and methods for risk identification. However, the obtained results must then be documented, which categorizes them directly during this first step, and are then subjected to a first relevance test (Hammer, 1998).

The second phase deals with the analysis of these weak signals and also evaluates the potential impact. The analysis is based on mathematical and statistical methods that determine the behaviour and distribution patterns of signals (Hauff, 2010). Hauff (2010) adds that in order to ensure a substantiated forecast, the causes of these calculated patterns should also be analyzed. Hammer (1998) indicates that the potential impact will be predicted by different

created **Scenarios** and by a comparison drawn with the principles of strategic planning, based on the **Diffusion Theory** and deviated **Trend Landscapes,** analyzed by **Cross-Impact-Analysis**.

In Hammer's (1998) third step there follows verification through objective and reasonable relevance, which is done by using a so-called discontinuity survey of experts in terms of their assessment of a specific question. Müller & Zeiser (1980) add that according to this survey three aims should subsequently be reached: determination of the potential impact of potential changes, determination of the probability for the appearance of these and finally the assessment of the necessity and urgency of reaction strategies. If reaction strategies seem to be necessary, these strategies have to be developed by using **Creativity Methods**, **SWOT** and **Portfolio Analysis** at an additional stage (Hammer, 1998). Afterward, this will then be evaluated, and a selection will be made (Bertram, 1993).

The last and, according to Hammer (1998) the most difficult, part of a strategic early warning system is the implementation of the **strategies** (Strategic Planning) developed in Phase 4, into concrete actions. This includes points such as the creation of operative plans, the organization and the monitoring of implementation (Hauff, 2010).

Hammer suggests the combination of subsequent phases, even if the detailed use of tools is missing, as the most appropriate approach in practice. Bertram (1993) states that Hammer's concept is one of the most far-reaching considered, due its detailed classifications and control function. Additionally, his concept covers most known requirements from the literature. The main criticism, which also exists in the literature, is the link to the operative area, which even Hammer (1998) himself names as the most difficult part.

2.3.6 Overview of previous work

In summary, it can be said that the drafts showed and mentioned herein and concepts as well as many other developed models - is basically a process of evolution - subject, where some can be displayed in chronological order. Thus,

the concepts of Aguilar (1967) and especially the concept of Ansoff (1976) can be named as the origin of early detection. These were only strategic and qualitative in nature because they treated "only" the fact that (corporate) risks can already emerge very early and these weak signals must be located by so-called "scanning". Aguilar (1967) extended it in a bit more in detail by adding to the component "scanning" even the so-called "monitoring", as the scanned risks can not be recognized as such immediately, as they are of a potential nature and must accordingly, be checked regularly.

The work of Kirsch & Trux (1979) builds on these concepts and leads to a discontinuities detail form, already mentioned by Ansoff (1976). Furthermore, Kirsch & Trux (1979) add to these concepts the filter system, as a further component, as otherwise an overlay and slack flow of the potential risks would emerge as result. Since these concepts, still rather vague - especially with respect to the procedure and the action – were, also due to the fact that they were mainly theoretical, there were developed further concepts both parallel to, as well as on, this basis. Some tried to make the risks search and evaluation quantifiable and for this reason tangible for business and corporate governance.

At this point should be mentioned the purely quantitative approaches based also on crisis and insolvency risk calculation, the Beaver (1966), Altman (1968) “Alman's Z-score” or Fulmer (1984), Taffler & Tisshaw (1977), Springate (1978), which want to express the stability based on past values of the company’s balance sheet by the use of only a few KPIs.

Furthermore, there is the concept of Krystek & Müller-Stewens (1993), who picked up the theoretical approaches and developed primarily a key figure model by which risks could be quantified. However, since key figures are based on historical data and the recognition of risks can be realized shortly before their entry or even after their entry, this concept can only be used as an operative EWS. In addition, the ratios have been calculated only on the basis of internal company data and disagrees with, for example, Aguilar's (1967) "environmental scanning". Krystek & Müller-Stewens (1993) therefore extended the model by systems, which were based on extrapolations and indicators and which at least predict the "near" future and also took key figures from the business environment

into consideration. Depending on the choice of indicators this concept was able to give a partial strategic orientation. The advantage of this concept was that early detection concerning the ability to present the procedure on a scheduled basis was implementable in a company. However, it is quite clear that the largely operative alignment is not sufficient to recognize all business risks and to take counteractions since the real weak signals and discontinuities cannot be quantified directly, but should be broken down during a process of analysis. The Table below gives an overview of the previous concepts.

Concept/ Alignment	Strategic/ operative	Qualitative/ quantitative	Precise/ vague	Theoretical/ practical	Internal/ external
Beaver (1966)	operative	quantitative	precise	practical	internal
Aguilar (1967)	strategic	qualitative	vague	theoretical	prevalent external
Altman (1968)	operative	quantitative	precise	practical	internal
Argenti (1976)	operative	qualitative	precise	practical	internal
Ansoff (1976)	strategic	qualitative	vague	theoretical	prevalent external
Taffler & Tisshaw (1977)	operative	quantitative	precise	practical	internal
Springate (1978)	operative	quantitative	precise	practical	internal
Battele Institut (1978)	strategic	qualitative	vague	prevalent theoretical	prevalent external
Kirsch & Trux (1979)	strategic	qualitative	vague	theoretical	prevalent external
Fulmer (1984)	operative	quantitative	precise	practical	internal
Krystek & Müller-Stewens (1993)	prevalent operative	prevalent quantitative	precise	practical	prevalent internal
Hammer (1998)	strategic	prevalent qualitative	precise	practical	internal + external

Table 3 Literature overview of concepts dealing with crisis or risk recognition

Source: Compiled by author

Most of the models designed to identify company risk or crisis, as shown above, are focused either on ‘operative’ or ‘strategic’, where most of the ‘operative’ can be also named as ‘quantitative’, and the ‘strategic’ as ‘qualitative’ models. Several authors point out the need for a more holistic approach (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015; Geißler, 1995; Hammer, 1998).

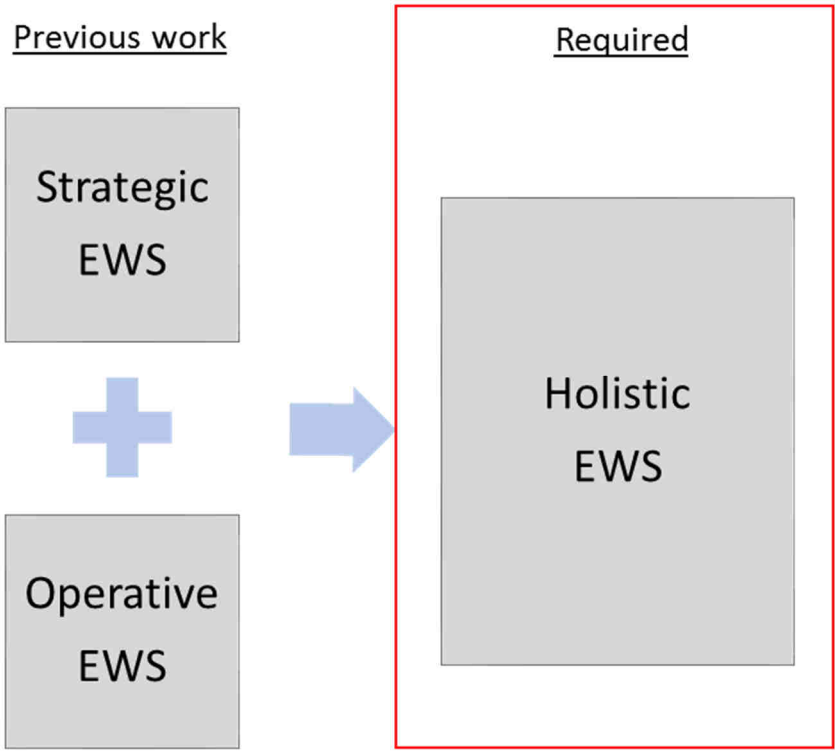

Figure 17 Required holistic EWS

Source: own illustration

This is the central rationale of this work: to develop an approach that entails an optimal consideration of strategic (qualitative) and operative (quantitative) factors, as shown in figure 17.

2.3.7 Identification of literature gap

As already summarized in the overview and presented in a chronological sequence, the development of EWS has grown historically and has been

formulated in more detail and partly adapted to the circumstances. With the awareness that risks exist for companies and that they can be detected even at an early stage in order to initiate adequate countermeasures, it is seen that it is now necessary to come to a very detailed division between operational, strategic, qualitative and quantitative, internal and external areas and EWSs. Numerous tools, concepts and methods have also been developed in the literature, in order to identify individual risks and risk areas during a company, branch, etc. (Ruderer, 2009).

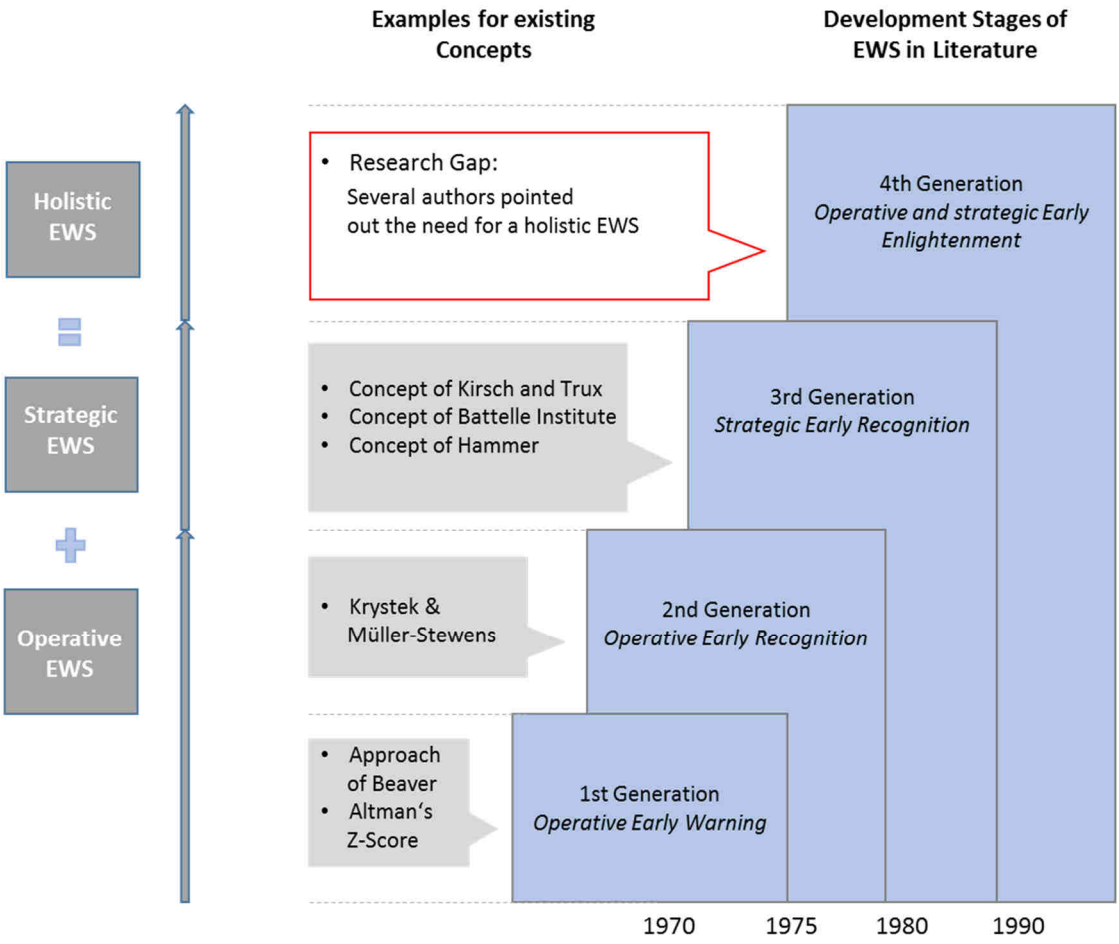

Figure 18 Conceptual framework - identification of research gap

Source: Own illustration

Figure 18 shows a possible differentiation of early warning methods by inclusion of some appropriate concepts as example, which have been explained above.

“Every class of early warning is typical of a specific time and has its own instruments and objectives” (Kirschkamp, 2007, p. 8). In the early 1970s the ***first generation*** was developed: the so-called (operative) early warning. This only focused on determining and identifying latent risks or threats (Kirschkamp, 2007). The aim, however, was to detect them so early that there still remained sufficient time to plan, implement and control appropriate counteractions (Krystek et al., 2007). The basis for early warning was especially forecasting on the basis of historical values (Kirschkamp, 2007). This means that reporting procedures were developed from key performance indicators, which sent signals by the exceeding or falling below of defined thresholds (Hauff, 2010). The tools used in the Concepts of the first generation are Business Ratios and Projections.

Business Ratios are past-, or present-, based and are purely analytical in character, KPIs are quantitatively-expressed information. In addition, KPIs do not really work efficiently in showing discrepancies because there is only a signal for the internal orientation, and so the external environment is missing (Hauser, 1989), and the early recognition was carried out in the classic bookkeeping way. The Bookkeeping Approach shows up problems which have already occurred and it also includes the disadvantage of time lag. The problems are manifested in the company a long time before they are viewable in the figures of the bookkeeping documents. To overcome the criticism of Bookkeeping, as analyzed by Hauschildt & Leker (2000), Controlling can curtail the time lag. The Controlling Approach, deals with the transparency of business results, finance, processes and strategy. The Controller is responsible for the design of CO-processes of defining goals, planning and management control of decision making. However, by analyzing the already-existing methods and tools described in the literature, it seems to be an appropriate approach, if used in combination with other systems, such as QM, which will be analyzed later during Chapter 6. During the same period as work on CO, the so-called ‘planning forecasts' were developed, in which it was possible to make a comparison between the planned or target data and the extrapolated "actual data", and then, at the discovery of any discrepancies, to take appropriate countermeasures in time (Hauff, 2010). Projection, which belongs to Controlling, is a feed-forward tool, which is formed by the comparison of the periodical plan data, but is based on historical experience. For this reason,

mistakes or errors, which were not recognized in the past, will remain disregarded.

However, with reference to first generation, concepts like Beaver or the Altman Z-Score model could be ascribed, using financial statements as their basis. The **Approach of Beaver** (1966) is an univariate discriminant analysis, where he points out that the ratio of cash flow to (total capital/debt capital) is the most appropriate discriminant for insolvency recognition, even if it is impossible to describe insolvency by only one parameter. **Altman's Z-Score** (1968) as a bankruptcy diagnostic model, in contrast to Beaver, is based on multivariate discriminant analysis. This was also criticized, especially because the index "sales / total assets" is highly dependent on the industry. All further quantitative, insolvency forecast models will be not named here further, as they all based on the idea of Altman. Despite criticism, his method is still used, as mentioned previously, especially as a rule of thumb. There remains the problem of the gap between Altman's Z-core model being purely quantitative and Argenti's being purely qualitative and, thus, unmeasurable.

The development of the so-called ***second generation*** took place from 1977 to 1979 (Hauff, 2010). Characteristics of the second generation, were the extensions to chances and opportunities (Krystek et al., 2007), as well as the extension of the planning horizon of the (operative) early recognition (Hauff, 2010). While the first generation only worked with annual plans and the appropriate (internal) working indicators, in the second generation, indicators (as instruments) were developed which were designed to identify longer-term, internal and external changes (Hauser, 1989). **Indicator-based early detection** (Concept of Krystek & Müller-Stewens, 1993) sends signals of relevant events/developments with sufficient regularity and sufficient notice, where 'external indicators' are macroeconomic, market, technological, social and political and 'internal indicators' are financial (KPIs), economic and employee-related. This development led quickly to the understanding that this system can recognize not only risks and dangers but also latent opportunities and chances (Krystek et al., 2007). However, indicator-based EWS are founded on the concept of directed search for changes, which hides the danger, that relevant changes will not be recorded and that existing causal chains will be broken down.

Potentially relevant developments in unrecognized observation areas will not be recorded. Hauser (1989) adds that the determination of indicators is often difficult, as well as being impractical.

The (strategic) forecasting is mentioned as the ***third generation*** when describing an additional development (Krystek et al., 2007). This has the additional goal of early detection of risks and opportunities, as well as the initiation of appropriate counteractions (Schlüter, 2004). Krystek et al. (2007) add that the Ansoff (1976) Concept of "Weak Signals" is useable in this stage for the identification of Threats and Opportunities from both the internal and external environment. All existing strategic concepts, such as the concept of Kirsch and Trux, Concept of Battelle Institute, or Concept of Hammer, are based on “Weak Signals”. To be able to describe Ansoff’s concept (1976) in brief, firstly, the term ‘discontinuity’ should be clarified. This can be described as "unpredictable, unforeseen, natural or man-made sudden change, consequence, event, or force that confounds or disrupts earlier expectations or estimates" (Business Dictionary, 2015). Kunze (2000) describes it as radar, oriented to "shadows" or "weak signals", which signal changes in the company environment. Kirschkamp (2007, p. 12) states that, "In this context, discontinuities are most important and therefore, it is the first aim of strategic early warning to detect ANSOFF's weak signals to inform the management and to initiate change". Ansoff (1984, p. 483) describes "weak signals" as "(…) a development about which only partial information is available at the moment when a response must be launched if it is to be completed before the development impacts on the firm". However, the first concept is based on ‘weak signals’, which **Kirsch and Trux** (1979) describe as Disperse-Suck-Filter-System, with systematic recycling and automatic filter check. The process is: Disperse, Suck, after filtering check for relevance, afterwards recycle by bringing back this filtered information. This concept is purely theoretical (metaphor) and strategic without concrete recommendations for its application, which makes it difficult to use in practice. The **Concept of Battelle Institute** (1978), which is often named in the literature as the first strategic radar approach is, in contrast, based on dynamic-based environmental analysis, which is a whole business-related monitoring system. It is divided into 5 steps: 1) sign-oriented environmental analysis 2) comparison between strategy-planning and scenarios

3) evaluation of deviation 4) search for strategic treatment alternatives 5) evaluation and decision about strategic treatment alternatives. Furthermore, the **Concept of Hammer** (1998) which is divided into 5 phases: 1) observation via scanning then recorded and afterwards monitored 2) analysis & evaluation of potential impact, which is based on a mathematical or statistical method and will be predicted by scenarios & comparison of strategic planning 3) verification by a survey of experts for determination of potential impact, change & reaction 4) development of strategies 5) implementation of strategies into concrete actions (operative plans), is not completely different from the concept of Battelle Institute, especially when looking at the linear prerequisites phases of strategic recognition. The combination of subsequent phases, even if the detailed use of tools is missing, is suggested by Hammer as the most appropriate approach in practice. Additionally, his concept covers most requirements, cited in the literature. The main criticism, which also exists in the literature, is the link to the operative area, which Hammer himself even names as the most difficult part. However, the tools which were used during the third generation are Diffusion Theory, Creativity Methods, Trend Landscape, Cross-Impact-Analysis, Scenario Analysis, SWOT Analysis, Strategic Planning and Portfolio Analysis, but for special parts, such as scanning or for the link from strategic to operative, to name but a few, tools are missing. This makes it especially difficult for SMEs to identify the most appropriate elements.

The ***fourth and last generation,*** so-called 'operative and strategic early enlightenment' is based on a holistic approach by the integration of both 'operative' and 'strategic' early recognition (Krystek et al., 2007). This stage is also characterized by networked thinking and builds the basis of response actions (Kirschkamp, 2007). As several authors have already pointed out, no holistic approach exists (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015). It is the central rationale of this work to develop a holistic EWS by selection and combination of appropriate tools. As also shown in figure 19 below, where an overview of the tools used during the operative and strategic Concepts are given, the related tools for a holistic Concept are unknown. This is within the operative Concepts: KPIs, projections and indicators and also within the strategic Concepts, when a part of the tools described above is missing: Diffusion Theory,

Creativity Methods, Trend Landscape, Cross-Impact-Analysis, Scenario Analysis, SWOT Analysis, Strategic Planning and Portfolio Analysis.

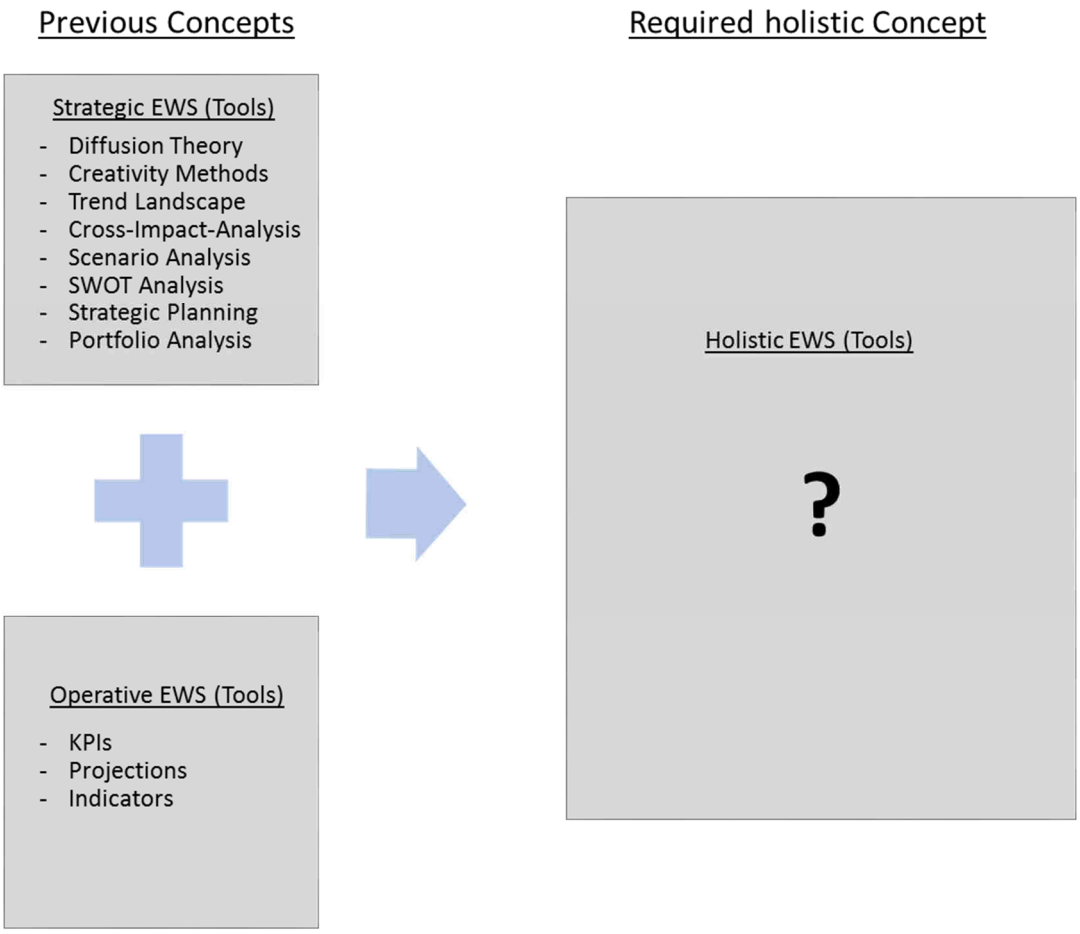

Figure 19 Overview of tools used in previous concepts

Source: own illustration

However, as the existing literature is very limited to the general, and thus relatively superficial, representation and, as the concepts were developed for the application to many, if not all, types of enterprises and companies, it is really not possible to fulfill the requirements of a holistic system, even not by linking already existing ‘strategic’ and ‘operative’ EWSs, especially when also trying to cover the practical aspect. This fact is apparent in Table 3, where only 2 of the 6 concepts, which have not been devoted to pure quantification, as e. g. an insolvency model,

work on the topic of the EWS both in the theoretical sense, but also by providing practical approaches such as the relatively precise function and description of its parts (Krystek & Müller-Stewens, 1993, as well as Hammer, 1998). However, these concepts also have a more one-sided view. Thus the work of Hammer (1998) is very much focused on the strategic part of an EWS, while Krystek & Müller-Stewens (1993) concentrate on to the operational view of the risks. Hammer (1998) concentrates on giving a very detailed structure of how a (strategic) EWS should look, but without taking into account how its so-called "5-point plan", could be used in detail. In particular, the link from the strategic to operative area is missing. Krystek & Müller-Stewens (1993), on the other hand, are very focused on a key indicator and/or indicator-based EWS, which, however, can only meet the almost operational requirements. This lack of depth in the descriptions and implementation approaches is one gap that ultimately leaves a lot of scope for individual interpretation or even intuition and is difficult to close for the SME. I would like to close this gap in this work, not by giving a "handbook" but at least a guide.

The generality of the literature leading to this topic is reflected, for example, in Table 3. It is easy to see that most criteria are quite strictly separated from one another. Among the most elementary separations in the subject EWSs are, from my point of view:

- Theoretical and practical
- Operational and strategic
- Quantitative and qualitative

For a holistic and applicable EWS, however, it is impossible to avoid combining these sub-areas with one another, and even fusing them, so that a smooth transition from the strategic to operative area, which includes both quantitative and qualitative aspects, would be possible. It is precisely the interplay and the linking of the quantitative and qualitative areas that are particularly important to emphasize. In the literature, these criteria are strictly and stringently assigned to operational (quantitative) and strategic (qualitative). It is, however, a fact that these factors are inseparable because (almost) every quality can be quantified and (almost) every quantity describes a certain quality. The qualitative or

quantitative expression is therefore used, as quality can sometimes only be expressed by several quantities, and vice versa.

To be able to start the development of a holistic EWS, where all relevant factors and their interdependencies are able to be identified and dealt with (Kirschkamp, 2007), the requirements of an EWS will be identified, by answering the first research question:

1. What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround / interim managers?

Based on the requirement findings, appropriate tools, which match the requirements of a successful EWS, will be explored. This will include CO and QM tools as best-practice elements, seeking to close the aforementioned gap. For example, a tool for the link from strategic to operative, which this work intends to solve by BSC, is completely missing during the previous concepts, which even Hammer (1998) himself names as the most difficult part. This is, however, the main criticism of Concept of Hammer (1998), even though Bertram (1993) states that Hammer's concept is one of the most far-reaching considered, due its detailed classifications and control function, as his concept covers most known requirements from the literature. The BSC as a CO tool for example, which has been mentioned too rarely in the EWS literature so far, is appropriate for use as part of an EWS. On the one hand, it has a strategic orientation from the outset, as it is based on the "vision" and "strategy", which are of purely qualitative nature. In order to follow this vision and strategy and constantly review it, a connection to operational key figures is required, which should be determined and developed individually by each company. This is predominantly quantitative in nature but may also have some qualitative approaches. There are already discussions about the implementation of the BSC, whether it is sufficient as a stand-alone solution for an EWS as it already covers many of the required areas - it is operational and strategic, it is quantitative and qualitative, and it has a relation between product, employees, finance and market. A counter-argument, however, is that the BSC, is, for example, almost entirely devoid of consideration of the environment.

In order to facilitate and support the achievement of objectives, the QMS is excellently suited, as it also includes both quantitative and qualitative aspects in a balanced way. The advantage of a "symbiosis" of BSC and QMS is primarily the fact that the QMS clearly defines the processes and the company structure in advance. This results in a very high degree of transparency and efficiency in the company, which, in turn, contributes significantly to the identification and formulation of the BSC's vision and strategy and the definition of the relevant key figures. The QMS also ensures a high-quality awareness and significantly reduces the sources of errors and errors themselves, and thus contributes to a high degree of risk prevention. The two components could be summarized, in that, firstly, the BSC begins from a purely strategic, qualitative point, and closes the loop by development of operative, more quantitative area, through which they are examined, and achievement of objectives ensured. Both systems focus on almost equal areas - on customers, processes, the market, and employees, but with a complementary view. While the QMS ensures the efficiency and high-quality requirements through detailed processes and high transparency, BSC analyses the cause-and-effect relationship between all factors. In summary, it can be said that the QMS is system-oriented and the BSC works as a result-oriented system, and through this close and complementary structure, risks can be detected quickly and appropriate reactions can be initiated simply and effectively. However, an exploration of the most appropriate tools should be undertaken, identifying those which match the requirements from the first research question, as this work should include both the theoretical and practical part and at the end deliver a guide for SMEs for the implementation and use of a holistic EWS.

In addition, if we now divide the EWS, according to Ansoff (1976), into the two major areas of "scanning" and "monitoring", where the literature mostly covers the "monitoring" area to a large extent, if not completely, but being able to elaborate the area of "scanning" in the form of a guideline approach, we find a gap (this work tries to solve it by PESTLE, named by Stewart & Rogers (2012) as a key tool for scanning the environment) in the current literature during the concepts for the use of tools for EWS. This is described in the literature as a complex area with a diversity of different risk areas, which reflects the quite incomplete elaboration and description of the numerous tools and methods for

risk identification. Although a part of the literature already contains chapters devoted to the tools and methods, these are often just listed and only briefly described. The precise application areas and possibilities for the respective instruments are missing. This fact, however, is understandable for the reason of the focus on the "generality" of the literature as mentioned above.

However, the aim of this work is the use for a smaller range of enterprises, where I will close this gap, as shown in figure 20, by exploring more closely the most important tools and methods and how they can be integrated into the construct of a holistic EWS.

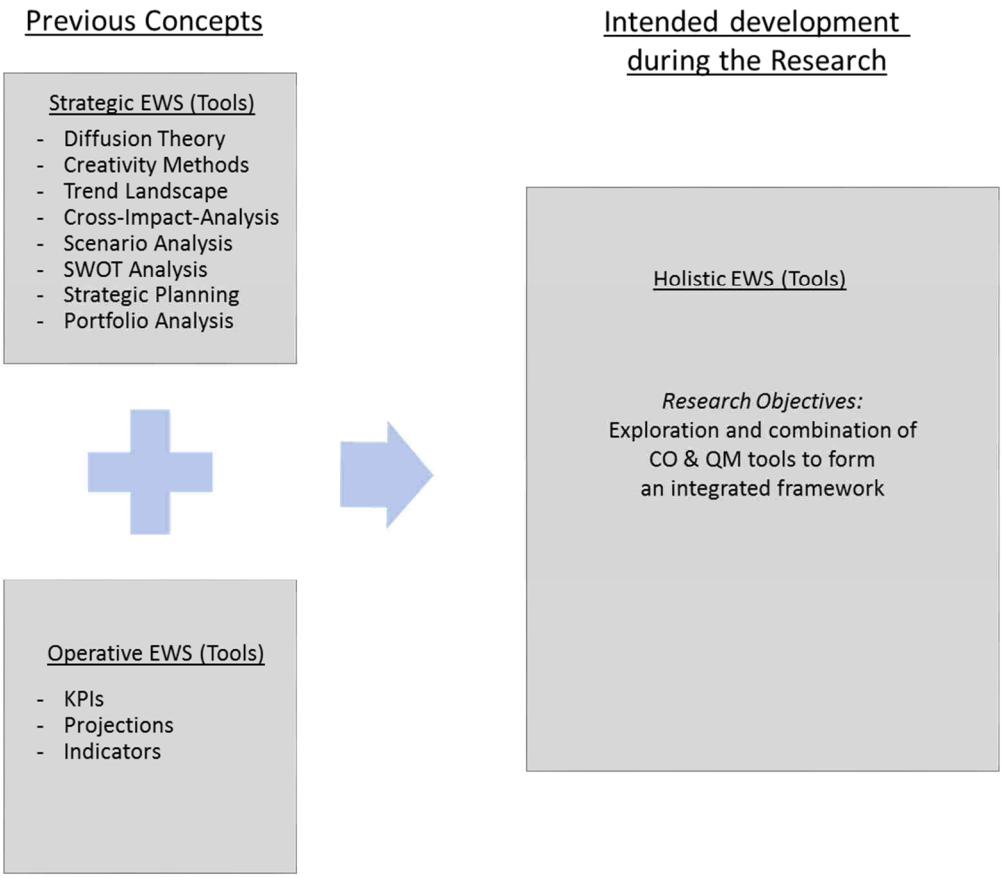

Figure 20 Intended development during the research

Source: own illustration

To be able to fulfill this aim, it is necessary to answer the second research question:

2. Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production industry and how can they be combined to form an integrated framework?

For this purpose, I will give an overview of the instruments that can be used mainly in the German food production SMEs, which risk areas can be covered and scanned, and then elaborate and verify the best-practice elements, also on the basis of the conducted interviews.

If we now take a closer look at the gaps presented individually, it becomes clear that in the literature "black-and-white thinking" prevailed. It was attempted to divide the hard-to-grasp issue of an EWS into as many individual parts as possible. These, however, cannot, and do not, have a smooth separation point, and an attempt was made to make these sub-areas individually transparent, comprehensible and applicable. This is a correct approach in a complex situation, but the parts have to be reassembled afterward, so that the end product is interlocked again and practicable, as otherwise, it becomes a non-applicable theory object. This combination of the mostly theoretically described parts I would like to make and detail in a certain kind of enterprise, by a detailed practical recommendation. This is based on the two main areas of CO and QMS and is supported by a pool of common tools and methods that are relevant for this branch of business, which combine to form a practically applicable and effective EWS.

To be able to cover also the practical and integrative approach, it is necessary to address the third question:

3. Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

The aim is to provide a holistic EWS, which includes the following factors:

- Theoretical and practical

- Operational and strategic
- Quantitative and qualitative

Furthermore, it is the intention with this construct to build a baseline for further research.

An overview of the three research questions and research objectives is shown in Table 4.

Research Questions

1. What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround / interim managers?
2. Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production industry and how they can be combined to form an integrated framework?
3. Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

Research Objectives

The objectives are:

1. to identify the requirements for EWSs in SMEs in the food production industry.
2. to explore CO and QM tools appropriate for an EWS for a German food production SME and to combine them to form an integrated framework.
3. to analyse implementation issues and considerations relevant to EWS tools in the food production SME context.

Table 4 Research questions and research objectives

In the context of the framework developed from the results of the literature review (Figure 18), the research questions and objectives can also be shown with reference to what they specifically address. The first research question and research objective aim to establish requirements for a successful EWS and provide added knowledge on the objectives with regard to having a framework for EWS building. The second research question and objective addresses points concerned with knowledge creation on CO & QM tools, which match the requirements of an EWS and their appropriate combination. The last question and objective analyzes the practical and integrative approach, which builds a contribution to practice. This is displayed in 1, 2 and 3 in Figure 21.

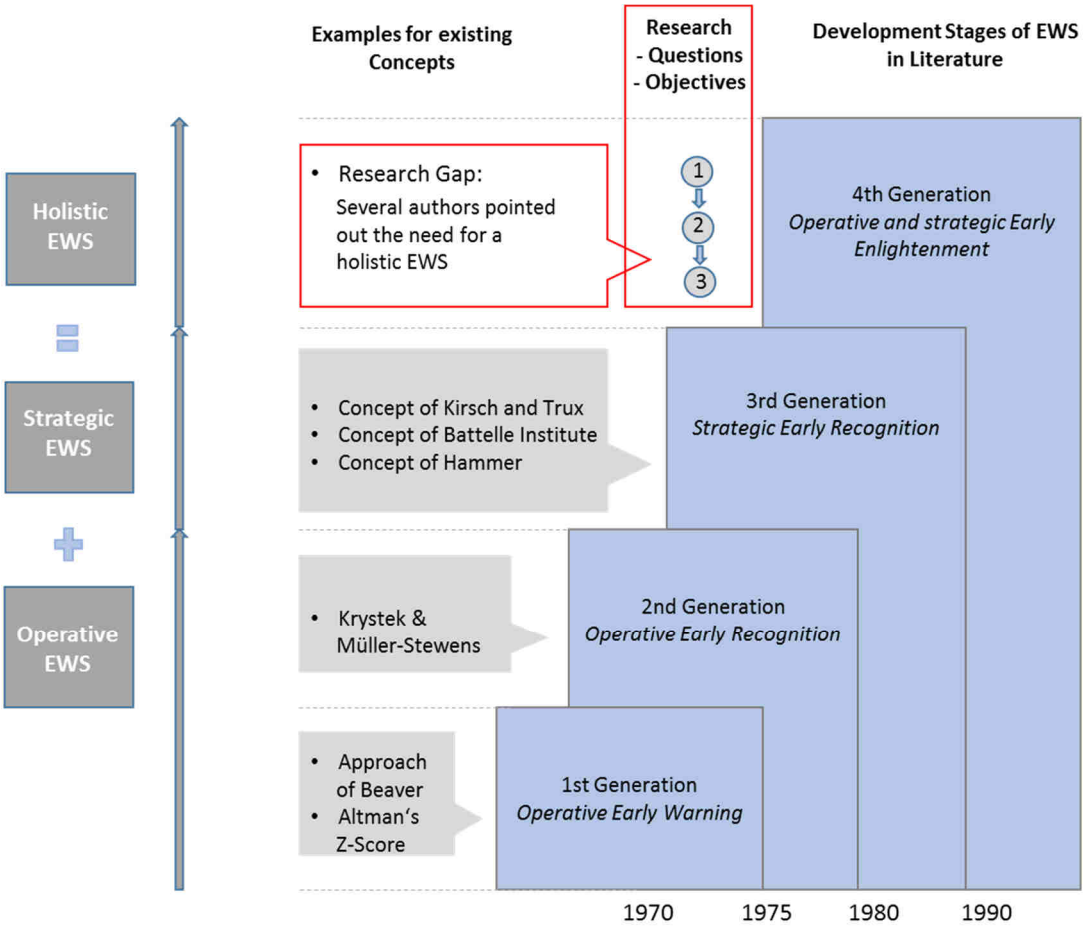

Figure 21 Conceptual framework - context of the research questions and objectives

Source: own illustration

This structured literature review on this given topic, the identified specific need for research in this area, the other identified gaps in research as well as the displayed connections between topics as displayed in Figure 18 and Figure 21 thereby demonstrate the initial contributions to knowledge and practice of this thesis.

3 Research Methodology

In the literature, there exists only a little information about the existence, implementation and, design of EWSs for the food production industry (Ruderer, 2009), which made it necessary to collect additional data in practice. This chapter gives an overview of the applied methodology and methods for problem-solving, as well as the selection of interviewees, and the analysis of results. Before describing the research methodology and methods appropriate to this study, it is appropriate to follow Kock`s (2007) suggestion, where he states that researchers should be guided by a framework of appropriate methodology.

3.1 Philosophical Framework

The literature describes a wide range of frameworks for the classification of philosophical paradigms, from which the researcher can select an appropriate one (Kock, 2007). As the written products of all the efforts should be clearly articulated for the reader (Huang, 2010), it could be done in the way of two paradigms of positivism and constructivism by answering four philosophical questions of: Ontology (What can be known?), Epistemology (What knowledge can we get?), Methodology (How can we build that knowledge?), and Ethics (What is the worth or value of the knowledge we build?) (Kock, 2007).

Constructivism is typically seen as an approach to qualitative research where the goal is to rely as much as possible on the participants` views of the situation being studied (Creswell, 2009). “Constructivism answers the methodological question with two hypotheses, both recognizing (following the teleological hypothesis) that we need knowledge, not just to understand, but also to build the reality we experience: the principle of complexity and the principle of intelligent action” (Kock, 2007, p. 73).

In contrast, Positivists rely on a traditional form of research, in which Causes probably determine Effects or Outcomes, by careful observation and measurement of the objective reality that exists in the world (Creswell, 2009). However, the positivist research is seen as a method for testing and refining hypotheses (Myers, 2013).

In a similar way to Huang, Ng & Coakes (2014) state that the researcher has at first to choose a suitable research stance (core beliefs about the nature of things in the world) which matches his beliefs of the world (ontology) and about how and what the researcher chooses to define as 'facts' (epistemology). McNiff & Whitehead (2010) narrow it down by describing Ontology as referring to a theory of being, to do with identification of ourself in relation to others, followed by Epistemology, which refers to knowledge, and asks what is known and how it comes to be known, linking to Methodology and how things are done.

3.2 Research Methodology

3.2.1 Theoretical Position

Quinlan (2011) describes methodology as a way in which the research is carried out followed by the means (methods) by which data is gathered for a research project. Ng & Coakes (2014) conclude that methodology is a practical structure based on ontology and epistemology close to the chosen methodology, methods are tools for data collection. The methodology can be divided into qualitative, regarding using words, and quantitative, regarding using numbers (Creswell, 2009).

As my personal view of society and organizations (ontology) and related philosophical process (epistemology) relies more on the constructivism – interpretivism, I prefer, as described by Ng & Coakes (2014), to immerse myself in every part of my project, which aligns with the qualitative data research strategy (Quinlan, 2011).

3.2.2 Qualitative Data

Qualitative research concentrates on the real world by observational data collection methods and 'interrogative' methods of data collection, which are exploratory or descriptive for researching complex issues (McGivern, 2013). Myers (2013) is more precise by stating that Qualitative research is best if the researcher wants to study a particular subject, especially when the topic is new and not much literature exists on that topic.

McGivern (2013) states that qualitative research is appropriate for the understanding of individuals and groups and why they think and behave in a particular way. Huang (2010, p. 94) confirms this view in a very pragmatic explanation: "Qualitative research is research about practice with practitioners". Davies (2007) summarizes and explains that in qualitative research, the observer is located in the world and interprets practical material, which makes the world visible, thus transforming it.

“Qualitative methods are widely assumed to use qualitative data analysis and induction“ (Wood & Welch, 2010, p. 59), where the theory is an outcome of research (Brymann & Bell, 2003). Using inductive reasoning, research starts ‘bottom-up’ and begins with collecting data about the topic (Mayer, 2008).

The goal of this research was to explore and establish Controlling and Quality Management tools for an EWS in the food production industry. Concepts and interrelations were generated with the help of turnaround-, controlling-, and quality management experts and then confirmed/refined and analyzed by considering how they could be implemented in practice through the application of case study research. To achieve these objectives of this research, this study adopted a qualitative approach, involving an ongoing literature review, semi-structured interviews, and two case studies.

Research plan

This research was split into 4 phases, which were developed sequentially.

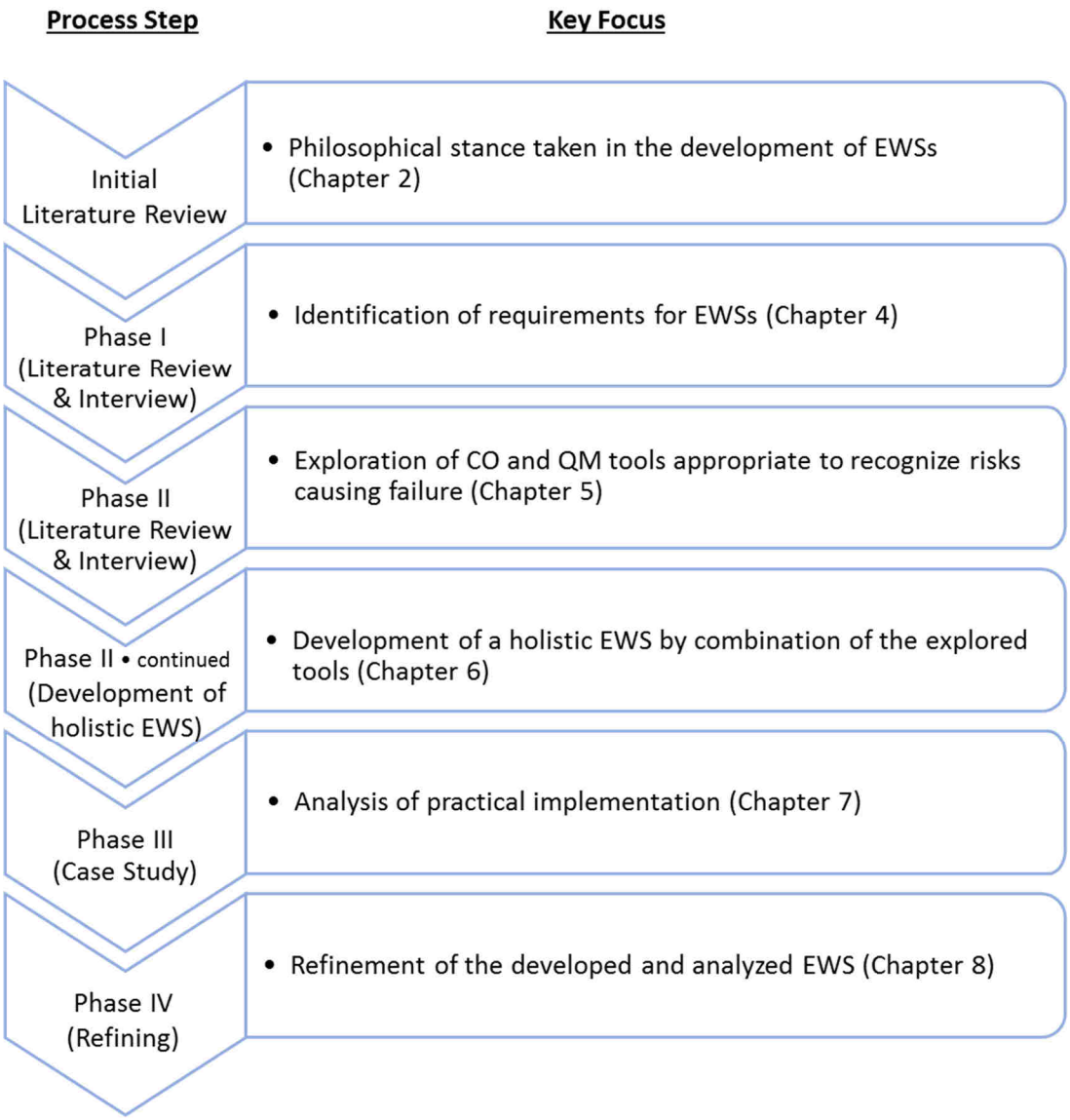

Figure 22 Process map of research phases and their intended outcome

Source: Own illustration

Figure 22 shows the iterative research phases and the intended outcomes of each, which will be described in brief.

The research started during Chapter Two with the initial literature review, where the aim was to make explicit the philosophical stance taken in the development of the early warning system.

The first phase during Chapter Four started with identification of the requirements for a successful EWS from literature review, followed by the semi-structured interview of three turnaround/interim management experts. The findings from the

theoretical and empirical area were compared, categorized and combined to form a unified list. The outcome helped the author establish a basis from both points of view, theoretical and practical, for the requirements which should be considered during the development of an EWS for German food production industry.

During the second phase in Chapter Five the unified list of the requirements from phase one, which was the starting point for the third stage of literature review and also for the semi-structured interview, was shown to the interviewees before interview. It was important to explore CO and QM tools not only from the literature but also from the empirical view as best-practice, with the help of two CO and two QM experts, independent of the case companies, to establish appropriate risk recognition factors of company failure and to match the requirements of a successful EWS. Here were the findings from both sources defined, categorized, compared and unified for the subsequent development of an EWS. The aggregated results from the literature and interviews were integrated in Chapter Six, where a holistic EWS was developed by the combination of the tools.

During phase three, in Chapter Seven, the developed model was shown to the companies with the aim of analyzing the appropriateness of implementation and use in SMEs, as well as for refinement. The two studies were within two separate and independent medium-size companies. Both companies were German producers of food with QM and CO departments.

During the fourth phase in Chapter Eight, the EWS was refined according to the recommendations resulting from the Case Studies.

The four phases will be described in detail later; most of them, however, use semi-structured interviews as their core data generation mechanism.

3.2.3 Semi-Structured Interview

The Semi-structured Interview uses the process of providing structure while allowing improvisation, where the interviewee has the opportunity to add important insights as they arise during the course of the conversation, while the previously prepared questions offer a measure of focus (Myers, 2013). "If I

conduct an interview, I am a constructivist" (McNamee & Hosking, 2013, p. 55). Saunders, Lewis, & Thornhill (2012) add, which makes sense to a constructivist, that the Semi-structured interview is used to gather data that is normally analysed qualitatively.

The Expert Interview is typically used for exploring a new field or for orientation in an unstructured field (Bogner et al., 2009). Flick (2010) helps by describing the Expert Interview as a specific form of applying semi-structured interviews, representing a group of specific experts. Semi-structured interviews seem to be appropriate to the chosen worldview of constructivism and to the complexity of the topic, which can only be handled by having personal conversations with experts.

Such an approach to interviewing enabled the author to address the complexities of the topic through conversation with experts. It helped to identify requirements of EWS, as well as to explore best-practice elements of controlling and quality management tools for the development of an EWS in SMEs, which will be explained in detail in the following sections:

Phase I: Identification of requirements for EWS

“The selection of expert-interviewees was based on purposive sampling” (Flick, 2010, p.168). An expert in this context could be defined as, “a person who is responsible for the solution of the problem or who has access to information needed for answering the questions” (Mayer, 2008). The experts here are either employed as interim managers or as turnaround consultants/advisors in struggling companies with more than five years’ experience in such roles. The rationale for using interim managers or turnaround consultants is that, by virtue of their professions, they will have seen more of this situation than most others. Due to the author’s experience as manager and turnaround consultant in the research area, access to a wide range of suitable interview candidates was possible

Initially, three turnaround/interim management experts, shown in the table below, participated in semi-structured interviews. Interviewing three respondents with the described background provided adequate evidence regarding the

identification of requirements for EWS. The author concluded that interviewing even more respondents from that sector would not provide any additional facts.

Date	Interviewee	Background	Interview time
23.06.2015	Expert 1	Experience: Turnaround Consultant / Interim Manager / Consultant for EWSs	3h
26.06.2015	Expert 2	Experience: Turnaround Consultant / Interim Manager / Consultant for Excellence and Change Management	2h
25.06.2015	Expert 3	Experience: Turnaround / Interim Management Advisor, Lecturer	2h

Table 5 Interviewees from Phase I

The structure (guideline) of the interviews was drawn from an ongoing systematic literature review to inform topics to be addressed. The interview partners were asked for their permission to conduct audio recording. The responses of the interviewee in the face-to-face interviews were audio recorded and verified directly after interviewing by playback of all answers. This method generated rich data relevant to the research questions, which were exploratory in nature. As ISO 9001:2015 only came in in October 2015 and mandates a risk-oriented quality management system, this research required an approach that was able to explore tools that might not have been considered as relevant, or important, previously. Therefore exploratory research offers a mechanism for considering the variations of experiences to date.

The names of participants and companies were anonymized. Flick (2010) states that all aspects of the research process have ethical implications, which he sees as linked to the four items of non-maleficence, beneficence, self-determination and justice. The research was conducted under the guidelines of “The University of Gloucestershire’s Handbook of Research Ethics”. Participation was entirely

voluntary, and confidentiality was guaranteed for interviewees and participants in the research.

Finally, I made sure that all research participants had the opportunity to review their answers. Interview, protocol and other data is stored safely on the researcher's personal computer and will be destroyed after approval of the thesis by the University of Gloucestershire (Argyris, 1982).

The interview data were translated and transcribed by the author. German was used both for the interview questions and interviews, as German is the corporate language within these companies. The data were analysed in 6 steps, recommended by Mayer (2008), wherein the first step audio records were read and transcribed to produce a report by marking text passages, which were recognized as answers. This was followed by the categorisation of the answers and, bringing data in a tabular format, the organizing of them by groups for facilitation of comparisons. The purpose of categorisation and cross-tabulation permitted the inspection of differences among groups and helped to determine relationships between variables. The third stage was used for establishment of internal logic between the individual pieces of information. After this, it was possible to record the internal logic in a written form, where the classification of the single items was detailed and specified further. In the fifth stage there followed the establishment of analysis of text and interview excerpts, where finally, a report including the opinions and interpretations together with recommendations or suggestions for actions was developed.

Issues that emerge from the interviews were also examined within the literature (Yin, 2014). The requirements for EWS were defined, categorised and compared to those identified in the literature and then a unified listing was developed, drawing on both sources. This was shown to the interviewee during Phase II.

Phase II: exploration of CO & QM tools, appropriate for recognizing risk factors of company failure

The toolkit of CO and QM is very large and it was necessary, with the help of two CO and two QM experts, independent of the case companies, to identify the most appropriate, measurable by the company value, including shareholder value,

market value, customer value, people value and future value (Töpfer, 2000), for EWSs, which matches the requirements identified by turnaround experts, interim managers, lecturers and literature review. The experts here are either employed as Controller or Quality Manager in companies, with more than five years' experience in such roles. The rationale for using Controllers or Quality Managers is that, by virtue of their professions, they are well able to identify the best-practice tools appropriate for the described requirements.

A list of categories equal to those identified and defined in Phase I were shown to informants before the interview. These requirements were worked out during the literature review and interviews. Therefore, in particular, those described in the following requirements for a practical EWS arise.

The requirements from Phase I, which an EWS in the Food Production Industry has to fulfill, were named with the following main points by the Turnaround experts and comply with literature review:

EWSs should:

- help recognizing risks timely and prevent them at an early stage.
- be holistic (strategic and operational) and practicable => not too complex.
- be future-oriented.
- include quantitative (hard) and qualitative (soft) factors.
- monitor all business areas.
- consider internal and external factors.
- be a top management information system – monitored by management.
- be designed for internal and external stakeholders with different reports.
- match characteristics of the company (culture, structure, size and type of management).
- have responsibility for their suitability lodged with the management.

These were also confirmed by the CO and QM experts, summarized in the table below.

Date	Interviewee	Background	Interview time
CO			
14.03.2016	Expert 4	Experience: Controlling / Interim Manager / Turnaround Consultant	40min
14.04.2016	Expert 5	Experience: Controlling Advisor / Business Manager for Competence Center Controlling, Lecturer	30min
QM			
22.03.2016	Expert 6	Experience: DIN EN ISO 9001ff. / HACCP lead Auditor	20min
16.03.2016	Expert 7	Experience: DIN EN ISO 9001:2015 Advisor, Lecturer	1h 15min

Table 6 Interviewees from Phase II

The interviewees were given a short introduction and explanation of the research and background of the interview. This was followed by an exploration of CO and QM tools, appropriate for recognizing risk factors of company failure. Two controlling experts and two quality management experts participated in semi-structured interviews. The interviewees were asked for their permission to conduct audio recordings or to make notes. In the first controlling interview, the responses of the interviewee in the face-to-face interviews were recorded by audio and verified directly after interviewing by playback of all answers. The second controlling, and also both quality management interviews, were recorded in writing, as the audio recording was unwelcome by not naming the reasons. The notes were made by the interviewer and were read to the interviewee after each answer for verification. German was used both for the interview questions and interviews, as German is the corporate language within these companies. The interview data were translated and transcribed by the author.

The names of participants and companies were anonymized. The research was conducted under the guidelines of "The University of Gloucestershire's Handbook

of Research Ethics". Participation was entirely voluntary, and confidentiality was guaranteed for interviewees and participants in the research.

Finally, all research participants had the opportunity to review their answers. Interview, protocol and other data is stored safely on the researcher's personal computer and will be destroyed after approval of the thesis by the University of Gloucestershire (Argyris, 1982).

The data were analysed by reading and transcribing audio and written records to produce a report by marking text passages, which were recognized as answers. Followed by the categorisation of the answers and, bringing data in a tabular format, organizing them by groups for facilitation of comparisons. The third stage was used for establishment of internal logic between the individual pieces of information. After this, it was possible to record the internal logic in a written form, where the classification of the single items was detailed and specified further. Finally, the explored CO and QM tools with the help of CO and QM experts were finally defined and categorized in comparison with those identified in the literature. The selection criteria evaluated not only whether, according to the requirements from Phase I, the selected tools are needed, but also whether the SMEs have the required resources and capabilities for their implementation (Rocha-Lona et al., 2013).

Early warning systems, named by interviewees and related to the literature review, could, according to the requirements from Phase I, include the following tools:

- *PESTLE*
- *SWOT Analysis*
- *Planning*
- *FMEA*
- *HACCP*
- *Turtle Diagram*
- *Fault Tree Analysis (FTA)*

- *Creativity methods*
- *BSC*

which will be explained in detail during chapter 5.

The aggregated results of the interviews, as well as the tools from the previous strategic concepts of Battele Institute (1978) and Hammer (1998), except Delphi-Method (similar to Expert Survey named by Hammer), which are Cross-Impact-Analysis, Portfolio Analysis, Diffusion Theory, Delphi-Method, Trend Landscape and Scenario Analysis, were integrated into the corresponding chapter 4 / 5 and built an important basis for the EWS approach in chapter 6, as well as for the validation and final refinement. The aim of the interview was, additionally to the theoretical basis, to consider the best-practice elements.

Afterwards, Popper`s approach was followed insofar as he suggests examining interview data informally and using it to derive conjectures (Wood & Welch, 2010), which link to the next step of Case Study, which was then used for analysing the appropriate implementation and use in SMEs as best-practice elements designed by Experts and literature review.

3.3 Case Study Approach

3.3.1 Theoretical Background

Before discussing the appropriateness of the case study research method for confirmation and validation of best-practice elements identified through expert interviews, it would be helpful to show the types, benefits, and risks of this research approach. A lot of comments exist in literature and minds of researchers about the aspects of case study research, especially what the near-synonyms mean – single case, case work, case method, etc. (Gerring, 2009).

In a broad sense, a case study can be seen as the "main benefits in the structure of knowledge for the development of an effective reasoning process, the development of effective self-directed learning skills and increased satisfaction with, and motivation for, learning" (Schwartz et al., 2002, p. 3). Yin (2009, p. 18) defines Case Study as "an empirical inquiry that investigates a contemporary

phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used".

A case study is about defining the topic, including the hypothesis and the set of cases with their information (Gerring, 2009), which can be explanatory, exploratory or descriptive case studies by answering the questions ‘What?’, ‘Why?’, and ‘How?’ (Yin, 2014). It may be understood as a single case which refers to the analysis of a large/extreme case or as a multiple case which incorporates several cases (Gerring, 2009). Yin (2014) states that even a single case can be accepted, which statement needs a strong argument to counter critics. "In sum, it is the choice of topic – not the method – that renders this genre problematic" (Gerring, 2009, p. 210).

While some researchers link Case Study to qualitative research (Gerring, 2009), Kumar (2011) states that quantitative design is also prevalent in the Case Study. Myers (2013) refines this by the application of quantitative design for testing the theory. Yin (2014), in contrast, does not distinguish between the various research strategies regarding quantitative and qualitative research.

Case Study is about building theory by qualitative research, which is more exploratory (to discover) or to test theory by quantitative research, which is more explanatory (to test, explain, or to compare) research (Myers, 2013). Yin (2014) concludes that some situations could be identified, where all strategies might be relevant and, on the other hand, situations where two strategies might be considered equally attractive.

However, the Positivist case study research is seen as a method for testing and refining hypotheses (Myers, 2013), where, in contrast, constructivism is typically seen as an approach to qualitative research, where the goal is to rely as much as possible on the participants` views of the existing situation (Creswell, 2009).

There must be some general principles, where the researcher seeks to explain a single outcome for a single case, “which may be understood as a study oriented toward explaining the point score for a single case rather than a range of values across cases, or a range of values occurring within a single case” (Gerring, 2009, p. 187).

A single case refers to the analysis of a unique or extreme case, often representing a critical case in testing a well-formulated theory, as well as the revelatory case when an investigator has the opportunity to analyze a phenomenon previously inaccessible to science inquiry (Verschuren, 2003). The key here is to justify the choice with strong arguments for the reason to be able to offer resistance (Yin, 2014). It would follow the explanation of Gerring (2009, p. 209) that “if the within-case evidence is sketchy – if, for example, the case might be constructed in a variety of different ways, each of which provides a plausible fit for the theory and the evidence – then she may choose to place less emphasis on these results”.

Multiple Case Study will, in contrast, be more powerful, where you have the possibility of the replication of two or more cases, where the conduction of them can require extensive resources and time, but where the decision to undertake multiple studies decision in preference to single studies cannot be taken lightly (Yin, 2014).

The single-, and multiple-, case studies reflect different design situations, where within these two variants, there could be unitary or multiple units of analysis, which can be characterised in four categories, each with two dimensions: single-case (holistic) designs, single-case (embedded) designs, multiple-case (holistic) designs, and multiple-case (embedded) designs (Verschuren, 2003).

"The holistic approach to research is once again more a philosophy than a study design. You can use any design when exploring a situation from different perspectives, and the use of multiple methods is prevalent and desirable" (Kumar, 2011, p. 129). Yin (2014) explains it in more detail, where he states that you can use the holistic design when the case study examines only the global nature of an organization or a program.

The embedded design, in contrast, can be a single case study as a program that involves large numbers of funded projects, or an organization, including more than one unit (Verschuren, 2003). “The individual cases within a multiple-case study design may be either holistic or embedded. When an embedded design is used, each individual case study may, in fact, include the collection and analysis

of quantitative data, including the use of surveys within each case" (Yin, 2014, p. 63).

The means of evidence-gathering depends on the type of information, which can be obtained by interview, documents, newspaper, etc. (Kumar, 2011). Using several different techniques in combination helps to avoid the loss of information, which means the use of triangulating multiple sources of data (Saunders et al., 2012). Gerring (2009, p. 4) in contrast argues that case study "should not be defined by a distinctive method of data collection but rather by the goals of the research relative to the scope of the research terrain".

The advantage of a case study is that the researchers test or explore theories of real-life situations, but particularly in a business setting, because firms may be sceptical, it can be difficult to get access to a particular company or group of companies (Kumar, 2011).

3.3.2 Case Study Approach applied to my Research Design

Yin (2014) explains that there is no formula to determine whether or not the Case Study method is appropriate for the research. However, in order to answer questions seeking to explain the present circumstances of 'how' or 'why', Case Study research will be relevant. Furthermore, the need for an extensive description of some phenomena makes this method appropriate (Gerring, 2009).

In considering the above explanation of Yin (2014), I have come to the conclusion that I am also looking for the answers/ideas connected with the questions 'WHY?' (What are the requirements of an EWS/Why do companies fail?) and 'HOW?' (What are the best CO & QM elements for an EWS in SMEs?/How can company risks and failure potentially be anticipated and prevented in SMEs?) I clearly identified Case Study as an appropriate approach, especially for the kind of knowledge of real-life, which Yin (2009) put at the heart of Case Study Research.

As a constructivist, I accept several definitions of the case study approach but would base my strategy on Yin`s definition, where he points out that case study is an inquiry and a research method, such as a survey or an experiment (Yin, 2014). The previous phases, including literature review and semi-structured

interviews, helped to identify requirements for EWS and explore CO and QM tools, appropriate for recognizing risk factors of company failure. In the present Phase III, two case studies have been used in order to confirm and refine best-practice elements in EWSs.

The case studies were prepared by data gathering from the literature review and the help of Turnaround, CO & QM Experts interviews, followed by practical fulfilment of operational members' interview by case. "The sampling and integrating further material is finished when the ‘theoretical saturation' of a category or group of cases has been reached" (Flick, 2010, p. 119).

Phase III: Case Studies

Two studies were used in Phase III to confirm and refine best-practice elements in EWSs (Yin, 2014). The two studies were within two separate and independent medium-size companies. Both companies are German producers of food with QM and CO departments: points which were important as selection criteria for this research phase.

The first study was in a company “A”, which is specialized in food production industry for fruit and vegetables. The second study was within an organization “B”, which is also active in the food production industry, this time for milk products. The studies involved three semi-structured interviews, shown in the table below, per study of the senior management of relevant functions: quality, controlling and the general management. The involvement of different functions had the advantage of producing a discussion with the aim of analyzing the appropriateness of EWS implementation from different points of view. German was used both for the interview questions and interviews themselves, as German is the corporate language within these companies.

Date	Participant	Background	Interview time
06.09.2016	Expert 8 (GM)	Medium-size company “B” in food production industry (Milk products). Interview of relevant function: GM	1h 50min
06.09.2016	Expert 9 (CO)	Medium-size company “B” in food production industry (Milk products). Interview of relevant function: CO	
06.09.2016	Expert 10 (QM)	Medium-size company “B” in food production industry (Milk products). Interview of relevant function: QM	
29.08.2016	Expert 11 (GM)	Medium-size company “A” in food production industry (Fruits and vegetables). Interview of relevant function: GM	3h
29.08.2016	Expert 12 (CO)	Medium-size company “A” in food production industry (Fruits and vegetables). Interview of relevant function: CO	
29.08.2016	Expert 13 (QM)	Medium-size company “A” in food production industry (Fruits and vegetables). Interview of relevant function: QM	

Table 7 Interviewees from Phase III

The EWS approach was developed during Phase II by the writer on the basis of literature/interview, own logical approach and then validated by the informal exchange of ideas with experts. The development was based on the findings from the Literature Review and for practicable development of the final EWS approach,

with the help of CO and QM experts, best-practice CO and QM tools, appropriate for an EWS within the food production industry, were explored. The developed model was shown to the companies with the aim of analyzing the appropriateness of implementation and use in SMEs of best-practice elements designed by experts and literature review.

The interview partners were asked for their permission to conduct audio recording or to make notes. The responses of the interviewees in the face-to-face interviews were recorded by writing, as the audio recording was unwelcome – the reason was not given. The notes were made by the interviewer and were read to the interviewee after each answer for verification.

The names of participants and companies were anonymized. Yin (2014) advises case study researchers, to work with special care and sensitivity, to gain informed consent of participants, as well as to protect the privacy and confidentiality of the participants. The research was conducted under the guidelines of "The University of Gloucestershire's Handbook of Research Ethics". Participation was entirely voluntary, and confidentiality was guaranteed for interviewees and participants in the research.

Finally, I made sure that all research participants had the opportunity to review their answers. Interview, protocol and other data are stored safely on the researcher's personal computer and will be destroyed after approval of the thesis by the University of Gloucestershire (Argyris, 1982).

The data were translated by the author and analysed in 6 steps, recommended by Mayer (2008). In the first step, written records were read and transcribed to produce a report by marking text passages, which were recognized as answers. Followed by the categorisation of the answers and, bringing data in a tabular format, organizing them by groups for facilitation of comparisons. The third stage was used for establishment of internal logic between the individual pieces of information. After this, it was possible to record the internal logic in a written form, where the classification of the single items was detailed and specified further. In the fifth step followed the establishment of analysis of text and interview excerpts, where finally a report including with the opinions and interpretations together with recommendations or suggestions for actions were developed. The issues from

this phase were used for the refinement of the EWS for practical appropriateness in Phase IV.

3.4 Refining

Phase: IV: Refining of the developed model

As Yin (2009) recommended further investigation and refinement of best practices, subsequently, the aggregated results of the interviews were integrated into the corresponding model by analytical consideration of the theoretical basis and integration with the statements from practice. For this reason, the technical, financial, organizational, and operational sight were taken into account. At the end, this approach enabled the verification of a practicable EWS, which was compared, validated and refined appropriately by suggestion for implication.

3.5 Minimizing bias

In all research, according to Pannucci & Wilkins (2010), “Bias”, described as tendencies that prevent from unprejudiced reflection on a given issue, subject or question, can occur at any phase of research, including study design or data collection, as well as in the process of data analysis and publication. Miles et al. (2014) states that bias should as far as possible be avoided. Voss et al. (2002) add that risk of bias on the part of the researcher/observer can be minimised by using triangulation and multiple case studies. Pannucci & Wilkins (2010) in contrast, state that an appropriate research design can minise bias. Miles et al. (2014) explain in detail, that especially the researcher has some opportunities to avoid bias by, for example, including different positions from a company, keeping questions firmly in mind during the interviews, making the intentions clear for participants and clarifying things for the avoidance of misunderstandings. Pannucci & Wilkins (2010), in conclusion, say that through understanding of bias, such as selection bias, performance bias, etc., and how it affects study results, enables the researcher to overcome it by designing the research accordingly.

The researcher tried to avoid all bias which could possibly occur during the research. First of all, the qualitative research, by using semi-structured interview

as the method, enabled the researcher to explore all relevant details, clarify and answer all questions, which arose during the interview. Furthermore, it was possible for the researcher to focus, by using the semi-structered interview as a guide, on questions during the interviews.

The consideration of different professional backgrounds was increased especially by the choice of respondents for the first and second phase, thus different points of view could be taken into account. During the first phase Interviewees with the background of Tunaround Consultant, Interim Manager, Lecturer, Interim Management Advisor were used and, during the second phase, those with the background of Controlling, Interim Manager, Tunaround Consultant, Controlling Advisor, Lecturer, Business Manager for Competence Center Controlling, DIN EN ISO 9001 ff./ HACCP lead Auditor, DIN EN ISO 9001:2015 Advisor were used.

Furthermore, by the choice of the case studies, by applying multiple case studies, in this context it was arranged that the interviewees who participated were from different positions within an organisation, such as Controlling, Quality Management and General Management.

Finally, as it was a subsequent research study including an ongoing literature review, it was able to compare the findings from different sources and additionally verify daty by sequential phase.

3.6 Limitations

The results of this research are only applicable to the defined food production industry sector; any transfer to other industries requires further investigation.

4 Phase I: Identification of requirements for EWS

Before best-practice CO and QM tools, appropriate for an EWS within the food production industry, are explored with the help of CO and QM experts, first, the requirements of an EWS will be identified by literature review and semi-structured interviews with Turnaround and Interim Managers. This chapter answers the first research question.

4.1 Literature review

The selection and practical development of the EWS used for the EWS-development will be at first based on the findings from the literature review.

4.1.1 EWS – definition

An Early Warning System (EWS) can be defined as an information system designed to warn companies when problems arise (Löhneysen, 1982) where companies have to initiate counteractions (Götze & Mikus, 2000). Kästner (2012) adds that an EWS should promptly predict factors which are important for the development of company success. The aim of an EWS is to identify risks in real time and give the company enough time to deal with them (Löhneysen, 1982). Trustorff (2012) in contrast states that an EWS has to recognize the risk in the formation phase. Ruderer (2009) goes one step further and claims that an EWS has to work by making use of available information as early as possible, and so accurately and comprehensibly predict the relevant variables of the company. Bedenik et al. (2012, p. 672) conclude that "The role of early warning systems as an instrument for crisis aversion is in: revealing weak signals, transferring important information about environmental changes, prevention of business crisis, and constructing a creative base for timely and appropriate response".

The Literature Review in Chapter 2 shows that numerous tools and methods which try to cover the points mentioned above have already been developed but it became clear that some gaps are still in existence. It is those gaps which this work tries to fill by, firstly, attempting to establish a framework by identification of

requirements for the EWS as an important tool for risk and crisis identification. It informs the user in time about latent (invisible but available) risks, which optimizes control of the company (Romeike & Hager, 2013). It makes it possible for the company to gain valuable time for an adequate reaction to imminent dangers, using all possible measures (Ruderer, 2009). Early warning can be used as a way of thinking which accepts the decisions and the possibilities of change as well as the uncertainties in company and environment (Kloss, 1984), which is especially relevant nowadays.

4.1.2 EWS – a topic in this day and age

Janßen & Riediger (2015) state that companies today have to identify risks which were scarcely considered in the past. They add that due to globalization the companies are much more affiliated with each other (the figure of multinational companies has increased in the last 50 years from 7,000 to 104,000; it is estimated that it will reach 140,000 by 2020) and increase the complexity of risk. “Indicators and EWSs are becoming more important as they can predict possible future changes in their early stages and thereby reduce the time needed to make adequate decisions” (Bedenik et al., 2012, p. 672). The EWS is appropriate if it is able to recognize risks correctly and early enough (Hillebrand, 2005) and this is where its design plays an important role (Krystek, 1987).

As mentioned, the fourth and last generation**,** so-called ‘operative and strategic early enlightenment’ is based on a holistic approach by integration of both ‘operative’ and ‘strategic’ early recognition. However, there is still no clear holistic approach in existence.

4.1.3 Design of an EWS

The design of an EWS is subdivided into different areas, reasons/symptoms and indicators, which will be summarized, wherein the first stage the monitoring area will be determined then followed by the early warning indicator for each monitoring area and the definition of the requisite size and tolerances (Krystek, 1987). Ruderer (2009) mentions the same three points and adds a fourth: the

definition of data processing. Furthermore, Trustorff (2012) states that for the location and recognition of relatively weak signals, it is necessary to identify some possible sources of the signals, e. g. journals, books, radio, TV, Internet, blogs or social media.

The design of the system should include people, plants and the combination of people and plants for a specific relationship (Löhneysen, 1982). These elements record data, stimuli, impulse, signals and information about a specific situation or development by analyzing them, measuring the probability of their occurrence and determining the strength of their effect on the company (Hahn, 1979). Ruderer (2009) adds that a modern EWS does not only predict as early as possible the future development but is also an entry point for critical discussion of cause and effect relationships, where the employees have continuously to deal with changes occurring in the company environment. Argyris (1982, p. 38) describes it as “a process in which people discover a problem, invent a solution to the problem, produce the solution, and evaluate the outcome, leading to the discovery of new problems”. This is followed by the explanation of “action” by Sevón (1994, p. 2), which describes it as “the means by which a goal, which lies in the surroundings of a though-action system, is achieved“. “Such analysis of risk interactions can help managers understand that risk isn’t always what it seems” (Hampton, 2009, p. 63). "This requires some analysis or understanding of the new situation; it requires a background of knowledge or methods which can be readily utilized; and it also requires some facility in discerning the appropriate relationships between previous experience and the new situation" (Bloom et al., 1956, p. 38).

The information about risk coming from different sources should be combined to form a holistic system (Brühwiler, 2001). “Some companies have developed a panel of early warning indicators, sometimes referred to as a risk dashboard, to track movement in selected areas that are crucial to the company’s well-being.” (Hampton, 2009, p. 63). Ruderer (2009) shares this view by stating that EWSs are information tools, which have the aim to recognize the negative development at an early stage so that the company has enough time for the reaction before the damage sets in. Although a part of the literature already contains chapters devoted to tools and methods, these are often just listed and only briefly

described. The precise application areas and possibilities for the respective instruments are missing. However, the aim of this work is the use of an EWS for a smaller range of enterprises, and this research seeks to fill this existing gap by examining the most important tools and methods more closely and also how they can be integrated into the construct of an EWS. For this purpose, I will give an overview of the instruments that can be used mainly in the German food production SMEs; which risk areas can be covered and scanned; and also elaborate and verify the best-practice elements, also on the basis of the conducted interviews.

Depré (2011) states that companies should pay attention to communication and information policy where the information can come too late, not in accordance with the required regulations, unauthorized, and with inappropriate comprehension (too extensive, too tight). Kelders (1996) adds that for the decision-making for recognized problems it is important to have processes for information search. Good risk information can be used to develop early warning systems that alert an organization to potentially dangerous situations (Hampton, 2009). The risk policy of the company has to be written down so that the company's aims and expectations can be protected (Allenspach, 2006). The participation of employees is also important in early warning systems, as the system needs to match the characteristics of the company (structure, culture, size and type of management) (Bedenik et al., 2012). Kloss (1984) states that the environment and company give out recognizable signs, which should be noticed.

4.1.4 External / internal area

The first research work about “environmental analysis” came from Aguilar in 1967, where he constitutes the need for external review and monitoring by dividing company environment into the following subsystems:

- Economic terms
- Technological terms
- Legal-political terms
- Socio-cultural terms

- Physical-ecological terms (Kunze, 2000).

The company has to fix the external and internal area of monitoring and, for each area, there should be developed an indicator that sends a signal every time access changes (Hauser, 1989). Löhneysen (1982) states that an EWS should identify both internal and external dangers at an early stage. The operative EWSs are based on KPIs relating to past performance, and the strategic EWSs predict the future development of market, competitors, and company by supplementing each other (Berndt, et al., 2011).

The scanning and monitoring should include the micro and macro environment (Trustorff, 2012). Ruderer (2009) narrows it down by stating that the monitoring area of an EWS should primarily focus on the external area including macroeconomic, political, social and ecological environment by the inclusion of the supplier's sales market; on the other hand, the direction of an EWS concerns the internal area marginals. Rieser (1980) adds the technological environment. Berndt et al. (2011), in contrast, states that an EWS starts with the identification and evaluation of risks in the operative area and communicating that information to the central risk management. In this context, the question arises about where and what could be possible sources of such information, especially for weak signals. There are basic differences between internal and external sources (Koslowski, 1994). Internal sources include primarily the controlling and accounting. However, information from memos, reports and card files can be helpful, as well as the knowledge and personal experience of corporate members (Hauff, 2010). The external information gap about markets, competitiors, economic cycle and law, is still big in SMEs and this is a latent danger for decision-making. The manager should be aware of which information is necessary, where the sources are for this information, and which methods can provide this information (Mischon, 1982). External sources naturally include newspapers, magazines or books, as well as information from seminars or fairs (Röttger, 2005). However, weak signals can be seen as rooted in Ansoff's (1976) concept of the strategic early recognition, which will be explained below.

4.1.5 Strategic and Operational

Bedenik et al. (2012) describe "operational" early warnings as short-term oriented and "strategic" early warnings as long term. Krystek & Müller-Stewens (1993) explain it in more detail by differentiating between operational and strategic early warnings which are based on short-term measures of success and mainly aim to detect risks, whereas long-term objectives focus on profit and try to detect risks and opportunities. There exist two ways of detecting the signs: Monitoring, which is the analysis of the environment limited to single phenomena and Scanning, which is the process of acquiring information (Kirschkamp, 2007). Kunze (2000, p. 40) describes "environmental scanning" as "(…) the acquisition and use of information about events and trends in an organization's external environment, the knowledge of which would assist management in planning the organization's future courses of action". Hillebrand (2005) states that scanning is the formal scanning of the environment and the company with the aim of identifying the "weak signals", which, afterwards, will be analyzed and completed by monitoring. Monitoring analyzes the supposed change in detail and describes them together with the prediction of potential consequences (Kunze, 2000).

The recognition of strategic risks will be accomplished by locating the sign of discontinuous change, analysis and subsequent evaluation of its relevance (Trustorff, 2012). With a strategic EWS it is more or less impossible to recognize the signs by using indicators, which is the reason for the use of discontinuity which also has the advantage of more time for counteraction (Hillebrand, 2005). The discontinuity can be described as "unpredictable, unforeseen, natural or man-made sudden change, consequence, event, or force that confounds or disrupts earlier expectations or estimates (Business Dictionary, 2015). Kunze (2000) describes it as radar, oriented to “shadows” or “weak signals” which signal changes in the company environment. Kirschkamp (2007, p. 12) sums up thus, “In this context, discontinuities are most important and, therefore, it is the first aim of strategic early warning to detect Ansoff’s weak signals to inform management and initiate change”. Ansoff (1984, p. 483) describes “weak signals” as “(…) a development about which only partial information is available at the moment when response must be launched, if it is to be completed before the development impacts on the firm”.

Ruderer (2009) states that an EWS should be in use for both operational and strategic areas. "Operational early warning deals with data of high concreteness whereas strategic early warning deals with data of low concreteness" (Kirschkamp, 2007, p. 13). The operational EWS tries to prevent crises by frequently using instruments such as business ratios, projections, and indicators (Kirschkamp, 2007). They are past-oriented, which has the disadvantage that some risks can not be recognized in time. (Hillebrand, 2005). Trustorff (2012) warns about the examination of operative and strategic risks regarding independent reference parameters (potential for success versus operational success), time horizon (long-term versus short-term) and target dimension (strategic versus operational). In the long term, the threats of potential success will affect the success and the liquidity situation of the company by wrong strategic decisions or changes in the company environment going unremarked. Conversely denoting a high operational risk potential produces a considerable restriction of the scope of action for handling strategic risks. The survey by Roland Berger, conducted in 2003, shows that in 2001 around 80%, and in 2003 around 70%, of the companies that experienced a crisis, identified the crisis for the first time in the acute stage of a liquidity crisis, which is very late and costs valuable time (Welsch, 2010). The beginning of a crisis lies a long time before the illiquidity - in this book, “Modernes Sanierungsmanagement”, Crone & Werner (2012) describe six types of crisis: stakeholder, strategy, product, success, liquidity crisis and, finally, insolvency.

Bedenik et al. (2012) add that the global economic crisis should motivate companies to use operational early warning systems as well as strategic, which according to Ansoff (1976) means that when a threat/opportunity first appears on the horizon, we must be prepared for very vague information, which will progressively develop and improve with time.

4.1.6 Qualitative and Quantitative

Some signals, such as "weak signals" or "shadows" are usually measurable qualitatively by the news, observation of events, people, organizations, regulations or case laws (Kunze, 2000). Trustorff (2012) claims that strategic risk,

in contrast to operational risk, in terms of liquidity and success impact, can not be measured and evaluated quantitatively. He says that the success potential doesn`t belong to any stochastic regulation and only mathematically modellable in accordance with the current state of research. Wiedmann (1984) adds that it is important not only to look at quantitative but also qualitative aspects, which demands holistic thinking. Furthermore, strategic risks, due to the high degree of uncertainty, are difficult to quantify or calculate (Trustorff, 2012).

These highlighted points demonstrate that it is not enough to look only at financial statements and financial ratios, because the management capabilities, environment, human resources, ownership, and other qualitative factors are also important for preventing failure (Kurschus et al., 2015). The combined set of qualitative and quantitative factors allows identification of the real situation in the company with regard not only to the financial statements but also to a wide variety of factors related to company's management capabilities, competencies of human resources, possible impact of internal and external environmental factors and other important non-quantitative aspects, by supporting the company with crisis identification (Kurschus et al., 2015).

“The ideal way forward for a successful handling of risk is a holistic approach, i.e. an integrated approach taking all types of risk and their interactions into account” (McNeil et al., 2015, p. 5). Several authors point out the need for a more holistic approach including quantitative and qualitative factors (Bedenik et al., 2012; Kurschus et al., 2015; Purvinis et al., 2005). The aim of this work, to develop an approach that entails an optimum consideration of both quantitative and qualitative factors, is to assist the management. A successful leader has to know the company processes, constantly develop new goals, innovate, make sure that the organization is still true to its core values, and continue to nurture a culture that fosters continual learning (Frontiera & Leidl, 2012). To have the possibility of overseeing the whole area he has to have an appropriate management system.

4.1.7 Responsibility of CEO

Monitoring is not a backroom function but instead an active process involving managers at all levels who share an awareness of the risks that the organization

faces by providing them with necessary organizational flexibility (Bedenik et al., 2012). Brühwiler (2001) adds that the CEO is responsible for the risk management, which is the first step in any process or, to be precise, a management process. According to COSO II, the management has the responsibility for identifying all external and internal risks which could have an effect on the strategy or company aim (Hillebrand, 2005).

Consistent with past studies, in his study, Abebe (2012) defines environmental scanning as "the managerial activity of learning about events and trends in the organization's environment". An EWS enables management to avoid the possible crisis, as with the growth of uncertainty the gap between needed and available time for business decision-making increases (Bedenik et al., 2012).

“The purpose of the early warning systems is to indicate all the possible changes in the earliest crisis phase, in order for management to have enough time to consider reactive activities and to provide the largest possible number of measures available for countering the crisis, which increases the manager’s sensitivity to changes” (Bedenik et al., 2012, p. 675). Pedler & Abbott (2013) describe the connecting of feelings and lived experience with awareness of our ‘theory-in-use’ as ‘thinking on one’s feet’ by reflection-in-action that builds new understandings which inform our actions in evolving situations. "This provides a basis for future action and generates new or modified ideas in the process" (Reynolds, 1998, p. 186).

In particular, Schön (1983) describes learning in and from work experience, where practitioners reflect on their knowing-in-practice. This develops skills or broader notions of competence (Reynolds, 1998). "A practitioner may reflect on the feeling for a situation which has led him to adopt a particular course of action, on the way he has framed the problem he is trying to solve, or on the role he has constructed for himself within a larger institutional context" (Schön, 1983, p. 62).

However, by looking for a solution to a problem a practitioner has to stop and think – to step back and reflect thoughtfully on his experience (Gosling & Mintzberg, 2003). Schön (1983) adds that they seek to understand the situation and change it. “This activity contains the famous planning tool Force Field Analysis and is credited to Kurt Lewin, whose ‘field theory' described a field of

forces or pressures acting on any particular event. From this point of view, all situations can be seen as being in temporary equilibrium, with the forces acting to change the situation being balanced by the forces acting to resist change" (Pedler et al., 2013, p. 130). Revans (1966) explains it in a very simple way by the possibility of change for everybody after recognizing its necessity. Kurt Lewin describes the change process in 3 phases, shown below,

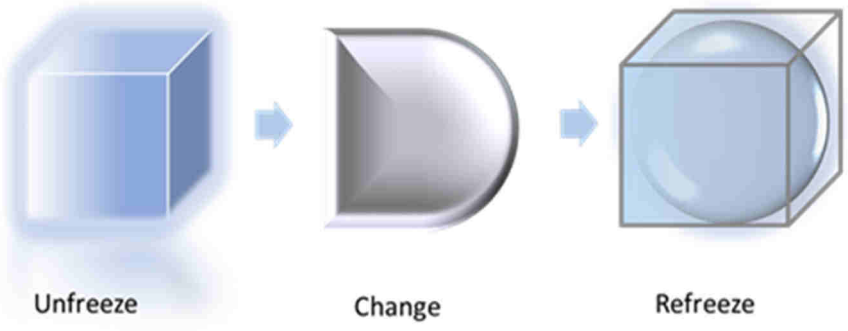

Figure 23 Kurt Lewin's Change Model

Source: McAteer (2014)

where “the **first phase** of change is identified as unfreezing our normal or “current state”, the **second phase** is changing, in which we begin our transition to a new state of normal and the **final stage** we refreeze our new pattern and establish a new mindset and a new normal" (McAteer, 2014).

Schön (1983) describes the reflection process as surfacing, testing and evaluating intuitive understandings which are intrinsic to experience, where the person is engaging in reflective conversation with the situation. Far-sighted corporate management requires early information so that the company's management has a larger field of action for crisis-prevention or opportunity tackling (Jacob, 1986). The CEO has to set up appropriate reporting obligations for the responsible divisions, which include all major risks and elements of risk management and amendments thereto (Schmidt, 2015). "What is even more important is that, in addition to developing such measures, they be a part of the

reports that reach top management so that awareness is created at the highest level" (Gopinath, 2005, p. 26).

"In the SME sector, the company's crisis identification is specific because of the nature of SME business management which creates the strong dependability of business results on human resources and environmental factors" (Kurschus et al., 2015, p. 152). Furthermore, the information search and information processing expenditure is enormous, so that it is not manageable for SMEs for the reason of lack of sufficient technological and human resources, in comparison to big companies, to overview the whole area (Schlüter, 2004). The management has to start with the company policy and strategic plan, reducing complexity, so that the exploration of information could be found close to the symptoms, without an endless search for alternative problems (Kelders, 1996).

4.1.8 Reasons and Symptoms

For the identification of risks the use of early warning indicators, which are branch-, or company-, specific with the employees being sensitized to the critical handling of recognized changes in the company and environment, is appropriate (Ruderer, 2009). Early warning indicators can be considered as diagnostic signs for detection of hidden events, which could be various kinds of positive and negative trends or developments in the environment (Rothwell, 2010).

Krystek et al. (2007) explain that early warning indicators have to fulfill some demand and demonstrate the following attributes: singularity, completeness, timely availability of information and economic justification. "These are the measures which, after surpassing certain previously set boundaries indicate the occurrence of change and development of new trend; they represent signals of possible upcoming crisis, but cannot predict the magnitude and time of indicator materialization and impact on the firm" (Bedenik et al., 2012). Töpfer (1999) explains it in more detail where he structures the early warning indicators in three stages: early recognition, early awareness, and early warning.

In previous research it was shown that the most frequent use is still for operational early warning indicators, focusing on profit margin and firm liquidity level, while

competitor and branch analysis, as strategic early warning instruments, are neglected (Bedenik et al., 2012). “The financial statements of a small company might show stable performance, but the change of some environmental factor might force significant changes in the company’s finances” (Kurschus et al., 2015, p. 154).

The concept of strategic early warning systems can be seen as rooted in Ansoff’s (1976) concept of weak signals, which are inadequately defined and vaguely structured pieces of information, which forewarn of the occurrence of strategic discontinuities (e. g. changes of trend). “The concept of weak signals is based on the assumption that discontinuities in technological, economic, social and political environment do not appear at random, neither are they unpredictable, but rather that they can be spotted by means of weak signals, since such discontinuities are set in motion by people and their interests” (Bedenik et al., 2012).

Allenspach (2006) defines risk as the possibility, which in the context of goal achievement processes – due to success factors such as interference processes – affects the result of the underlying expectations. The success factors of a company, as shown by Crönetz et al. (2009), consist of market, company background/identity, continuous improvement, resource, structure, processes, competence, aims, and strategy, which have to be monitored. Bedenik et al. (2012) conclude that early warning indicators constitute a critical business success factor and companies will be more successful if they use them. Early warning indicators are therefore quantitative and qualitative auxiliary values, supporting a company by identifying risks and possibilities at an early stage before they become apparent (Töpfer, 2000). Kirschkamp (2007, p. 13) states, "A holistic view is used where all relevant factors and their interdependencies have to be identified and dealt with".

However, an appropriate way of dealing with them is an additional level of consideration, known as Critical Reflection, and is used to identify good practice through a deeper and more intense probing into practice and by challenging practitioners to emancipate themselves from restrictive views and to provoke direct action (Pedler & Abbott, 2013). Reynolds (1998), in particular, thinks that Critical Reflection is the cornerstone of emancipatory approaches to education

and practice, being a radical pedagogy for the examination of social and political processes, involving an analysis of power and control within the task or problem.

Rigg & Trehan (2008) describe Critical Reflection as a process by which adults identify the assumptions governing their actions, locate the historical and cultural origins of the assumptions, question the meaning of the assumptions, and develop alternative ways of acting, which may also include new understandings brought about by becoming conscious of their social, political, professional, economic, and ethical assumptions. Sambrook & Stewart (2000) add four activities, central to Critical Reflection: the assumption of analysis, contextual awareness, imaginative speculation, and reflective skepticism.

Pedler & Abbott (2013) give an overview of three levels of reflection: Effective Practice, which can be described as technical reflection based on the expert knowledge of the practitioner; Reflective Practice, where ideas develop through personal experience to create 'hindsight' by reflection-on-action, which is carried out after the event or by building new understandings that inform our actions in evolving situations by reflection-in-action; and Critical Reflection, which is characterised by a deeper and more intensive probing into practice as shown in the following table:

	Initial stage: Effective Practice (Technical Reflection)	Development stage: Reflective practice	Critical stage: Critical reflection
Knowing	The theory of action learning advising…	The theory in relation to my practice	The theory in relation to new possibilities for emancipation
Doing	Imitating other action learning advisers	Questioning the rules and methods of action learning	Questioning self and the ends and purposes of action learning
Being	… In relation to me as expert practitioner	… In relation to me as reflective practitioner	… In relation to me as emancipatory practitioner

Table 8 Reflecting on Knowing, Doing and Being

Source: Pedler & Abbott (2013)

In a practitioner's reflective conversation, where he is a part of it, he acts as an agent or experiment by including his own contribution, which may foil his projects and reveal new ideas (Schön, 1983). Gosling & Mintzberg (2003) put the 'self' as a subject for reflection, where, through the process of change, action pulls together relationships, organization, self and context. The basis is that analysis, intervention, organization theory and intervention theory combine together (Cremer, 1980).

"Intervention produces practical improvements" (Huang, 2010, p. 100). There can be no insight without self-knowledge. "Through the unintended effects of action, the situation talks back – the practitioner, reflecting on this back-talk, may find new meanings in the situation which lead him to a new reframing" (Schön, 1983, p. 135). At the end, it is not only the absence of an EWS which causes a corporate crisis but also its unsuitable integration into the company (Berndt, 2011).

4.1.9 Integration of EWS

Ruderer (2009) assigns the EWS to the risk identification process phase and also includes the risk handling process for the reason that after prediction and clarification activity it also initiates the counteraction by the decision makers. Crönetz et al. (2009) state that the EWS is the original form of risk identification. The phase of risk identification includes the collection of actual and future (potential and latent) risks, which is the most important step during risk management, where the result of this stage is essential for all following steps (Krystek & Fiege, 2015). Breitkreuz & Lange (2011), in contrast, say that EWS is a main tool of crisis management. EWS is a "Before Fact Approach", and crisis management is an "After Fact Approach" (Wiedmann, 1984). Crönetz et al. (2009) add that EWS works as a preventive in crisis avoidance and crisis management serves to overcome an already existing crisis. Krystek (2015) explains it in more detail where he names the avoidance of crisis as Active Crisis Management, subdivided into Accrual and Preventive Crisis Management, and the Handling of Crisis as Reactive Crisis Management, which is subdivided into Repulsive and Liquidative Crisis Management – as already discussed in Chapter 2.3.

The main point here is to identify the right problem, the variety of the recommendations for measurements can follow afterwards (Crönetz et al., 2009). Following the main problems by the establishment of an EWS, where the determination of them as critical for the countable monitoring area as well as the definition of the early warning indicators are huge challenges (Ruderer, 2009).

"Board members, CEOs, and divisional directors are the main users of early warning systems, while the lack of experts for gathering and analysis of indicators, as well as the absence of management initiatives, are the crucial reasons for deficiency in early warning systems implementation" (Bedenik et al., 2012, p. 672). EWS plays an important role for company risk management and by the integration and sensitization of employees in the critical handling process to the recognition of internal and external changes, provides a huge contribution to the establishment of a risk culture (Ruderer, 2009).

However, the literature discusses different approaches for the integration of EWS, where the authors described it variously as a part of Risk Management, Crisis Management, Compliance System (Laue & Kunz, 2014), Controlling System or as standalone (Meier, 2007), etc. This work is based on the recommendations of the ISO 31000 (combination of subsystems) and relies on the CO and QM system, which focus on the Committee of Sponsoring Organizations of the Treadway Commission (COSO) II principles I and II. According to the description of Inderst et al. (2013) the term "risk identification" will be used in this work as having the same meaning as EWS. COSO is a valid worldwide framework for internal control and appropriate for improving corporate governance in Germany (Löw, 2008). According to the "Business Judgement Rule" the General Manager and the Board of Directors have to furnish proof that, at the time of making a decision which brought the risk for business, they had a basis of appropriate information (Inderst et al., 2013). The principles I and II of COSO II are to identify all possible occurrences, without risk evaluation, which could have a positive or negative effect on the execution of strategy or achievement of objectives (Hillebrand, 2005). The risk identification should include all risks which need to be considered during the decision-making process by the management (Schmidt, 2015). It has to sample all possible information about known and unknown risks and to summarize them (Altenähr et al., 2009).

Rocha-Lona et al. (2013) recommend during the selection criteria process not only to evaluate whether the selected tools are needed, but also whether the SMEs have the required resources and capabilities for the implementation. The information search process of a company has to be realistic, clear and simple (Kelders, 1996). Also Donnersmarck & Schatz (1999) state that it is important to focus on organizational, communicative and human aspects and to avoid strong hierarchical structure.

However, an EWS has to predict the future of a company's relevant variables

- as early as possible
- as accurately as possible
- as comprehensibly as possible

and the employees are to be sensitized to the critical handling of the recognition of changes in their area (Gleißner & Meier, 2001). Practice means working with other people in sets and including one's personal reflective practice (Pedler & Abbott, 2013). Weick et al. (2005) narrow it down further by stating that Practice is equated with doing, concreteness, understanding, know-how, and wholes as opposed to Theory which is equated with thinking, explanation, knowing, and dissection into parts.

It is important to have a common understanding of risk management and the tools and processes, which describe and control the risks (Brühwiler, 2003). He adds that the understanding of risk management begins with the recognition that the most of the risks are "home made" by human characteristics, which could be, for example, the wrong estimation of future development or missed monitoring of exposed tasks, or of being too ambitious or too self-confident (Brühwiler, 2003). In the end, the adoption of a management system has to be a strategic decision for an organisation to help to improve its overall performance and provide a sound basis for sustainable development initiatives, where the design and implementation will be influenced by its varying needs, objectives, products provided, processes employed and the size and structure of that organisation (Tricker, 2014).

4.2 Semi-structured Interview

In addition to the requirements listed above, for the practicable development of the final EWS, the requirements of the interviewees should also be considered. These requirements were worked out during the interviews. The points described in the following requirements for a practical EWS arise from this.

The following main requirements for an EWS in the Food Production Industry were given by the Turnaround Consultants, Lecturers and Interim Managers (Interview answers from Phase I):

4.2.1 Early Warning Systems - a topic in this day and age

The Literature Review states that companies today have to identify risks which were scarcely considered in the past (Janßen & Riediger, 2015). *The second interviewee pointed out that the (working) world is becoming increasingly complex: inconstant, uncertain, ambiguous and a complex environment and the only way to respond to such developments in good time, without trying to dominate the uncertainty, is to recognize risks in a timely fashion and prevent them at an early stage.* This is in line with the literature, where Janßen & Riediger (2015) state that due to globalization, companies are much more affiliated with each other (the number of multinational companies has increased in the last 50 years from 7,000 to 104,000; it is estimated that it will reach 140,000 by 2020) and increase the complexity of risk. However, the aim of an EWS is to identify risks in real time and give the company enough time to deal with them (Löhneysen, 1982).

The third participant added that EWSs help to detect crises and counter them in order to control early on, which increases the possibility of protecting assets and, in the end, of securing jobs. Löhneysen (1982) describes the EWS as an information system designed to warn companies when problems arise where companies have to initiate counteractions (Götze & Mikus, 2000). *The first participant summed up with the statement that they have to meet the requirements of risk management and help to connect to the future through information sampling. The mentioned connection to the future equates to those identified in the literature review by* Bedenik et al. (2012, p. 672) that “Indicators and EWSs are becoming more important as they can predict possible future changes in their early stages and thereby reduce the time needed to make adequate decisions”. However, it should be re-emphasised that the theory also identifies methods within the EWS, such as Business Ratios, which are only past-, or present-, based and also the classic Bookkeeping which includes the disadvantage of time lag.

All interviewees confirmed that EWSs are definitely an important topic in the Food Production Industry. They state that it helps to prevent large-scale disease by the improvement of information on, and thus prevention of, health hazards that are

causally attributed to food consumption. Bedenik et al. (2012, p. 672) conclude that "The role of early warning systems as an instrument for crisis aversion is in: revealing weak signals, transferring important information about environmental changes, prevention of business crisis, and constructing a creative base for timely and appropriate response". It makes it possible for the company to gain valuable time for an adequate reaction to imminent dangers, using all possible measures (Ruderer, 2009). *The third participant stated that to be able, in both a timely and complete way, to protect the health of consumers, the company has to get warnings on prominent food and possibly product recalls of dangerous food and animal feed.* The theory confirms this view by the description that an EWS is an important tool for risk identification, where it informs the user in time about latent (invisible but available) risks, which optimizes control of the company (Romeike & Hager, 2013).

4.2.2 Requirements which an EWS in the Food Production Industry has to fulfill

All participants pointed out that EWSs should be holistic (strategic and operational) and practicable – so not too complex! The literature review explains this in more detail and warns, Trustorff (2012), about the examination of operative and strategic risks regarding independent reference parameters (potential for success versus operational success), time horizon (long-term versus short-term) and target dimension (strategic versus operational). In the long term, the threats of potential success will affect the success and the liquidity situation of the company by wrong strategic decisions or changes in the company environment going unremarked. Conversely, denoting a high operational risk potential produces a considerable restriction of the scope of action for handling strategic risks. *The first interviewee stated that it is not enough to collect pure economic figures.* Also Kurschus et al. (2015) state that it is not enough to look only at financial statements and financial ratios, because the management capabilities, environment, human resources, ownership, and other qualitative factors are also important for preventing failure. Trustorff (2012) claims that strategic risk, in contrast to operational risk, in terms of liquidity and success impact, can not be measured and evaluated quantitatively. He says that the success potential

doesn`t belong to any stochastic regulation and is only mathematically modellable in accordance with the current state of research. The combined set of qualitative and quantitative factors allows identification of the real situation in the company with regard not only to the financial statements but also to a wide variety of factors related to company's management capabilities, competencies of human resources, possible impact of internal and external environmental factors and other important non-quantitative aspects, by supporting the company using crisis identification (Kurschus et al., 2015).

The interviewee added that companies need market information – "if I do not every day check the direction in which the values go, I have a problem relatively quickly". All participants revealed that they need business numbers, production figures and the forecast of changes that can be expected in their industry in the future. The literature review explains it in more detail by describing the design as a system, which should include people, plants and the combination of people and plants for a specific relationship (Löhneysen, 1982). These elements record data, stimuli, impulse, signals and information about a specific situation or development by analyzing them, measuring the probability of their occurrences and determining the strength of their effect on the company (Hahn, 1979). *The first interviewee indicated that they have to bring in the information that is important for their business to the manager every day.* According to the theory the information about risk coming from different sources should be combined to form a holistic system (Brühwiler, 2001). "The ideal way forward for successful handling of risk is a holistic approach, i.e. an integrated approach taking all types of risk and their interactions into account" (McNeil et al., 2015, p. 5).

All participants summed up with the statement that a Comprehensive Early Warning System consists of three areas: strategy, performance, and operational, financial, economic area. They should include quantitative (hard) and qualitative (soft) factors, which have to be future-oriented. Wiedemann (1984) adds that it is important not only to look at quantitative but also qualitative aspects, which demands holistic thinking. Furthermore, strategic risks, due to the high degree of uncertainty, are difficult to quantify or calculate (Trustorff, 2012). Some signals, such as "weak signals" or "shadows" are usually measurable qualitatively by the

news, observation of events, people, organizations, regulations or case laws (Kunze, 2000).

4.2.3 Business areas which an EWS should be able to cover

The first interviewee stated that Early Warning Systems should have an integrated financial Controlling system so that the interaction between strategic and operational corporate management can be monitored and evaluated interactively. This is in line with the results of the literature on curtailment of the time lag by Controlling (Meier, 2007 or Hauschildt & Leker, 2000) and in line with the central rationale of this work to develop a holistic approach.

The second participant, in contrast, stated that the internal and external risks for all business processes and relevant support processes must be taken into account. Also, the literature review states through Löhneysen (1982) that an EWS should identify both internal and external dangers at an early stage. The first research work about “environmental analysis” came from Aguilar in 1967, where he constitutes the need for external review and monitoring by dividing company environment into the following subsystems:

- Economic terms
- Technological terms
- Politico-legal terms
- Socio-cultural terms
- Physical-ecological terms (Kunze, 2000).

The company has to fix the external and internal area of monitoring and, for each area, there should be developed an indicator that sends a signal every time access changes (Hauser, 1989). Löhneysen (1982) states that an EWS should identify both internal and external dangers at an early stage. The operative EWSs are based on KPIs relating to past performance, and the strategic EWSs predict the future development of market, competitors, and company by supplementing each other (Berndt, et al., 2011).

The third interviewee added that the Financial Economic Area, liquidity sizes, centralized Profit & Loss sizes, working capital - no area can be outsourced. All participants confirmed that all business areas have to be monitored. The manager should be aware which information is necessary, where the sources are for this information and which methods can provide this information (Mischon, 1982). *The second interviewee pointed out that the necessary risk indicators must be identified, properly selected and analyzed and evaluated iteratively*. *The third interviewee added that it must first be created and later observed, what is important for the company, for each sector, and this is of paramount importance. The second summed up by saying that the whole thing will need effective and efficient communication to internal and external areas.* The literature review confirms this view in Ruderer (2009) that a modern EWS does not only predict as early as possible the future development but is also an entry point for critical discussion of cause and effect relationships, where the employees have continuously to deal with changes occurring in the company environment.

4.2.4 Priority which an EWS should have in a company

The second interviewee indicated that an EWS should hold an independent position in a company, where neutral analysis and assessment is possible. The second participant, in contrast, stated that it should be a top management information system – monitored by management. This generally corresponds to the literature review in Bedenik et al. (2012) that monitoring is not a backroom function but instead an active process involving managers at all levels who share an awareness of the risks that the organization faces by providing them with necessary organizational flexibility.

The second interviewee gave an example of Employee Fluctuation, which is an important parameter and is not anchored directly in the financial management area originally, but in the power economic sector in human resources. He stated that this could consider a million things and then be configured accordingly. Also, literature review states in Brühwiler (2001) that the information about risk coming from different sources should be combined to form a holistic system. *All interviewees summed up with the statement that in the end, the CEO must have*

a Management Cockpit, which shows him what happens daily and where the bottlenecks are, and where he has to intervene or respond. This is in line with the results of the literature review, where “Some companies have developed a panel of early warning indicators, sometimes referred to as a risk dashboard, to track movement in selected areas that are crucial to the company`s well-being” (Hampton, 2009, p. 63). This is in line with the work of Frontiera & Leidl, (2012) in which they describe the need for a successful leader to have an appropriate management system in order to be able oversee all necessary areas.

4.2.5 Stakeholders by whom it should be agreed

All interviewees stated that EWSs should be designed for internal and external stakeholders with different reports, ideally based on central systems. This is in line with the literature review, that early warning system has to fulfill some demand (Krystek et al., 2007). *They added that the processes could possibly be extended to external suppliers and their value-added processes; other risks, barriers to trade or from natural disasters should be checked and adapted if necessary.* This is even though, according to the theory, the external information gap about markets, competitiors, economic cycle and law, is still big in SMEs, which is a latent danger for decision-making.

All participants stated that the data should be prepared in accordance with demand, especially in small businesses. In general, this corresponds with the literature review that the information search and information processing expenditure is enormous, so that it is not manageable for SMEs because of lack of sufficient technological and human resources, in comparison to big companies, to overview the whole area (Schlüter, 2004). *The third participant added that top management is interested in liquidity figures; the Production Manager is interested in machine runtimes OEE (Overall Equipment Effectiveness). He indicated additionally that timely data delivery also creates transparency and trust towards shareholders or lenders.* Gleißner & Meier (2001) state that an EWS has to predict the future of a company`s relevant variables as early as possible, as accurately as possible, as comprehensibly as possible and that employees are to be sensitized to the critical handling of the recognition of changes in their area.

4.2.6 Software appropriate for an EWS

All participants confirmed that standard tools or software à la SAP for SMEs is not known - there are mostly self-made solutions. This generally corresponds to the literature review, that the recommendation is, in general, to use the Office applications (Ruderer, 2009), such as Excel, Visio, etc., as no EWS software, appropriate for SMEs, exists.

4.2.7 Persons who are responsible for the appropriateness of the EWS

All interviewees agreed that the responsibility for the suitability of an EWS is definitely a management matter and is to be established accordingly at the highest decision-making and control level. This is in line with the literature review that the CEO is responsible for the risk management, which is the first step in any process or, to be precise, a management process (Brühwiler, 2001). *They stated that it is important to understand that the property, resource, communication-oriented and timely handling of the relevant risks only work if the roles and responsibilities are clearly defined and are embedded in the organizational structures of the company.* This generally corresponds to the literature review that the CEO has to set up appropriate reporting obligations for the responsible divisions, which include all major risks and elements of risk management and amendments thereto (Schmidt, 2015).

All participants indicated that it must be initiated top-down, and thus the responsibility lies somewhere in the management. The third interviewee commented that it could be located at the "Head of Controlling" but that the commitment should come from the management. What is even more important is that, in addition to developing such measures, they be a part of the reports that reach top management so that awareness is created at the highest level" (Kurschus et al., 2015). *The first interviewee, in contrast, stated that it could be a range, depending on CEO, CFO, IT and which one has the experience, to select and create a list of requirements under normal circumstances, where the company has to decide what it wants to achieve, what needs should be included, how flexible and transparent it needs to be, and how safe it must be afterwards.* This is in line with the literature review, where it states that the adoption of a

management system has to be a strategic decision for an organisation that can help to improve its overall performance and provide a sound basis for sustainable development initiatives, where the design and implementation will be influenced by its varying needs, objectives, products provided, processes employed and the size and structure of that organisation (Tricker, 2014).

The above set of requirements will be used for the development of an EWS approach for SMEs within the food production industry.

5 Phase II: Exploration of CO and QM tools

Based on the findings of the Literature Review and for practicable development of the final EWS approach, with the help of CO and QM experts, best-practice CO and QM tools, appropriate for an EWS within the food production industry, will be explored. This chapter seeks to answer the second research question.

5.1 Literature review

Based on the findings of the Literature Review and for practicable development of the final EWS approach, the resulting CO and QM tools will be used for the EWS-development.

Risk Identification and Monitoring

Before the Risk Identification and Monitoring tools can be defined, their tasks will be defined in detail for complete understanding in order to ensure that a common understanding can be shared across the whole work (Hopkin, 2013). The understanding of this work depends on ISO 31000:2009 explanation, where risk identification is a process of finding, recognizing and describing risks, where risk monitoring is responsible for continual checking, supervising, critically observing or determining the status in order to identify change from the performance level required or expected (ISO, 2009).

5.1.1 Methods for determination of context

The Literature Review gives, as appropriate tools for determination of context, PESTLE, Cross-Impact-Analysis, SWOT-Analysis (Meier, 2007; Hopkin, 2013), which are described below.

PESTLE

The first research work about “environmental analysis” came from Aguilar in 1967, as stated above, with his emphasis on the need for external review. According to the literature review “The common qualitative approach is the

PESTLE analysis named by Stewart & Rogers (2012) as a key tool for environmental scanning, that considers the political, economic, social, technological, legal and ethical (or environmental) risks faced by the organization" (Hopkin, 2013, p. 64). McCabe (2010, p. 57) states that "… the main functions of PESTLE analysis is in the context of 'environmental scanning', an analytical process described as necessary in terms of understanding events and trends in the external environment". Breitkreuz & Lange (2011) add, that the PESTLE analysis is a model which adds to the environmental analysis. Notwithstanding the fact, according to the research from Bedenik et al. (2012), that this tool is not well known in practice, we see a high degree of necessity, as described above, to analyse and to fix the environment of the company, which can be best done by a systematic tool like PESTLE. However, Allenspach (2006) states that it belongs more to the strategic work, where the main and sub-aims will be analyzed. The interaction can be analyzed by CIA (Liebl, 1996).

Cross-Impact-Analysis

"Cross-Impact-Analysis is a method used in forecasting exercises aimed at measuring the correlation between future events (variables)" (Ferretti, 2016). It is a quantitative method, which shows the interdependency within a problem area and creates an understanding of connections (Wirtschaftslexikon, 2016). CIA is in order to identify how developments in one area interact with those in another. It is able to show how one situation impacts another situation (Ferretti, 2016). At this stage it is not clear whether or not this tool is too complex for SMEs. In this context that means that the lack of experts for gathering and analysis, especially relating to maths, as well as the absence of management initiatives, are the crucial reasons for deficiency. The results should be able to predict the future development of market, competitors and their own company's position, which can be afterwards included into a SWOT analysis to understand their own Strengths and Weaknesses and to be ready to grasp the Opportunities and overcome the Threats.

SWOT Analysis

"The SWOT Analysis has the advantage of also being able to consider the rewards available to the organization from the opportunities in the external environment. One of the strengths of the SWOT analysis is that it can be linked to strategic and tactical decisions; a danger is that it is not a structured risk classification system and, therefore, there is a possibility that not all of the significant risks will be identified" (Hopkin, 2013, p. 64). SWOT analysis also includes the non-financial aims and can be used as a qualitative tool (Allenspach, 2006). In summary, it can be said that SWOT can be seen as a matrix, where the relevant results will be summarized, analyzed and used as a basis for further actions. However, after the determination of the organizational context, the company also has to identify sources of risk, areas of impact, and events, by including changes in circumstances and their causes, as well as their potential consequences and then adjust their strategic plan accordingly (Hauff, 2010).

5.1.2 Methods for risk identification

The phase of risk identification includes the collection of actual and future (potential and latent) risks, which is the most important step during risk management (Krystek & Fiege, 2015). The literature describes Brainstorming, Brainwriting, Portfolio-Analysis, Delphi-Method, Scenario, Diffusion theory, FMEA (Meier, 2007), Altenähr et al. (2009) add Fault Tree Analysis and SWOT analysis as appropriate common tools for risk identification. Krystek (1987) states that planning is also a tool which helps to identify risks. Allenspach (2006) in contrast, differentiates between collection methods (Interview, Questionnaire) as “identification of already existing risks” and “detection methods” (Fault Tree Analysis, Brainstorming, Brainwriting, Delphi-Method, Joined-up Thinking, Network Analysis) as identification of future and not yet known risk potentials. According to the literature review, the risk identification phase begins with the collection of information where, from the collected information, specific diffusions or behavior patterns can be found by mathematical and statistical methods and so prognoses can be made.

Diffusion Theory

Diffusion Theory describes that on one hand the concreteness of the information increases with time and, on the other, the time for counteractions decreases. This is described in the literature as a complex area with a diversity of different risk areas. Due to uncertainties regarding existing paradigms and invariants of diffusion backing (Innovation setting) the implementation of change is possible. The diffusion theory includes empirically more or less secure legalities for the dissemination of events, ideas, innovations. The contagion effects in the spread of new forms of behavior are the focus of diffusion research, whose results are shown in structural curves (diffusion functions). They interpret distribution patterns derived from empirical studies (Krystek & Müller-Stewens, 1993). The detection of diffusion patterns is divided into three different types of infection. Either by infection of a constant percentage of uninfected persons per unit of time or by exponential infection, the new ideas are transmitted from subject to subject. Also, combinations of constant and exponential running expansions can be observed (Hammer, 1998). The benefit of the practical application of diffusion functions as an early Enlightenment concept is found over time, which leads to a better adjustment to changes in the business environment. It is possible to set limits on trend reactions earlier and to make better decisions and greatly reduce risk, especially in long-term investment projects. Trend lines, which are adapted to the situation, representing the designed diffusion functions, are based on several considerations.

Trend Landscape

One of the well-known instruments for early detection is the generation of trend landscapes. This is especially helpful in relation to the processing of the information obtained through scanning and monitoring. Herein, the development of discovered individual trends should be checked for correlations and thematically combined or aggregated to rectifiable trends (Schlüter, 2004). This combination of trends to form trend landscapes has several advantages as a result: the cognitive load can be manageable (Neubauer & Solomon, 1977); the flood of information leads quickly to clarifying failure (Wilensky, 1967); and

system relationships can be far better diagnosed in such sufficiently demarcated analysis units (Liebl, 1996). Based on the prognosis results, appropriate scenarios can be built (Hauff, 2010).

Scenario Analysis / Technique

Scenarios are not, however some leaderships may wish for it, a magic crystal ball, which exactly predicts the future, but they help systematically to observe the future and to recognize all conceivable long-term changes during the company-environment to recognize. Scenario Analysis demonstrates alternative situations and assists in the decision-making process (Nagel et al., 2013). It is an EWS appropriate for the identification of strategic business units at risk (Kötzle, 1993). Reimer & Fiege (2009) add that Scenario Technique is one of the most significant tools for strategic management and strategic controlling. The aim of this method is to explore the future developments and possible solutions, wherein incorrect planning can be identified through five steps (Nagel et al., 2013). In the first phase, the examined field is structured and the time horizon defined (Reimer & Fiege, 2009). The second phase identifies and examines the areas of influence of the examined field with the appropriate key factors, followed by the selection of the scenario and projection of the current situation onto the desired planning horizon (Nagel et al., 2013). During the fourth phase, the scenario is elaborated, which could be done by sensitivity analysis (Reimer & Fiege, 2009). The last phase, also known as scenario-transfer, deals with the establishment of acceptance packages and deduction of practical consequences (Nagel et al., 2013). Basically, Scenario Analysis is open to a lot of qualitative and quantitative techniques, which were approved in practice, such as morphological matrix or relevance tree analysis for problem structuring, survey and Delphi method for data generation, brainstorming and checklists for idea findings method or cross-impact-analysis and trend extrapolation for forecasting (Kötzle, 1993). In addition, an existing portfolio analysis is well suited to represent the actual situation of the company in comparison with the competition.

Portfolio Analysis

Portfolio Analysis of Boston Consulting Group is a systematic evaluation of company`s business units or their product lines by the two variables of Market Share and Market Growth based on the product life cycle. Depending on Growth and Share, the graph shows Stars, Question Marks, Cash Cows and Poor Dogs (Fiedler, 2001). It is questionable whether tools such as Portfolio Analysis, which, at the beginning of 20th century, were important for the analysis of the right position in the market for the company, are still workable. However, Nagel et al. (2013) state that the portfolio analysis is based upon the life cycle of products and services, where all products pass through different phases by showing the company if the product/service is balanced. As the analysis horizon, a specified period will be taken, one which is needed by the company for the development of an innovation, the necessary time for acquisition and its launch on the market and also the period for a realization of the investment projects and diversification (Reibnitz, 1992).

Planning

Planning helps, with the use of known planning techniques, in the development of strategic treatment alternatives for the handling of imminent change (Hauff, 2010). Krystek (1987) adds that planning helps to rethink, in advance, all possible events/developments with crisis potential in order to react fast when a crisis occurs. At this point the question arises whether nowadays, when the world is becoming more and more dynamic, especially the planning, which relates to the inflexible tool, is still appropriate -and how it should give the company orientation and stability? This question should not encourage the companies to avoid planning, but rather to make them aware of the developments and take them into consideration. However, according to the Literature Review some concepts such as the Concept of Battelle Institute (1978) uses planning as a comparison between the premises of the strategic planning and the sign-specific scenario results. The statement derived from the sign-specified scenario is compared with the strategic planning, and only if there is sufficient deviation between the premises of the strategic planning and the scenario results, the next step will

follow (Hauff, 2010). Also the Concept of Hammer (1998) indicates that the potential impact will be predicted by different created scenarios and by a comparison drawn with the principles of strategic planning. When planning, the organization should consider the issues and determine the risks and opportunities to avoid undesirable effects (Ohligschläger & Below, 2015). “A plan prepared to take advantage of, or to minimize the effect of an event which is considered to be unlikely to occur but, if it did, would have a considerable impact on the organization's ability to achieve the objective” (Krystek, 1987, p. 132). There are many ways in which risk can be defined and/or described, but it is important that sufficient information is collected about each risk, which will be stored and/or recorded (Brühwiler, 2003).

FMEA

Failure modes and effects analysis (FMEA), also known as failure modes, effects, and criticality analysis, is used to identify ways a process or product can fail to meet critical customer requirements (Foster, 2013). It is used to determine high-risk functions or product features based on the impact of a failure, where it systematically considers each component of a system: identifying, analyzing, and documenting the possible failure modes within a system and the effects of each failure on the system (Pyzdek & Keller, 2013).

Brühwiler (2003, p. 48) explains it in more detail: “This standard establishes requirements and procedures for performing a failure mode, effects, and criticality analysis (FMECA) to systematically evaluate and document by item failure mode analysis, the potential impact of each functional or hardware failure on mission success, personnel and system safety, system performance, maintainability, and maintenance requirements. Each potential failure is ranked by the severity of its effect so that appropriate corrective actions may be taken to eliminate or control the high-risk items". Ruderer (2009) adds that the FMEA concentrates more on the effect of the failure than the cause, where the aim is to avoid the potential failure during the development of a product or establishment of a process, which means it is also an appropriate tool for the food production industry.

FMEA is a preventative model, wherein it is important to recognize the failure as early as possible (Romeike & Hager, 2013). FMEA uses a nine-step process (Wilensky, 1967):

1) Assign an identifier to each component
2) List functions for each part
3) List one or two failure modes for each function
4) Describe effects of each failure mode
5) Determine hazard likelihood and categorize
6) Estimate likelihood of failure
7) Estimate failure detection
8) Identify highest risks
9) Eliminate or reduce highest risks (Foster, 2013).

The main problem during the risk management process is that risks which are not recognized, can also not be analyzed and managed. Ellenbürger et al. (2009) recommend combining the tools according to the risk profile for maximized completeness of risk identification. Schmitz (2006) states that especially the FMEA and HACCP in combination for the food production industry have a wide range of method steps to build up self-control systems for risk control and risk monitoring, which should be analyzed individually for each company. In practice some companies develop a HACCP analysis, which is afterwards systematically evaluated by FMEA.

HACCP

“Hazard Analysis and Critical Control Point (HACCP) has been recognized internationally as a logical tool used in the food industry to identify potential food safety hazards so that preventive actions can be taken to mitigate the potential risks. The system continues to be used at all stages of the food supply chain” (Reuvid, 2013, p. 151). Petersen & Nüssel (2013) describe HACCP as a QM method which consists of the following seven principles:

- Procedure of Hazard Analysis
- Determination of Critical Control Points
- Determination of Critical Limits
- Monitoring of Critical Control Points
- Determination of Corrective Actions
- Verification of the HACCP system
- Documentation

Ruderer (2009) adds that HACCP is an important tool in the food production industry for a systematic risk identification. Romeike & Hager (2013) go a step further and state that HACCP is a method which aims to save the food production industry and at the end to protect the consumer. However, risk identification should include an examination of the knock-on effects of particular consequences, including cascade and cumulative effects, where it has to sample all possible information about known and unknown risks and to summarize those (Altenähr et al., 2009). It should also identify what might happen, where it is necessary to consider all possible causes and scenarios that show what consequences can occur (Schmidt, 2015).

Fault Tree Analysis

The Fault Tree Analysis (FTA) is a top-down, deductive failure analysis, which analyses all possible reasons of one undesired deviation (top event), which by interrelation cause the disruption (Ruderer, 2009). Allenspach (2006) states that the FTA has the advantage that it also considers ‘soft facts', such as technology, people, etc. Ruderer (2009) adds that deviation from qualitative to quantitative is also possible in this method. Brühwiler (2003), in contrast, states that FTA is a quantitative tool, which calculates the probability of the occurrence of complex scenarios when the connection of the event is known. He adds that this method traces an event back to its root in order to find reasons. "Fault-tree analysis (FTA) is an analytical tool that graphically renders the combination of faults that lead to failure of a system" (Foster, 2013, p. 202). It is an appropriate tool for reliability

and safety analysis (Marshall, 2012). Foster (2013) adds that the technique is useful for describing and assessing events within a system. Romeike & Hager (2013) go a step further and state that Fault Tree Analysis is an appropriate tool for simulation in which causes will be analyzed with the aim of producing a statement of liability, security, and availability. For verification of the analysis results from FTA, it is also possible to use the Delphi-Method.

Delphi-Method

This is a method of expert survey for creating quantitative forecasts, which has proven itself in the generation of forecast information and assessment of changed constellations and discontinuities. The basic concept refers to the overall better results in the structuring and analyzing of problems by a group of experts compared with individual assumptions (Götze, 1993). The experts estimate anonymously, via standardized questionnaire, future developments both qualitatively and quantitatively. The consensus of opinion ultimately obtained then forms a basis for strategic planning (Koslowski, 1994). In implementing the Delphi method a so-called monitor group that can exist alongside corporate employees, also from consultants or market researchers, is responsible for defining the problem domain, the preparation of questionnaires, the evaluation of results as well as providing additional information (Götze 1994). According to the literature review, in Hammer's (1998) third step there follows verification through objective and reasonable relevance, which is effected by using a so-called discontinuity survey, a so-called survey of experts in terms of their assessment of a specific question. Müller & Zeiser (1980) add that according to this survey, three aims should subsequently be reached: determination of the potential impact of potential changes, determination of the probability for the appearance of these and finally the assessment of the necessity and urgency of reaction strategies. However, the quality of the results depends primarily on the expertise of the respondents with respect to the subject area and method of application. A combination of in-house and external experts prevents operating and industry blindness. Additionally, the organization should establish, implement, maintain and continually improve a management system, including the processes needed and their interactions (DIN EN ISO 9001, 2015). For this tool to be really

appropriate, we must take into account the statement of Kurschus et al. (2015, p.152) that "In the SME sector, the company's crisis identification is specific because of the nature of SME business management, which creates the strong dependability of business results on human resources and environmental factors". In this context, that means, that the lack of experts for gathering and analysis of this signs, as well as the absence of management initiatives, are the crucial reasons for deficiency.

Turtle Diagram

Turtle Diagram is a useful tool for describing, understanding and analyzing processes. It utilizes four legs to represent four questions about a process (with whom, with what, how, how many); and, a head and tail to represent the questions about the process inputs (what should we receive) and the process outputs (what should we deliver to meet expectations); the shell of the turtle is used for the process name (Jaeger, 2016). It sensitizes people to interfaces, shows dependencies, transparency and determines measurements (TÜV, 2013). The gathered data is useful for risk identification and for building the basis of a systematic risk management (Benes & Groh, 2014). The consolidation of all risks from all processes can be used as a basis for a holistic risk management (TÜV, 2013). At the end, it is appropriate to conduct an SWOT Analysis for validation of the process, which will show at the same time the opportunities for improvement (Hallbauer et al., 2015). The systematic analysis of the processes by this tool is obvious, but also the investment of work, which is seldom not a problem in SMEs, as the description of the processes can not only be done as a profile.

Brainstorming

Brainstorming is a method for stimulating creative thinking by collating general and spontaneous ideas of a chosen group of staff members. The aim is to develop as many ideas as possible to ease problem-solving (Nagel et al., 2013). This method has some critical points, which can be found in theory and also in practice, where some work will be done twice within a work group when perhaps it could be done by a single person. This is an important point especially for the

SMEs, which complain about lack of resources and time. However, it is a process with a purpose and/or anticipated outcome that is applied to relatively complex or unstructured ideas. (Watton et al., 2001). A very simple explanation of reflection is expressed by Reynolds (1998) as a key element of problem-solving. Rigg & Trehan (2008, p. 375) link the definition more to practice by explaining the development of the transferable idea, and also by offering the potential for organizational learning and change". It is not dependent on the already-existing theory but establishes a new one by linking thinking with doing, which must later be converted into action (Schön, 1983).

Brainwriting

In this tool, diversity of opinions becomes obvious as each participant writes down their ideas on cards, which are displayed on a pin board. During this method, the participants have on the one hand time to rethink things, but on the other hand the spontaneity goes lost, where vague ideas, in contrast to brainstorming, will not be activated. This has a high degree of effectiveness, as it committed contributions from everyone and attempts to organize and structure possible solutions (Nagel et al., 2013).

To provide both theoretical perspectives and accounts of practice where practitioners reflect directly on their own practice, Pedler & Abbott (2013) recommend ‘Writing’, which is an important part of professional practice by facilitating self-reflection. Watton et al. (2001) explain Reflective Writing in more detail by stating that it provides the opportunity to gain further insights into one’s own work through deeper reflection on experiences, reviewing them with the help of others by discussing issues, and through further consideration of theory.

5.1.3 Methods for risk monitoring and review

Altstetter (2008) describes the last phase of the Risk Management Process after risk identification, analyzing and treatment, as the Monitoring Phase, where all relevant risks have to be monitored and all possible changes in them should be recognized as early as possible. The literature describes the BSC as an

appropriate tool for risk monitoring and review (Wolf, 2010; Brühwiler, 2003; Töpfer 2000; Schröder, 2005).

Balanced Scorecard (BSC)

A balanced scorecard is a strategic tool appropriate for designing the whole planning, monitoring, and control process, which combines the key performance indicators from the past with future value drivers (Allenspach, 2006). Measurable by Company Value = Shareholder, Market, Customer, People, Future Value (Töpfer, 2000). Wolf (2010) describes BSC as CO tool, which is appropriate for Risk Identification. Today's world-environment changes rapidly and at this point criticism could arise, if such a strong analytical process is still manageable for the companies during this short period, by consideration of the relations, as well as interdependencies. However, according to the literature, so far, BSC is appropriate for use as part of an EWS. On the one hand, it has a strategic orientation from the outset, as it is based on the "vision" and "strategy", which are purely qualitative in nature. However, in order to follow this vision and strategy and constantly review it, there is a connection to operational key figures required, which should be determined and developed individually by each company. These are predominantly quantitative in nature.

5.2 Semi-structured Interview

In addition to the tools listed above, for the practical development of the final EWS approach, the tools of the respondents should be considered. These tools were worked out during the interview. Therefore, those described in the following list are particularly relevant for a practical EWS.

5.2.1 Early Warning Systems - a topic of CO and QM

The fifth interviewee stated that CO and QM deliver data which are very important for the decision maker. He added that it enables them to get the information at an early stage, recognize risks on time and prevent them. This is in line with the literature, where Seghezzi et al. (2007) state that QM is a model which focuses

on clients, products, processes, etc. and CO focuses on strategy, planning, and company development. Donnersmarck & Schatz (1999) add that as the information within both systems comes from the internal and external areas and especially CO continuously sends signals of deviation, they are outstandingly appropriate as an EWS.

The fourth participant explained it in more detail and indicated that it helps the manager's study reports and compare them to the plans set earlier. According to this statement, the literature review shows that the QM (DIN EN ISO 9001, 2015) requires an annual management review, which should include decisions and actions related to opportunities for improvement and any need for changes and resources. Additionally, CO ensures the necessary supply of data and information by inclusion of planning and management control (Fiedler, 2001). The *fifth interviewee added that results that management receives help to rethink all possible events/developments with crisis potential in advance in order to react fast when a crisis occurs: which may motivate them to re-plan, to set new strategies, or to reshape organizational structure.* This part is clearly shown in the literature by the concepts of Battele Institute (1978) and Hammer (1998), where they recommend, dependent on the deviation of the strategic plan, to re-think and if necessary to re-plan the strategy. *All participants confirmed that EWSs are an important topic within the CO and QM area in the Food Production Industry.* This is in line with the literature where Löhneysen (1982) describes the EWS as an information system designed to warn companies when problems arise where companies have to initiate counteractions (Götze & Mikus, 2000).

5.2.2 Requirements from Phase I, which an EWS in the Food Production Industry has to fulfill

A list of categories equal to those identified and defined in Phase I were shown to informants before interview. These requirements were worked out during the literature review and interviews. The requirements from Phase I, which an EWS in the Food Production Industry has to fulfill, were named, with the following main points, by Turnaround experts, Lecturers and Interim Managers and also comply with literature review, as follows:

- EWSs should help recognize risks in a timely fashion and prevent them at an early stage.
- They should be holistic (strategic and operational) and practicable => not too complex.
- They should be future-oriented.
- They should include quantitative (hard) and qualitative (soft) factors.
- All business areas should be monitored.
- Internal and external factors should be considered.
- It should be a top management information system – monitored by management.
- It should be designed for internal and external stakeholders with different reports.
- It should match characteristics of the company (culture, structure, size and type of management).
- The management should be responsible for the suitability of an EWS.

These were also confirmed by the CO and QM experts.

5.2.3 Appropriate CO and QM tools according to the requirements from Phase I

The toolkit of CO and QM is very large and it was necessary, with the help of two CO and two QM experts, independent of the case companies, to identify the most appropriate for EWSs, which match the requirements identified during the Phase I. *Early warning systems, named by interviewees and related to the literature review, could, according to the requirements from Phase I, include the following tools:*

- PESTLE
- SWOT Analysis

- Planning
- FMEA
- HACCP
- Turtle Diagram
- Fault Tree Analysis (FTA)
- Creativity methods
- BSC

all of which have been explained above.

The literature names additionally Portfolio Analysis, Delphi Method, Scenario Analysis, Diffusion Theory, Trend Landscape and Cross-Impact-Analysis (Meier, 2007) as appropriate common tools for an EWS. The aggregated results, as well as the tools named in the literature, except the Delphi Method (similar to Expert Survey, according Hammer) during the previous strategic concepts of Battele Institute (1978) and Hammer, will be considered during the development of the EWS in Chapter 6.

5.2.4 Tools classified as 'best-practice-elements'

The aim of the interview was, additionally to the theoretical basis, to consider the best-practice elements. The rationale for using Controllers or Quality Managers is that, by virtue of their professions, they are well able to identify the best-practice tools appropriate for the described requirements. *For the reason that the risks* should be identified as completely as possible, the best-practice tools are named and briefly described also according to the literature review, below:

- *PESTLE, which was named by the third interviewee, is a model which counts to the environmental analysis and considers the political, economic, social, technological, legal and ethical (or environmental) risks faced by the organization.* This is in line with the literature review by Meier (2007) and Hopkin (2013).

- *SWOT, which was named by the seventh interviewee, is helpful for a company to understand their Strengths and Weaknesses, to be ready to grasp the Opportunities and overcome the Threats.* The literature by Hopkin (2013) and Allenspach (2006) indicates SWOT as an appropriate tool for the understanding of the internal Strengths and Weaknesses, as well as of the external Opportunities and Threats.

- *Planning, which was pointed out by the fourth participant, helps to rethink all possible events/developments with crisis potential in advance in order to react fast when a crisis occurs.* Also, several authors (Hauff, 2010; Krystek, 1987; Ohligschläger & Below, 2015) indicated 'Planning' as an appropriate tool for risk/crisis identification.

- *FMEA, indicated by the seventh interviewee, is used to identify ways a process or product can fail to meet critical customer requirements.* A lot of literature is available which confirms it as a model for failure prevention (Foster, 2013; Romeike & Hager, 2013; Ruderer, 2009; Brühwiler, 2003; Pyzdek & Keller, 2013).

- *TURTLE, pointed out by the sixth participant, analyses processes by recognition of their weaknesses, effectivity, and efficiency, as well as the interfaces and their dependencies.* This, in general, corresponds to the literature review by Jaeger (2016), TÜV (2013), Benes & Groh (2014) and Hallbauer, et al. (2015).

- *HACCP, named by the seventh interviewee, is used in the food industry to identify potential food safety hazards so that preventive actions can be taken to mitigate the potential risks.* The literature review also reveals HACCP as a valuable tool for risk identification within the food industry (Ruderer, 2009; Romeike & Hager, 2013 and Reuvid, 2013).

- *Fault Tree Analysis is a failure analysis, added by the seventh participant, which analysis all possible reasons for an undesired deviation (a major event), which by interrelation can cause the disruption.* Also, several authors cited the FTA as a tool for analysis of an undesired deviation (Ruderer, 2009; Allenspach, 2006; Foster, 2013; Marshall, 2012 and Romeike & Hager, 2013).

- *Creativity methods, such as Brainstorming or Brainwriting, named by the fourth and fifth interviewee, can be used for supporting the above methods, by data-gathering.* Creativity methods were also described in the literature review as a supporting tool for data-gathering (Nagel et al., 2013; Rigg & Trehan, 2008; Reynolds, 1998 and Watton, Collings & Moon, 2001).
- *BSC, named by the fourth participant as a Management Cockpit and by the sixth expert as risk radar, is a strategic tool appropriate for designing the whole planning, monitoring, and control process, which combines the key performance indicators from the past with future value drivers.* This is in line with the literature review, agreed by Allenspach (2006), Töpfer (2000), Brühwiler, (2003), Schröder (2005) and Wolf (2010).

In the end, pointed out by the fourth interviewee, the CEO must have a Management Cockpit, which delivers him an overview of the whole company, where environment information is included and enables him to make appropriate decisions as well as react to changes in time. This view is also confirmed by the literature review, where the information about risk coming from different sources should be combined to form a holistic system (Brühwiler, 2001). “Some companies have developed a panel of early warning indicators, sometimes referred to as a risk dashboard, to track movement in selected areas that are crucial to the company’s well-being.” (Hampton, 2009, p. 63). *The fourth interviewee added that internal and external risks for all business processes and relevant support processes must be taken into account and efficient communication to internal and external areas should be ensured.* This is in line with the literature review, where the phase of risk identification is the most important step, as the result of this stage is essential for all following steps (Krystek & Fiege, 2015). Ruderer (2009) shares this view by stating that EWSs are information tools, which have the aim to recognize the negative development at an early stage so that the company has enough time for the reaction before the damage sets in.

5.2.5 Integration in a company

The fifth interviewee indicated that the beginning of early risk recognition lies rather in an attitude question and a question of open communication, of readiness to scrutinize existing things, and in the importance of critical discussion inside the company. Pedler & Abbott (2013) share this view by stating that Practice means working with other people in sets and including one's own personal reflective practice. Ruderer (2009) adds that by the integration and sensitization of employees in the critical handling process to the recognition of internal and external changes, provides a huge contribution to the establishment of a risk culture. *The fifth participant added that the tools could only help to support when the company has an appropriate framework for them.* The theory confirms that, whatever the aim of the single system is, the company has to be able to tailor the framework to their needs, which includes the micro and macro environment (Dahm & Haindl, 2011). *The sixth interviewee stated that the employees must be sensitized to the openness of critical discussion by cause and effect relationships.* The mentioned statement is in line with the literature review, however, the employees are to be sensitized to the critical handling of the recognition of changes in their area (Gleißner & Meier, 2001). *The fourth participant added, that, employees continuously have to deal with changes occurring in the company environment. The fifth interviewee pointed out that this all requires analysis or understanding of the new situation, and this knowledge, especially in SMEs is often lacking.* The literature review confirms that Practice is equated with doing, concreteness, understanding, and know-how as opposed to Theory which is equated with thinking, explanation, knowing, and dissection into parts (Weick, 2005).

Companies should pay attention to communication and information policy, wherein the risk policy of the company should be written down. This generally corresponds to the literature review, where Donnersmarck & Schatz (1999) state that it is important to focus on organizational communicative and human aspects and to avoid strong hierarchical structure. *The fifth participant commented that tools can help identify, describe and control the risk, but the employees should be able to use the tools and to notice signs, coming from the company and environment.* This agrees with the literature in Kelders (1996) that, the information

search process of a company has to be realistic, clear and simple. Rocha-Lona et al. (2013) recommend during the selection criteria process not only to evaluate whether the selected tools are needed, but also whether the SMEs have the required resources and capabilities for their implementation. *The seventh interviewee summed up with the statement that whatever the tools of any system are, the company has to be able to tailor the framework to their own needs. The fourth participant added that the most important goal for this system should be an overview of the whole area.* The literature review confirms this view in Kirschkamp's (2007, p. 13) statement, "A holistic view is used where all relevant factors and their interdependencies have to be identified and dealt with".

5.2.6 Tool Software appropriate for an EWS

All interviewees agreed that a holistic standard tool or software for SMEs, according to the requirements and including the named tools, is not yet known - existing solutions are mostly self-made. This generally corresponds to the literature review, that the recommendation is, in general, to use the Office applications (Ruderer, 2009), such as Excel, Visio, etc., as no EWS software, appropriate for SMEs, exists.

5.2.7 Persons who are responsible for the appropriateness of the CO and QM tools

All participants indicated that the responsibility for the suitability of the CO and QM for an EWS is definitely a matter for Management and of the CO and QM employees. This generally corresponds to the literature review by Bedenik et al. (2012) that monitoring is not a backroom function but instead an active process involving managers at all levels who share an awareness of the risks that the organization faces by providing them with necessary organization flexibility. *The fourth interviewee added that, if possible, it would make sense to involve IT experts, who can help to implement the tools and combine them appropriately. However, the fourth expert summed up with the words that, the recognition and monitoring of the relevant risks only work when the roles and responsibilities are clearly defined, and a workable framework exists.* This is in line with the literature

review, where the CEO has to set up appropriate reporting obligations for the responsible divisions, which include all major risks and elements of risk management and amendments thereto (Schmidt, 2015).

6 Development of an EWS

Even with the final EWS-approach, it will not be possible to consider all details in advance. To Depré's (2011) observation that the beginning of early risk recognition lies rather in an attitude question and a question of open communication, of a readiness to scrutinize existing things of the importance of critical discussion throughout the company, Ruderer (2009) adds that a modern EWS should also include an entry point for critical discussion of cause and effect relationships, where the employees have continuously to deal with changes occurring in the company environment. "This requires some analysis or understanding of the new situation; it requires a background of knowledge or methods which can be readily utilized; and it also requires some facility in discerning the appropriate relations between previous experience and the new situation" (Bloom et al., 1956, p. 38).

Depré (2011) states that companies should pay attention to communication and information policy, where the risk policy of the company has to be written down so that the company's aims and expectations can be protected (Allenspach, 2006). While the environment and company give out recognizable signs, which should be noticed (Kloss, 1984), the tools help identify, describe and control the risk (Brühwiler, 2003). Whatever the aim of the single system is, the company has to be able to tailor the framework to their needs, which includes the micro and macro environment (Dahm & Haindl, 2011).

The most important goal for this system should be to overview of the whole area as a combination and not as separate tools (Evans, 2014). This EWS will be tailored with consideration for the requirements explored in chapter 4:

- *EWSs should help recognize risks in a timely fashion and prevent them at an early stage.*
- *They should be holistic (strategic and operational) and practicable => not too complex.*
- *They should be future-oriented.*
- *They should include quantitative (hard) and qualitative (soft) factors.*

- *All business areas should be monitored.*
- *Internal and external factors should be considered.*
- *It should be a top management information system – monitored by management.*
- *It should be designed for internal and external stakeholders with different reports.*
- *It should match characteristics of the company (culture, structure, size and type of management).*
- *The management should be responsible for the suitability of an EWS.*

This will be effected by the inclusion of tools from chapter 5, shown in Figure 24, which contain all items necessary for the solution of the problem described in chapter 1.

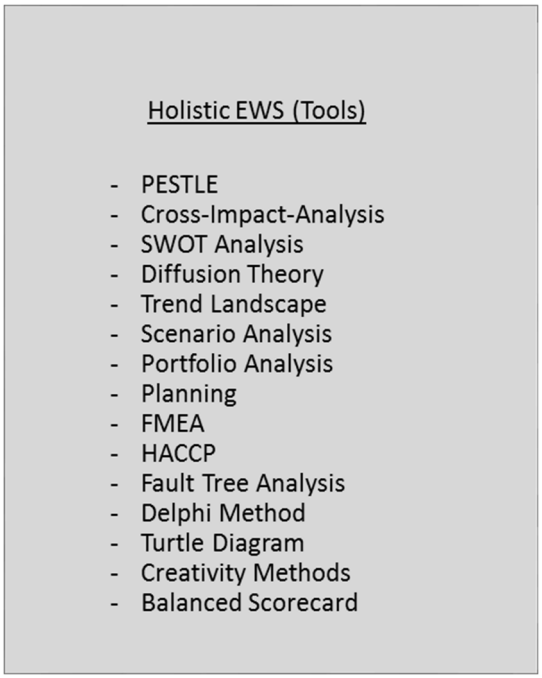

Figure 24 Tools for a holistic EWS

Source: own illustration

The combination of the explored CO & QM tools to form a holistic EWS should provide an answer to Question 2 from Chapter 1. Finally, the EWS approach should be analyzed with the help of two case studies to consider its practical suitability.

The combination of the QMS and CO tools during the construct (Figure 25) of a holistic EWS, where each of the tools represents the model, is separated into the three following steps in consideration of the requirements coming from the literature review and interviews:

- Determination of context
- Risk identification
- Risk monitoring and review

6.1 QMS & CO as a construct for EWS tools

The companies within the food production industry have an absolute need for high quality as its lack can lead to serious problems (Petersen & Nüssel, 2013) and most of them have, for this reason, a quality management system (QMS), where the basis is ISO 9001 (Ruderer, 2009). The QMS of ISO 9001 is appropriate as the basis for using the company flow chart for integration of additional management systems (Wagner & Käfer, 2010). Rothlauf (2014) states that in the future it will not be possible to sustain one`s position for the companies in the national and international competition without guarantee of high quality, which stretches across the complete chain of economic value added. QMS is a Management System for conduction and control of a company in terms of quality, which determines the policy and aims as well as the achievement of the aims (Giebel, 2011). Tricker (2014) adds that the ISO 9001 allows the company to align and integrate its own QMS with other management system requirements.

The components of DIN EN ISO 9001 are: Continuous Improvement; Internal Customer-contractor Relationship; Process-driven Organization and Working Structure; Involvement and Motivation of all employees (Brüggemann & Bremer, 2012). To establish DIN EN ISO 9001 a company has to get their processes under control; they have to plan them, follow them, ensure that they are effective, correct

them if they are deficient and constantly improve the existing processes (Tricker, 2014).

The requirements of the main points for DIN EN ISO 9001:2015 are in the areas of:

- Quality Management System as process approach
- Consideration of Quality Aims and Policy
- Strategy and Stakeholder Orientation
- Resource Management and Knowledge Management
- Customer Approach
- Product Development and Realization
- Measurement Analysis, Risk Prevention, and Improvement (Hinsch, 2014).

In general, it can be said that Quality Management has the following eight principles, which a company has to test and improve:

- The company has to focus on the customer
- The company is led by a leadership and involves people
- The management has to follow a systems approach while the company has to apply the process approach and the decision-makers the factual approach
- One of the most important principles is continual improvement and last but not least the mutually-beneficial supplier relationship (Tricker, 2014).

The advantage of a QMS is that you have a clearly-defined process flow, clear company structures, high transparency, increased efficiency, traceability of products, sustainable quality consciousness, better image, reduction of mistakes, cost cutting (Seghezzi et al., 2007).

Crönetz et al. (2009) cite EWS success factors comprising market, company background/identity, continuous improvement, resources, structure, processes, and competence – these factors, as described above, are regulated in ISO 9001

(Hinsch, 2014) and can be analyzed for discontinuities by the QMS. This International Standard promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a quality management system, to enhance customer satisfaction, fully understanding and documenting customer requirements; ensuring compliance with identified statutory legislation (Tricker, 2014). Specific requirements are considered essential to the adoption of a process approach (DIN EN ISO 9001, 2015). The process approach involves the systematic definition and management of processes, and their interactions, where any activity that receives inputs and converts them to outputs, so as to achieve the intended results is in accordance with the quality policy and strategic direction of the organization (Tricker, 2014). Management of the processes and the system as a whole can be achieved using the Plan-Do-Check-Act (PDCA) cycle with an overall focus on risk-based thinking aimed at taking advantage of opportunities and preventing undesirable results, where often the output from one process becomes the input for another process (DIN EN ISO 9001, 2015).

However, the additional factors of finance, aims and strategy need to be included and can be monitored by the CO system (Vesper, 2014). Controlling supports the Management with transparency, shows them potentials for cost cutting and measurements for increasing profitability, but the Managers claim that they communicate only the aim of cost cutting, without the recommendation of the possible way of reaching them (Belkin, 2011). As risk management takes place between the poles of customer requirements and customer satisfaction (Brühwiler, 2001), it is proposed to use the existing QMS (Foster, 2013), where the process is driven by customer expectation (Evans, 2014) along with a Controlling System. Bruhn (2011) pointed out that for the efficiency of QMS QM and CO belong together in a holistic EWS (cf. Figure 25). Weber et al. (2011) adds that Controlling together with the Quality Management system is able to react in a very short time to cost cutting and cash generation by means of “Plan, Do, Check, Act”.

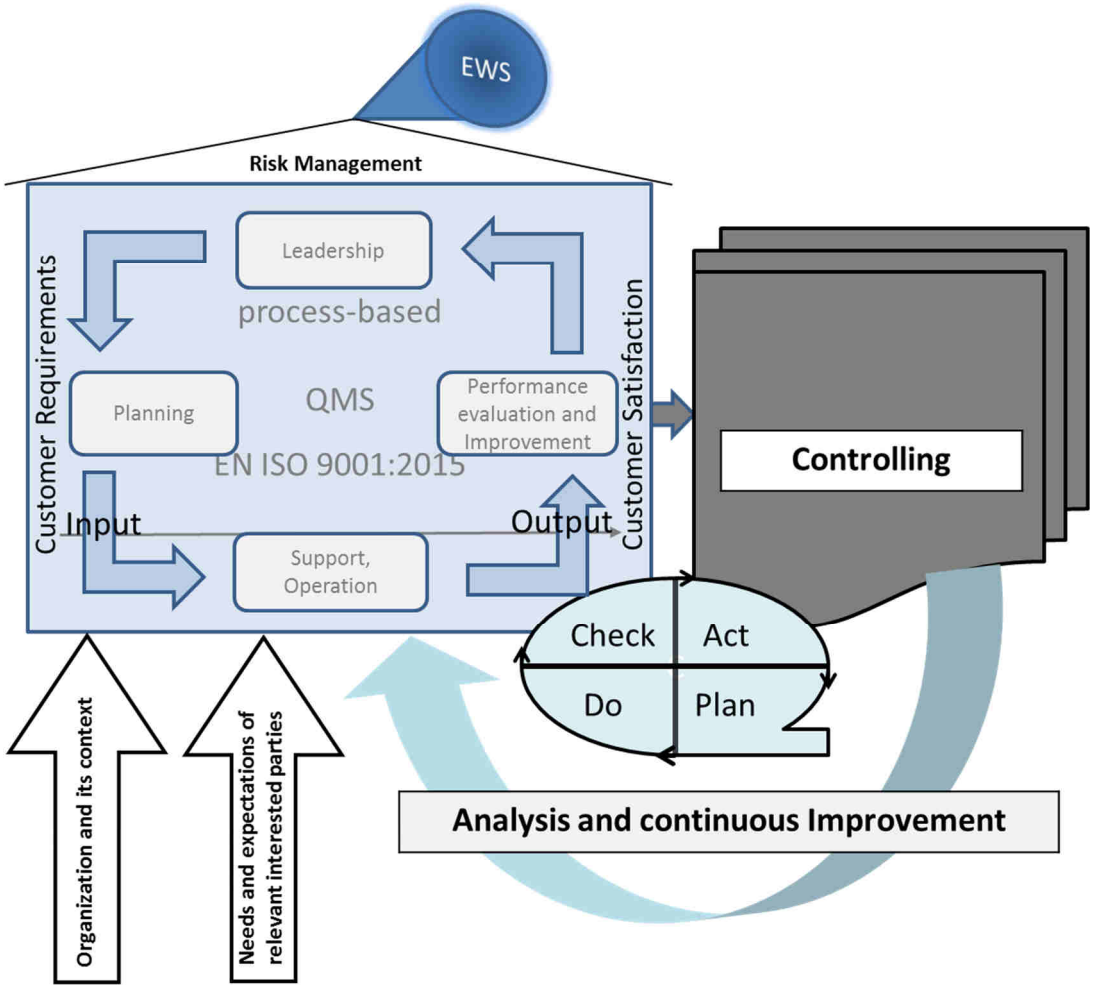

Figure 25 QMS & CO as construct for EWS tools

Source: own illustration, based on DIN EN ISO 9001:2015

The controller supports the Quality Management with process costs information, which helps them to identify and specify reasons for a problem and define the operative value driver. There should not only be a systematic combination, but also a personal one (Weber & Schäfer, 2011).

This would also remove the critique that Quality Management, if anything, has too narrow a focus and that problems are not solved from the process view, for the reason of still focusing on the operative area and losing sight of communication, organizational structure, and support of Top-Management

(Küpper et al., 2013). The criticism also often includes the lack of continuous improvement of finance indicators, which are very important for the evaluation of the financial impact, as well as the permanent relation to the external environment (Weber et al., 2011).

The combination of QM & CO will be now explained in more detail. Seghezzi et al. (2007) state that QM is a model which focuses on clients, products, processes, etc. and BSC is a holistic Controlling, which focus on strategy and company development. The aim of Controlling, especially of the BSC, as a holistic CO tool, is the analysis of cause-effect connection between the areas, which makes continuous improvement possible, and where the combination of QM with BSC as two Management concepts, complement one another by focusing on the customer, operating, market and employee perspective (Seghezzi et al., 2007). This makes it possible for companies to react to changes much earlier and fulfill the requirements of an EWS. Donnersmarck & Schatz (1999) add that as the information obtained by the BSC and QM comes from both the internal and external areas, it is outstandingly appropriate as an EWS, as the BSC permanently sends signals of any deviation. Brühwiler (2003) goes a step further and states that the BSC is appropriate as EWS by using the QMS as a basic Management System of the whole Risk Management Process. Töpfer (2001) concludes with the explanation that QM is system-oriented and BSC is result-oriented, so both together build a holistic system by process building and result control. Many concepts show that the processes are the core of the change strategy, such as Quality Management (Belkin, 2011).

However, it is clear that there exists a strong relationship between BSC and QM, wherein the information, according to the explanation of Seghezzi et al. (2007), which comes from focusing on clients, processes and employees from the QMS, will also be found in the BSC. Töpfer (2000) states that QM and BSC are two sides of the same coin. The BSC displays the results of QM, which is a tool that works to design and control the company (Töpfer, 2000). He adds that the measurement results and performance indicators from the Quality Management will be converted within the BSC into KPIs, which refer to all areas and enable the Quality Management to operationalize and make it more useful by the use of the scorecard.

As shown above, the QM, in conjunction with BSC, fulfills the requirements of Chapter 4 as a holistic EWS by the inclusion of external and internal, strategic and operational, qualitative and quantitative, factors. The appropriacy of BSC, which was often criticized as too complex for SMEs, was analyzed in different studies and confirmed for the use of SMEs (Elshamly, 2013). BSC is an easily manageable tool, which integrates tools available in the company (here: QMS) under the same roof to produce a holistic Management System (Töpfer, 2000). The steps of implementation will be summarized subsequently, and the appropriacy, by inclusion of tools, for practice will be analyzed through two Case Studies.

The introduction process for a BSC is estimated by Töpfer (2000) to be about 6 months (as explained at the beginning of this chapter, most of the companies in the food production industry have already implemented a QMS, and so the author sees no need to describe this part further) and includes the following steps:

- Vision / Strategy / Aim
- Process analysis ➔ definition of critical success factors and value drivers
- Classification of the value drivers to the areas of BSC
- Identification of KPIs
- Connection of KPIs / analysis of reasons/activity relationship

The combination of QM and BSC begins with the Mission and Vision; the fundamental elements of "Policy and Strategy" establish the review on the basis of sub-criteria, where the information from market, measurements and knowledge have to match within cause-effect-relationships from the customer, operating, market and employee perspective (Töpfer, 2000). Anyway, the development of the EWS is related to DIN EN ISO 9001:2015, which was introduced in October 2015 (DIN EN ISO 9001, 2015), in which SMEs have to develop a risk-oriented QMS during the following three years. This system was complemented by CO, as described above, where the integrated tools and their use will be explained below.

6.2 Determination of context

The first step during strategic early recognition according to the concepts of Battelle Institute (1978) and Hammer (1998) is that of environment analysis, which both define as early clarification and which is where the weak signals will be primarily located. As Meier (2007) states that there exists a strong relationship between Risk and Quality, where both (here: regulation of ISO 31000:2009 and DIN EN ISO 9001:2015) require as a starting point the determination of context by the observation of the internal and external company environment and the identification of factors, which could have an impact on the company, this stage could be used during the above described construct, as **allocation of weak signals**. This is marked in figure 26 as Number 1. The appropriate tools will be described during this chapter.

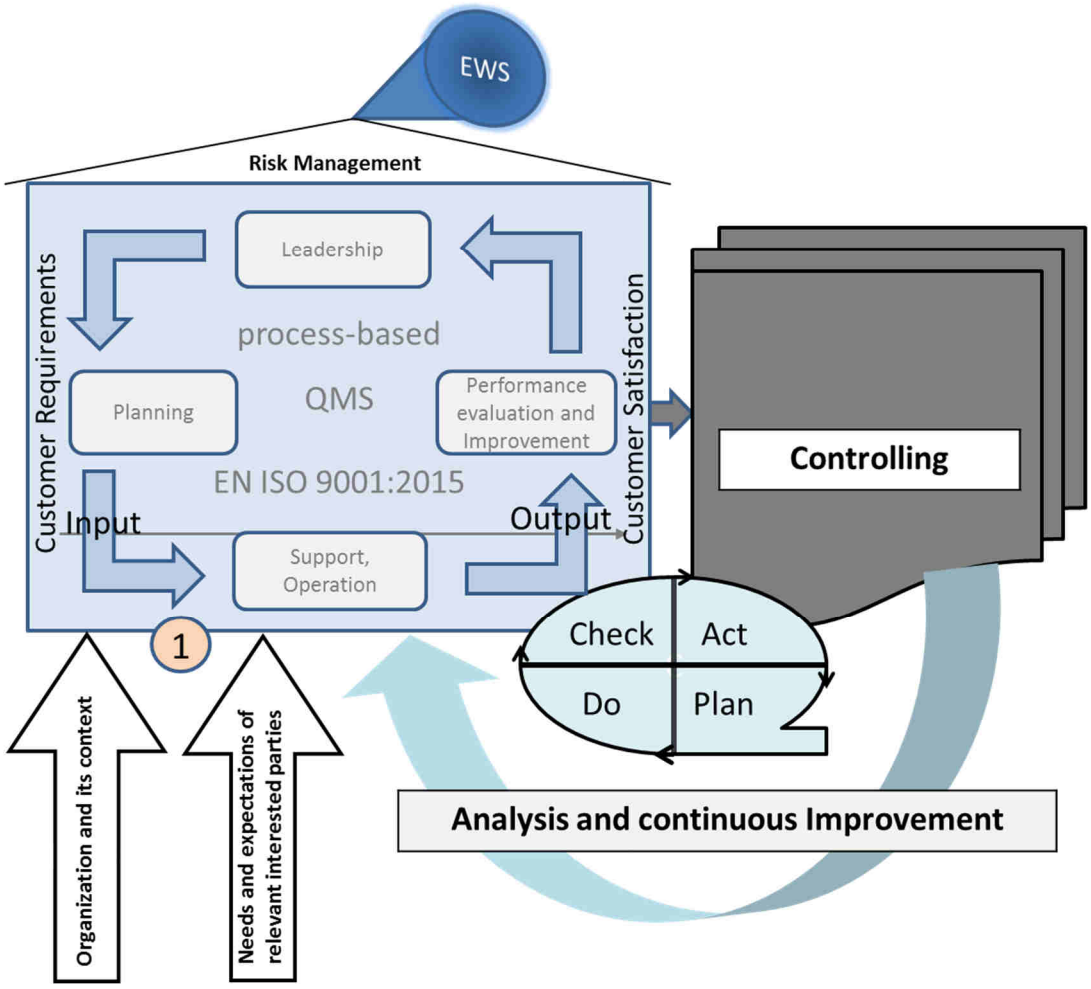

Figure 26 Determination of company context

Source: own illustration

6.2.1 Weak Signals

The strategic early recognition can be seen as rooted in Ansoff's (1976) concept of weak signals, which are inadequately defined and vaguely structured pieces of information, which forewarn of the occurrence of strategic discontinuities (e.g. changes of trend). "The concept of weak signals is based on the assumption that discontinuities in technological, economic, social and political environment do not appear at random, neither are they unpredictable, but rather that they can be

spotted by means of weak signals, since such discontinuities are set in motion by people and their interests" (Bedenik et al., 2012).

"Weak signals" according to Ansoff (1976) are indisputable in the scientific literature. The early perception of relevant, qualitative, however imperfect and not clearly defined, information is one of the primary tasks of the early Enlightenment (Hammer, 1998). Conjectures, predictions, dissemination of new ideas and views in the media, opinions of key individuals or influential institutions, as well as expectations about imminent events can be examples of weak signals. Such information from the business environment with relatively unstructured content can indicate innovations, needs, and discontinuities (disasters). Weak signals are distinguished in particular by the fact that they are relatively unstructured information whose informational value is severely limited. They often refer to uncertain, utopian or apparently unrealistic ideas. They also often affect creeping changes, are mostly intuitive and qualitative in nature and do not allow clear conclusions (Bedenik et al., 2012).

Due to the variety of interpretation possibilities such as "third variable" (Krystek, 1987) and their initially small influence on the overall system, they initially remain unnoticed, because the sooner the information is perceived, the more difficult the interpretation and forecast of their development are (Hauff, 2010). Only after accumulating and exceeding tolerance limits, they can lead to abrupt changes in the level or direction of the system, where it is possible to recognize clearly the importance and practical relevance of such soft factors (Liebl, 1996). Ansoff (1976) distinguishes between five uncertainty levels (States of Ignorance), where each has a different information content.

As shown in the figure 27, the first uncertainty condition (Sense of Threat/Opportunity) represents the highest level of ignorance in which it is only known that a threat or opportunity is present. Neither its form nor its source can be determined. In the second stage (Source of Threat/Opportunity) it is now possible to identify the source of the change, but the precise characteristics of the threat or opportunity are not yet determined. This is achieved only in the third stage of uncertainty (Threat/Opportunity Concrete). Only here it is possible to determine the exact nature of the impact and the timing of the threat or

opportunity. Based on this, during the fourth stage (Response Concrete) the counteractions and strategies can be developed. Finally, in the fifth stage (Outcome Concrete) the consequences of the proposed measures and their impact on the company's success can be determined (Ansoff, 1976).

States of Ignorance / Info Content	1 Sense of Threat/ Opportunity	2 Source of Threat/ Opportunity	3 Threat/ Opportunity Concrete	4 Response Concrete	5 Outcome Concrete
Conviction that discontinuities are impending	YES	YES	YES	YES	YES
Area of organization is identified ,which is the source of discontinuity	**NO**	YES	YES	YES	YES
Characteristics of threat, nature of impact, general gravity of impact, timing of impact	**NO**	**NO**	YES	YES	YES
Response identified: timing, action, programs, budgets	**NO**	**NO**	**NO**	YES	YES
Profit impact and consequences of responses are computable	**NO**	**NO**	**NO**	**NO**	YES

Figure 27 Knowledge-State of Discontinuity

Source: Kirschkamp (2007)

As a representation of appropriate counteractions, Ansoff (1976) developed the Strategic Issue Analysis. Therein, the impact of unusual events on the respective business segment is estimated and analyzed. In parallel, during a ready diagnosis, the reactivity of the individual business units is analyzed. After this opportunity-susceptibility-analysis the efficiency of reactions observed and appropriate priorities, readiness levels, and measures are defined by cost-benefit analysis (Koslowski, 1994).

However, at first the Weak Signals should be detected. Two ways exist: by monitoring, which is the analysis of the environment limited to a single

phenomenon, and by scanning, which is the activity of acquiring information (Kirschkamp, 2007).

6.2.1.1 Scanning and Monitoring

Weak signals, as shown in the table 9, will be recorded by direct or non-direct observation of early enlightenment relevant environmental and corporate divisions (Liebl, 1996). While in the directed search a defined observation area is monitored with predetermined indicators, the non-directional observation corresponds to a dynamic environment analysis outside specified fields of observation and indicators (Hammer, 1998). Such scanning, which, in principle, includes all forms of information-gathering, is suitable. In contrast, monitoring is an activity equivalent to an in-depth search for additional information on previously identified phenomena (Liebl, 1996).

<table>
<tr><th></th><th>Undirected search</th><th>Directed search</th><th></th></tr>
<tr><td>Informal</td><td>The scanning for weak signals outside the domain and without a focus on a specific topic.</td><td>The scanning for weak signals inside the domain and without a focus on a specific topic.</td><td rowspan="2">Scanning</td></tr>
<tr><td rowspan="2">Formal</td><td>The scanning for weak signals outside the domain, concentrating on a specific theme.</td><td>The scanning for weak signals inside the domain, concentrating on a specific theme.</td></tr>
<tr><td>The observation and deeper search for information outside the domain, concentrating on the specific topic regarding an identified signal.</td><td>The observation and deeper search for information inside the domain, concentrating on the specific topic regarding an identified signal.</td><td>Monitoring</td></tr>
</table>

Table 9 Differentiation of scanning and monitoring by basic activities during the detection phase

Source: Krystek and Müller-Stewens (1993)

In contrast to the informal search, during the formal observation the examined topic is known (Koslowski, 1994). The directional and non-directional monitoring of the business environment through a monitoring and scanning system is a prerequisite for further analysis. The quality of forecast also depends on the scanning frequency, the orientation dimension of observation areas and the information efficiency (Hammer, 1998). With continuity, the integration of the scanning in the corporate culture and the necessary financial support increases (Koslowski, 1994). The probability of detection of discontinuities to analyze their effects and to develop appropriate reactions increases with the breadth of the observations (Liebl, 1996). A free exploration enables the observer, in addition to the experiencing of the recovery of data and the realization of new views and methods, to point out the existing data gaps and can trigger a targeted search (Koslowski, 1994).

6.2.1.2 Sources of Weak Signals

In this context, the question arises, where and what could be possible sources of these weak signals. There are basic differences between internal and external sources (Koslowski, 1994). Internal sources include primarily the controlling and accounting. However, information from memos, reports and card files can be helpful. It is also important not to forget the knowledge and personal experience of corporate members (Hauff, 2010). Also, if the external information gap about markets, competitors, economic cycle and law, is still big in SMEs, which is a latent danger for decision-making, the manager should be aware which information is necessary, where the sources are for this information and which methods can provide this information (Mischon, 1982).

External sources naturally still include newspapers, magazines or books. To this can be added personal information, for example through information from seminars or fairs (Röttger, 2005). Another important source of weak signals is the Internet (Krystek et al., 2007), especially since this offers a variety of information, to which one has a flexible, timely and resource-efficient access (Sonnenschein, 2005).

6.2.2 Tools for determination of company context

In the first stage, the weak signals will be primarily located in the strategic, relevant observation areas and there subsequently follows the diagnosis of the reasons in connection with sign-specific effect prognosis (Krystek et al., 2007). ISO 31000 (2009) states that it is important to evaluate and understand both the external and internal context of the organization since these can significantly influence the operation of the company. DIN EN ISO 9001 (2015) adds that "The organization shall determine external and internal issues that are relevant to its purpose and its strategic direction and that affect its ability to achieve the intended result(s) …". This is in line with concept of Battelle Institute (1978) and Hammer (1998), where they describe as a first process step the observation of environmental areas, and the recording of weak signals. Hammer (1998) states that the observation of weak signals should be via "scanning", e. g. on the basis of directed and undirected observation, then recorded and afterwards monitored via "monitoring" (Hauff, 2010).

The first research work about “environmental analysis” came from Aguilar in 1967, where he constitutes the need for external review and monitoring by dividing company environment into the following subsystems:

- Economical terms
- Technological terms
- Legal-political terms
- Socio-cultural terms
- Physical-ecological terms (Kunze, 2000).

6.2.2.1 PESTLE

According to the literature review and interviews, the **PESTLE** tool will be appropriate for a common qualitative approach, which analyses and considers the political, economic, social, technological, legal and ethical (or environmental), etc. risks faced by the organization" (Hopkin, 2013, p. 64). McCabe (2010, p. 57) states that “… the main functions of PESTLE analysis is in the context of

‘environmental scanning’, an analytic process described as necessary in terms of understanding about events and trends in the external environment”. Breitkreuz & Lange (2011) add that the PESTLE analysis is a model which adds to the environmental analysis. Allenspach (2006), in contrast, states that it belongs more to the strategic work, where the main-, and sub-, aims will be analyzed. Notwithstanding the fact, according to the research from Bedenik et al. (2012), that this tool is not well known in practice, we see a high degree of need for weak signals, as described above, to analyze and to fix the environment of the company, which can be best done by a systematic tool like PESTLE.

However, the scanning and monitoring should include the micro and macro environment (Trustorff, 2012). Ruderer (2009) narrows it down by stating that the scanning and monitoring of an EWS should primarily focus on the external area including macroeconomic, political, social and ecological environment by the inclusion of the supplier’s sales market. On the other hand, the direction of an EWS concerning the internal area is marginal. Rieser (1980) adds the factor of the technological environment.

Furthermore, Mischon (1982) recommends the determination of the organizational context by subdivision in different areas (external, intercompany and internal areas), followed by reasons/symptoms and indicators, which will be explained in chapter 6.4 and summarized in a table. Ohligschläger & Below (2015) describe that the **external issues** arising from legal, technological, competitive, market, cultural, social and economic environments, whether international, national, regional or local. ISO 31000 (2009) mentions the same areas and adds regulatory, financial, key drivers and trends having an impact on the objectives of the organization and relationships with, and perceptions and values of, external stakeholders, which should be considered.

Mischon (1982) also names the **intercompany scope** by including suppliers, customers, competitors, and banks. Ohligschläger & Below (2015) add that besides the customers, there are other people, owners, cooperation partners, society, occupational unions, and associations. The DIN EN ISO 9001:2015 claims to understand the needs and expectations of interested parties, where "The organization shall monitor and review information about these interested

parties and their relevant requirements." (DIN EN ISO 9001, 2015, p. 19). Hinsch (2014), in contrast, states that the company has to analyze the requirements and the expectations of the stakeholders and adjust their strategic plan according to the interested parties.

Additionally, even if the **internal area** is often ignored, it includes important information which should be searched for amongst the governance, organizational structure, roles and accountabilities; policies, objectives, and the strategies that are in place to achieve them; the capabilities, understood in terms of resources and knowledge (e.g. capital, time, people, processes, systems and technologies); information systems, information flows and decision-making processes (both formal and informal); relationships with, and perceptions and values of, internal stakeholders; the organization's culture; standards, guidelines and models adopted by the organisation; and form and extent of contractual relationships" (ISO 31000, 2009, p. 10). The understanding of the internal context can be also facilitated by considering issues related to values and performance of the organization, which could be a combination of internal and external factors (DIN EN ISO 9001, 2015). Ohligschläger & Below (2015) add that the company has to monitor and review the information about the interested parties and analyze how they interact with each other.

6.2.2.2 Cross-Impact-Analysis

The interaction can be analyzed by CIA (Liebl, 1996). "**Cross-Impact-Analysis** is a method used in forecasting exercises aimed at measuring the correlation between future events (variables)" (Ferretti, 2016). It is a method, which shows the interdependency during a problem area and creates understanding for connections (Wirtschaftslexikon, 2016). CIA is applied to identify how developments in one area interact with those in another (Schlüter, 2004). Its ability is to show how one situation impacts another situation (Ferretti, 2016). Here, various events of their interactions will be examined and evaluated (Liebl, 1996). This is in line with the concept of Hammer (1998) where he states that the results must be subjected to a first relevance test during the first step. The examined interdependencies especially include the effect of each on the

probability of occurrence, the time period and the strength of the relationship (Schlüter, 2004). Löhneysen (1982) adds that an EWS should identify both internal and external dangers at an early stage, where the organization has to analyze and predict the future development of market, competitors and their own company's position (Berndt et al., 2011). This could be done by SWOT analysis.

6.2.2.3 SWOT Analysis

SWOT analysis, a widely used tool, is helpful for the company to understand their Strengths and Weaknesses, to be ready to grasp the Opportunities and overcome the Threats. The achievement of the Objective depends on the factors, how far they match the company's internal and external competitive environment, as shown in the figure below.

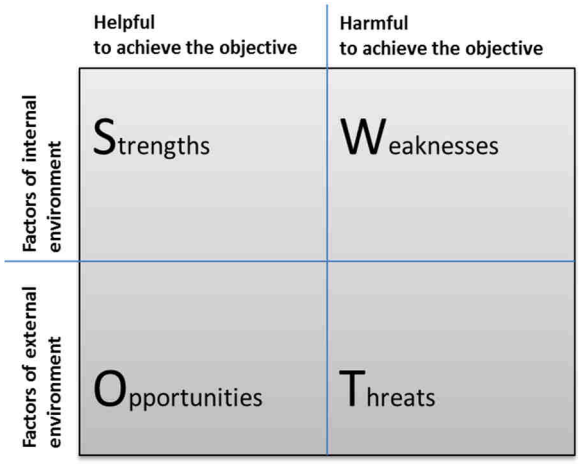

Figure 28 SWOT Analysis

Source: SWOT (2017)

"The SWOT Analysis has the advantage of also being able to consider the rewards available to the organization from the opportunities in the external environment. One of the strengths of the SWOT analysis is that it can be linked to strategic and tactical decisions; a danger is that it is not a structured risk classification system and, therefore, there is a possibility that not all of the significant risks will be identified" (Hopkin, 2013, p. 64). It also includes the non-

financial aims and can be used as a qualitative tool (Allenspach, 2006). In summary, it can be said that SWOT can be seen as a matrix, where the relevant results are summarized, analyzed and used as a basis for further actions.

However, after the determination of the organizational context, the company also has to identify sources of risk, areas of impact, events, by including changes in circumstances, their causes, as well as their potential consequences and adjust their strategic plan accordingly (Hauff, 2010). Hammer (1998) adds that after the observation of weak signals via "scanning", e.g. on the basis of directed and undirected observation, they should be recorded (Hauff, 2010) and after the first relevance test, the risks have to be identified by the application of appropriate tools.

6.3 Risk Identification

The phase of risk identification includes the collection of actual and future (potential and latent) risks, which is the most important step during risk management, where the result of this stage is essential for all following steps (Krystek & Fiege, 2015). The aim of this phase is to identify all risks which are essentially dangerous for the target achievement (Altstetter, 2008). Ruderer (2009) explains that the organization should identify sources of risk, areas of impact, events, by including changes in circumstances, their causes, and their potential consequences, for the reason that after prediction and clarification activity, the counteraction could be carried out by the decision makers.

However, as risk management takes place between the poles of customer requirements and customer satisfaction (Brühwiler, 2001), it is proposed for the second stage to use the existing QMS (Foster, 2013), where the process is driven by customer expectation (Evans, 2014) and by using the Plan-Do-Check-Act (PDCA) cycle with an overall focus on risk-based thinking aimed at taking advantage of opportunities and preventing undesirable results, where often the output from one process becomes the input for another process (DIN EN ISO 9001, 2015). Furthermore, Crönetz et al. (2009) cite EWS success factors comprising market, company background/identity, continuous improvement, resources, structure, processes, and competence. These factors, as described

above, are regulated in ISO 9001 (Hinsch, 2014), which affirms the appropriateness of analysis of the recognized discontinuities from the first stage during the QMS.

The risk identification in the EWS context is located in the described construct during the QMS, which is marked in figure 29 by Number 2. The appropriate tools will be described in this chapter.

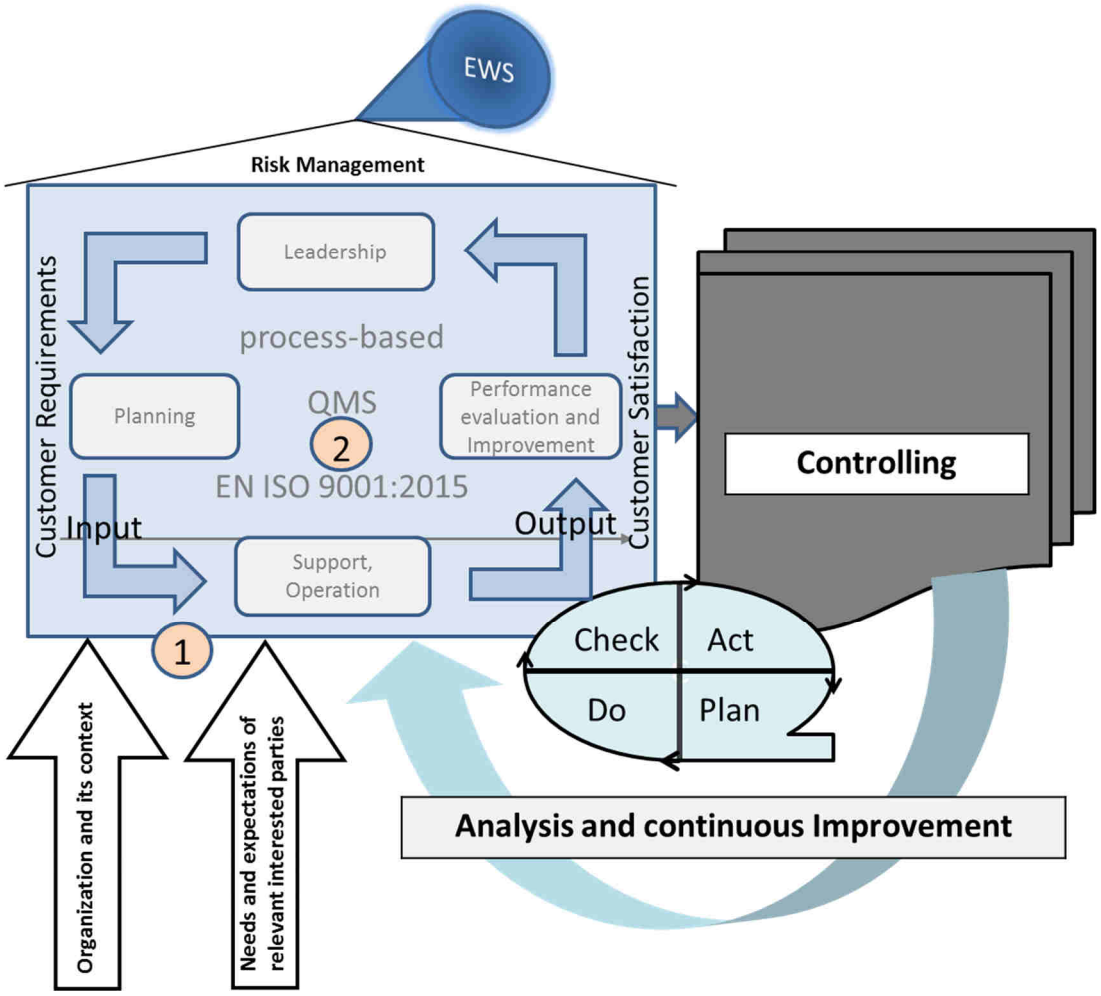

Figure 29 Methods for risk identification

Source: own illustration

6.3.1 Tools for risk identification

Hauff (2010) states that with the identification of a weak signal, the documentation and categorization begin with a simultaneous relevance test (for example, reinforcing of existing weak signals). From the collected information, which can additionally be supported by **Creativity methods** (Brainstorming or Brainwriting), specific diffusions or behavior patterns can be found by mathematical and statistical methods and prognoses made. By taking into account the likelihood of occurrence and rankings for their relevance, the discontinuity can be assessed more accurately. According to the concept of Hammer (1998) risk and opportunity random ranges permit a transparent presentation of different stages of the diffusion process and the urgency of the implementation of reaction strategies.

6.3.1.1 Diffusion Theory

Existing or emerging problems that can not be solved over a long period by an accepted model of a scientific field (paradigm), call for new approaches. A paradigm change, as a result of the concretization of vague guesses, is usually associated with a deeper impact on the social structure. It is necessary to recognize such changes early, as the new ideas, after having been analyzed by representatives of conventional paradigms, will diffuse throughout society, and - by new structured principles, views, and values - trigger change. Due to uncertainties regarding existing paradigms and invariants of diffusion support (Innovation attitude) the implementation of such change is possible. The diffusion theory includes empirically more or less secure rules for the diffusion of events, ideas, innovations. The infection effect in the spread of new forms of behavior in the focus of diffusion research, whose results are shown in structural curves (diffusion functions). They interpret distribution patterns, which were derived from empirical studies (Krystek & Müller-Stewens, 1993).

However, the detection of diffusion patterns is divided into three different types of infection. Innovations spread either by infection of a constant percentage of uninfected persons per unit of time or by exponential infection, where the new ideas are transmitted from subject to subject. Also, combinations of constant and exponential extending diffusions can be observed (Hammer, 1998). The benefit

of the practical application of diffusion functions as an early enlightenment concept lies in the time gain, which leads to a better adjustment to changes in the business environment.

It is possible to set limits on trend reactions earlier and to make better decisions and greatly reduce risk, especially in long-term investment projects. Trend lines, which are adapted to the situation, representing the designed diffusion functions, are based on several considerations. Changes do not run randomly, but represent development mechanisms and follow a distribution pattern. Special events (weak signals) are usually the trigger for changes. The recording of such signals can be improved by setting up a "corporate radar" (Hammer, 1998). With the systematic and continuous monitoring of risks and opportunities, strategic thinking can begin. The amplification of signals and their meanings, enable the planning and preparation of concrete measures, where failures and over-reactions can be avoided by timely warnings and adequate preparation and response times.

6.3.1.2 Trend Landscape

To be able to handle this flood of information, Liebl (1996) recommends using one of the well-known instruments for early detection: the generation of trend landscapes. This is especially helpful in relation to the processing of the information obtained through the scanning and monitoring. Herein the development of individual discovered trends should be checked for correlations and thematically combined or aggregated to curable trends (Schlüter, 2004). This combination of trends to form trend landscapes has several advantages as a result:

- the cognitive load can be manageable (Neubauer & Solomon, 1977)
- the flood of information leads quickly to clarifying failure (Wilensky, 1967)
- system relationships can be far better diagnosed in such sufficiently demarcated analysis units (Liebl, 1996).

The recovery of the trend landscapes can be accomplished for example with the help of the cross-impact analysis (Liebl, 1996). Here, various events of their

interactions will be examined and evaluated. The examined interdependencies especially include the effect of each on the probability of occurrence, the time period and the strength of the relationship. The individual factors will be assessed separately with 0 to 1 and listed in the form of a matrix so that these interactions can be evaluated quantitatively (Schlüter, 2004). Trends with high interdependence can then be combined to Trend Landscapes (Krystek & Müller-Stewens, 1993).

In this stage, the weak signals will be primarily located in the strategic relevant observation areas and there subsequently follows the diagnosis of the reasons in connection with sign specific effect prognosis (Krystek & Müller-Stewens, 1993). Based on the prognosis results, appropriate scenarios will be built (Hauff, 2010).

6.3.1.3 Scenario technique

The term "scenario" comes from Latin and means scene representation. Analogous to the situation created by stage and scenes giving a thematic outline to a play, so should scenarios create a framework for strategic planning (Götze, 1993). In general, a scenario represents a future situation and the development of the path from today into the future. The description of the general business-related scenario technique and its practical application varies in the literature. According to studies, it is used by more than 60% of the (surveyed) enterprises for forecasting (Koslowski, 1994). It has, therefore, despite former fierce criticism, gained ground as a strategic tool in practice. For the most plausible description of scenarios, the probabilities of relevant environmental developments are aggregated, using quantitative and qualitative data. This essential condition will be created to prepare for various future developments of the company. In order to answer the questions about the origin of a hypothetical situation and the respective alternatives progressively, different analysis, forecasting, creativity and brainstorming techniques are integrated into a stepped approach, whose main task is to convert collected strategic information into new knowledge and consistent alternatives. The resulting focus on key uncertainties, in scenario creation, usually leads to the indication of a trend scenario, which is a surprise-

free development by creating a positive and negative extreme scenario (contrast scenarios), by which it will be supplemented, shown in the figure below.

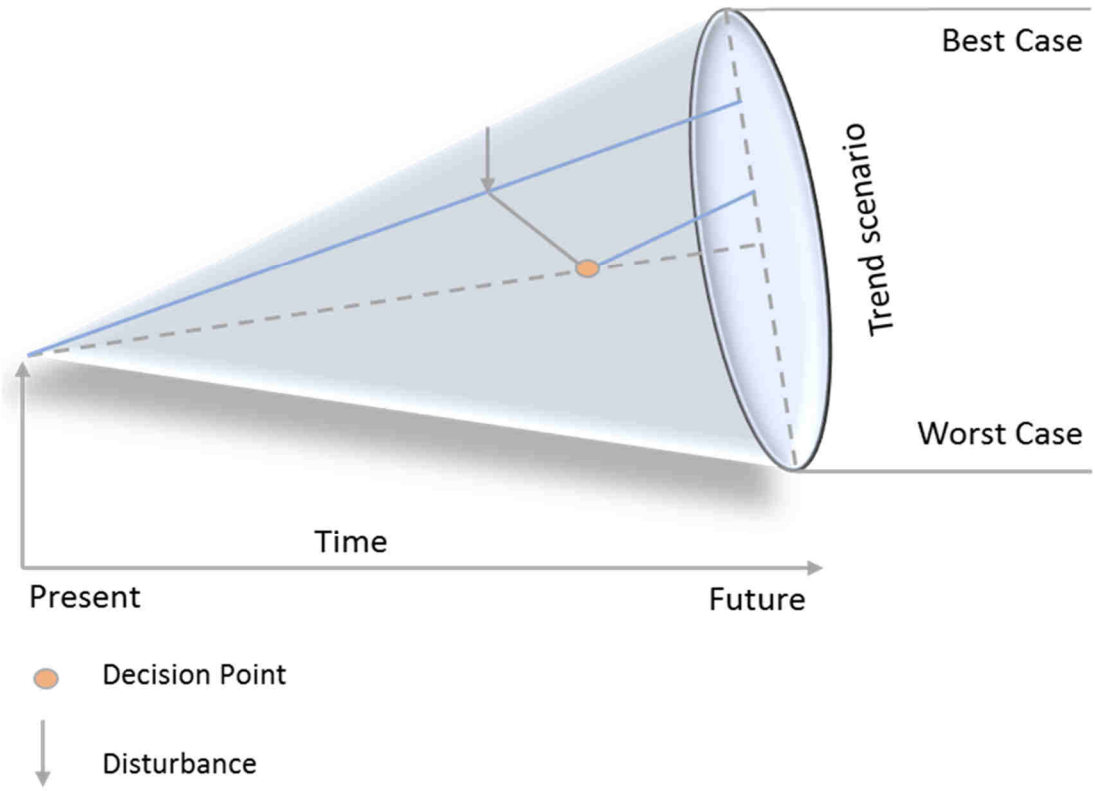

Figure 30 Scenario Funnel

Source: Krystek et al. (2007)

Opportunities and potential risks can be obtained through the recognition of factors and their mode of action on the development direction of the overall scenario. Thus objectives and problems can be discovered, existing plans checked and strategic alternatives developed, evaluated and decided (Götze, 1993). There are different, method-dependent approaches to creating a scenario. The multi-stage scenario process begins with the task analysis. Its aims and strategies of the company are evaluated and summarized in order to analyze the subject matter of the present situation. Basically operational potentials and risk moments are revealed for example by SWOT analysis, already explained, during the determination of organization context. In addition, an existing portfolio

analysis is well suited to represent the actual situation of the company in comparison with the competition. This is in line with the concept of Hammer (1998), where he recommends using it for the certainty of balance of strategic business units. This element will be explained in brief, as it will only be used in this model as an auxiliary tool for scenario analysis.

Portfolio Analysis

Portfolio Analysis of Boston Consulting Group is a systematic evaluation of company`s business units or their product lines by the two variables of Market Share and Market Growth based on the product life cycle. Depending on the Growth and Share the graph shows Stars, Question Marks, Cash Cows and Poor Dogs.

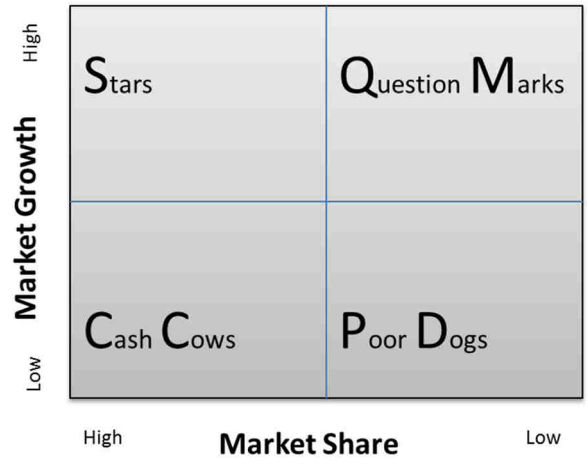

Figure 31 Portfolio-Analysis

Source: Hauser (1989)

This information is important for further scenario building as the analysis horizon. A specified period will be taken, one which is needed by the company for the development of an innovation, the necessary time for acquisition and launching on the market and also the period for a realization of the investment projects and diversification (Reibnitz, 1992). The task analysis also includes an initial estimate of the costs envisaged by scenario creation using cost-benefit analysis and priority analysis (Koslowski, 1994). Through the expert interview, relevant factors

in the local and neighboring systems are specified in the following impact analysis. Subsequent measurement and presentation of influences and their interdependencies in networking diagrams lead to statements about the system dynamics of the environment (Reibnitz, 1992). Based on the factors obtained, descriptive KPIs will be determined by trend projections. For further scenario development, critical descriptors with marked inconsistency are of particular importance. In addition, indicators with a low level of information that were previously classified as relevant, are important in terms of the early enlightenment in the environment development. For the purposes of monitoring, they will be observed and with the increase of information will be integrated into the scenario. Different developments of critical descriptors can lead to mutual gains or exclusions (Koslowski, 1994).

Cross Impact Analysis or cluster analysis allows the verification of various alternatives for consistency and logic (Götze, 1993). During the interpretation, the consistent adoption bundles with uncritical descriptors are supplemented, and the interaction evaluated. A likely, optimistic and pessimistic scenario is created. During a subsequent analysis after problem or opportunity fields' derivation, the necessity of action will be determined. The results serve as an orientation for future planning phases. External and internal, abruptly occurring disruption events (Hammer, 1998), which may not be unfavorable, but have a significant effect on the company, require the development of preventive and reactive measurements. The disruption event analysis designates such events and integrates them into the scenario. The identification of trend reversals, their entrance likelihood, timing, and significance are carried out by creative techniques or Discontinuity Survey.

The scenario transfer represents the interface with other decision-making tools. With its extension, during the construction of the scenario lessons learned in connection with a repeated check of the results, it is possible to develop a guiding strategy. By incorporating techniques from other scientific areas, the scenario technique meets the requirement of forecasting as a multi-paradigm research. It is used because of the variety of its analysis and interpretations as a basis for further design possibilities. Complex, internally consistent pictures of the future can be predicted, critical factors and their impact are highlighted. Scenarios allow

a conscious projection of discontinuities and simulation of effects and counter-strategies. Early identification of opportunities and threats is possible, so that action can be taken before the onset of disorders. The success of the scenario technique depends largely on the know-how and the selection of participants (Götze, 1994) and their information supply. By thinking and planning in alternatives, there is an awareness of the detection of weak signals and their detection by a high level of heterogeneity much more likely (Koslowski, 1994). However, obtaining results by this forecasting method, depending on the analysis of intensity and the presence of already-applied KPI, portfolio or other analytical instruments, is a relatively high personnel-, and time-consuming activity (Götze, 1993). This mostly corresponds with the existing concepts of Battelle Institute (1980) and Hammer (1998), where their recommendation, based on prognosis results, is to build scenarios, which will be compared with the strategic planning for sufficient deviation.

Comparison between the premises of the strategic planning and the sign specific scenario results

The premises from the sign specified scenario derived statement will be compared with strategic planning. Only if there is an adequate deviation between premises of the strategic planning and scenario results will the next step follow (Hauff, 2010).

Evaluation of the deviation determination

Before the search for alternative treatments, the relevance of weak signals and the urgency of possible action should be determined. If it does not show enough relevance for the development of the company, the process of the strategic early recognition can, at this point, be stopped or started with a new search for weak signals (Hauff, 2010).

6.3.1.4 Planning

After selection of the relevant discontinuity there follows under the direction of known planning techniques, the development of strategic alternative treatments for the handling of the imminent change (Hauff, 2010). It is important that the

company knows its strengths and weaknesses and plans accordingly. This should include business strategy, finance, investment and personal plans, as well as market and competition analysis, which should include risk analysis, observation of macroeconomic facts and product developments (Hinsch, 2014). Krystek (1987) adds that planning helps to rethink all possible events/developments with crisis potential in advance in order to react fast when a crisis occurs.

When planning, the organization shall consider the issues and determine the risks and opportunities to avoid undesirable effects (Ohligschläger & Below, 2015). “A plan prepared to take advantage of, or to minimize the effect of, an event which is considered to be unlikely to occur but which, if it did, would have a considerable impact on the organization's ability to achieve the objective” (Krystek, 1987, p. 132). Risk orientation is a task of top management (Hinsch, 2014) and has to be able to give assurance that the management system can achieve its intended result(s); enhance desirable effects; prevent, or reduce, undesired effects and achieve improvement (DIN EN ISO 9001, 2015).

"The organization shall determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the quality management system.

The organization shall consider:

a) The capabilities of, and constraints on, existing internal resources;

b) What needs to be obtained from external providers” (DIN EN ISO 9001, 2015, p. 25-26).

This especially includes People, Infrastructure, Environment for the operation of processes, Monitoring and Measuring Resources, Organizational Knowledge, Competence, Awareness, Communication and Documented Information (Tricker, 2014).

The adoption of a management system has to be a strategic decision for an organisation that can help to improve its overall performance and provide a sound basis for sustainable development initiatives, where the design and implementation will be influenced by its varying needs, objectives, products

provided, processes employed and the size and structure of that organisation (Tricker, 2014). Hinsch (2014) adds that the ISO requires the clear strategic position of an organization.

Strategic Management means that you make a plan for the future for about 5 to 10 years, where you set an aim. During this period things will be changed, such as markets, environment and so on (Fiedler, 2001). To be prepared and to be able to recognize these occurrences, the company has to have a working Strategic Management System, which should consider, after determination of the context, the identified sources of risk, areas of impacts, events, by including changes in circumstances, their causes and their potential consequences (Ruderer, 2009).

A successful leader has to know the company processes, constantly develop new goals, innovate, make sure that the organization is still true to its core values, and continues to nurture a culture that fosters continual learning (Frontiera & Leidl, 2012). This considers factors and criteria like customers, quantity and costs and time simultaneously (Seghezzi et al., 2007). All spheres from customer to employee to subcontractor should be taken into account by the support of appropriate tools.

6.3.1.5 Turtle Diagram

Turtle Diagram is a useful tool for describing, understanding and analyzing processes. This utilizes four legs to represent four questions about a process (with whom, with what, how, how many); and a head and tail to represent the questions about the process inputs (what should we receive) and the process outputs (what should we deliver to meet expectations); the shell of the turtle is used for the process name (Jaeger, 2016). It sensitizes people to interfaces, shows dependencies, transparency and determines measurements (TÜV, 2013). The gathered data is useful for risk identification and builds the basis for a systematic risk management (Benes & Groh, 2014). The consolidation of all risks from all processes can be used as the basis for a holistic risk management (TÜV, 2013). At the end is it appropriate to conduct an SWOT-Analysis for validation of

the process, which shows improvement opportunity at the same time (Hallbauer et al., 2015).

6.3.1.6 FMEA

Failure modes and effects analysis (FMEA), also known as failure modes, effects, and criticality analysis, is used to identify ways a process or product can fail to meet critical customer requirements (Foster, 2013). It is used to determine high-risk functions or product features based on the impact of a failure, where it systematically considers each component of a system, identifying, analyzing, and documenting the possible failure modes within a system and the effects of each failure on the system (Pyzdek & Keller, 2013).

Brühwiler (2003, p. 48) explains it in more detail, “This standard establishes requirements and procedures for performing a failure mode, effects, and criticality analysis (FMECA) to systematically evaluate and document by item failure mode analysis, the potential impact of each functional or hardware failure on mission success, personnel and system safety, system performance, maintainability, and maintenance requirements. Each potential failure is ranked by the severity of its effect so that appropriate corrective actions may be taken to eliminate or control the high-risk items". Ruderer (2009) adds that the FMEA concentrates more on the effect of the failure than the cause, where the aim is to avoid the potential failure during the development of a product or establishment of a process, which means it is also an appropriate tool for the food production industry.

FMEA is a preventative model, where it is important to recognize the failure as early as possible (Romeike & Hager, 2013). FMEA uses a nine-step process:

1) Assign an identifier to each component

2) List functions for each part

3) List one or two failure modes for each function

4) Describe effects of each failure mode

5) Determine hazard likelihood and categorize

6) Estimate likelihood of failure

7) Estimate failure detection

8) Identify highest risks

9) Eliminate or reduce highest risks (Foster, 2013).

The main problem during the risk management process is that the risks which will be not recognized, can also not be analyzed and managed, which could mean enormous harm for the company (Altstetter, 2008). Ellenbürger et al. (2009) recommend combining the tools according to the risk profile for maximized completeness of risk identification. Schmitz (2006) states that especially the FMEA and HACCP in combination for the food production industry have a wide range of method steps to build up self-control systems for risk control and risk monitoring, which should be analyzed individually for each company.

6.3.1.7 HACCP

“Hazard Analysis and Critical Control Point (HACCP) has been recognized internationally as a logical tool used in the food industry to identify potential food safety hazards so that preventive actions can be taken to mitigate the potential risks. The system continues to be used at all stages of the food supply chain” (Reuvid, 2013, p. 151). Petersen & Nüssel (2013) describe HACCP as a QM method, which consists of seven following principles:

- Procedure of a Hazard Analysis
- Determination of Critical Control Points
- Determination of Critical Limits
- Monitoring of Critical Control Points
- Determination of Corrective Actions
- Verification of the HACCP system
- Documentation

Ruderer (2009) adds that HACCP is an important tool in the food production industry for a systematic risk identification. Romeike & Hager (2013) go a step further and state that HACCP is a method which can save the food production industry and at the end protect the consumer.

“The aim of this step is to generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate or delay the achievement of objectives, where it is important to identify the risks associated with not pursuing an opportunity, as comprehensive identification is critical, because a risk that is not identified at this stage will not be included in further analysis” (ISO 31000, 2009, p. 17).

The principles I and II of COSO II are to identify all possible occurrences, without risk evaluation, which could have a positive or negative effect on the execution of strategy or achievement of objectives (Hillebrand, 2005). Identification should include risks whether or not their source is under the control of the organization, even though the risk source or cause may not be evident (Crönetz et al., 2009).

Risk identification should include an examination of the knock-on effects of particular consequences, including cascade and cumulative effects, where it has to sample all possible information about known and unknown risks and to summarize those (Altenähr et al., 2009). It should also identify what might happen, where it is necessary to consider all possible causes and scenarios that show what consequences can occur (Schmidt, 2015).

6.3.1.8 Fault Tree Analysis

Fault Tree Analysis (FTA) is a top-down, deductive failure analysis, which analyses all possible reasons for one undesired deviation (a major event), which by interrelation cause the disruption (Ruderer, 2009). Allenspach (2006) states that the FTA has the advantage that it also considers ‘soft facts', such as technology, people, etc. Ruderer (2009) adds that the deviation from qualitative to quantitative is also possible within this method. Brühwiler (2003), in contrast, states that FTA is a quantitative tool, which calculates the probability of occurrence of complex scenarios, when the connection of the event is known. He

adds that this method traces this event back to its root for the finding of reasons. "Fault tree analysis (FTA) is an analytical tool that graphically renders the combination of faults that lead to failure of a system" (Foster, 2013, p. 202). It is an appropriate tool for reliability and safety analysis (Marshall, 2012). Foster (2013) adds that the technique is useful for describing and assessing the events within a system. Romeike & Hager (2013) go a step further and state that fault tree analysis is an appropriate tool for simulation by which causes will be analyzed with the aim of producing a statement of liability, security, and availability. For the security of the analysis results, it is also possible to use the Delphi-Method (Löhr, 2010). In Hammer's (1998) third step there follows verification through objective and reasonable relevance, which is done by using a so-called discontinuity survey of experts (similar to Delphi Method) in terms of their assessment of a specific question. Müller & Zeiser (1980) add that, according to this survey, three aims should subsequently be reached: determination of the potential impact of potential changes, determination of the probability of the appearance of these and finally the assessment of the necessity and urgency of reaction strategies.

6.3.1.9 Delphi Method

This is a method of expert survey for creating quantitative forecasts, which has proved itself in the generation of forecast information and assessment of changed constellations and discontinuities. The basic concept refers to the generally better results in the structuring and analyzing of problems by a group of experts compared with individual assumptions (Götze, 1993). The experts estimate anonymously, via standardized questionnaire, future developments, both qualitatively and quantitatively. The consensus of opinion obtained at the end builds a basis for strategic planning (Koslowski, 1994). Carrying out the Delphi Method is performed by a so-called monitor group, which can include, in addition to corporate employees, consultants or market researchers, responsible for defining the problem domain, the preparation of questionnaires, the evaluation of results as well as providing additional information (Götze 1994).

The quality of the results depends primarily on the expertise of the respondents with respect to the subject area and method of application. A combination of in-house and external experts prevents operating and industry blindness. The scope and design of the questionnaire focus on the accuracy of the material and temporal classification of possible future events. The obtained data will be analyzed after the survey and aggregated to form a group judgment, where the quantitative results will be analyzed statistically, so that quartile margins, whose combined scattering, and outliers can be identified. Qualitative statements, in contrast, will be, as far possible without overlapping, combined to form homogeneous cluster class statement summaries, making the recognition of structures possible. In order to achieve a general consensus, by checking and possible modification of the method of taking statements, it repeatedly confronts experts with the statistical results (Götze, 1993).

The final qualitative and quantitative forecast arises from the answers with the greatest frequency distribution and the median of the last results (Koslowski, 1994). The Delphi Method fulfills the requirements of a process for early enlightenment. Trends and uncertainties in certain fields of research can be assessed realistically. Although the expert composition and questions contain a certain potential for manipulation, this method, through a structured, targeted approach and anonymity, is more effective than a group discussion (Götze, 1994).

By the flexible use of time and space, a greater number of expert interviews is possible, which leads to a wider resulting range of views. The isolated examination of the scope of duties, rigid approach and the individual discretion of issues, limit the creativity release and the possibilities of the collection of additional information and weak signals. The unsuitability of the median as a consensus opinion indicator and signal detection instrument (Götze, 1993), reinforces the importance of the review, discussion, and gathering of outside opinions. Despite the relatively high time and resource consumption, the Delphi Method with specific modifications supports the forecast function well and forms a solid basis for further analysis and forecasting instruments (Koslowski, 1994).

“If the opinion of one expert on an uncertain point is good, the opinion of many experts will be better” (Löhr, 2010, p. 86).

6.3.2 Summary of Risk Identification

For the reason that the risks should be identified as fully as possible, after the Diffusion Theory, Trend Landscape, Scenario Technique, Portfolio Analysis and Planning, follows the detail analysis by following tools: FMEA has the task of system components, TURTLE of processes, HACCP of critical points during the food industry, Fault Tree Analysis has the task of identification of a major event during risk management. Delphi Method, Check Sheets or creativity methods, such as Brainstorming or Brainwriting, can be used for supporting the above methods.

However, the main point here is to identify the correct problem (Crönetz et al., 2009), where the aim is not to identify all of the risks, but those which could endanger the company aim (Brühwiler, 2003). Ruf (2011) in contrast states that all possible risks should be identified and monitored. Allenspach (2006) adds that as many methods of risk identification as possible should be used for reduction of the blind spots.

Mayer (2008) in contrast refers to § 91 AktG and states that the risk identification includes only those risks which could endanger the substance of the company. Schäfer (2001) confirms this definition of § 91 AktG and adds that it would mean that only the avoidance of illiquidity or over-indebtedness is the aim. According to the German Law of §§ 17 – 19 InsO illiquidity, the threat of illiquidity or over-indebtedness means insolvency, which are the last stages of the development of the crisis process (Crone & Werner, 2012).

At the end the risk identification as a part of the EWS should also consider recognition of the crisis signs, which could arise very quickly by the oversight of one or more risks (Schäfer, 2001). An Early Warning System does not focus on the solution to the problems when they have already reached a certain level, but it should be possible to discover them early, before they have a disadvantageous impact on the company (März, 1983). “To finish first, you first must finish”

(Pocalyko, 2011, p. 1). Most companies don`t die because they are wrong; most die because they don`t commit themselves - they fritter away their valuable resources (Kautt, 2013).

6.4 Risk Monitoring and Review

According to ISO 31000 "*The organization's monitoring and review processes should encompass all aspects of the risk management process for the purpose of ensuring that controls are effective and efficient in both design and operation; obtaining further information to improve risk assessment; analyzing and learning lessons from events (including near-misses), changes, trends, successes and failures; detecting changes in the external and internal context, including changes to risk criteria and the risk itself which can require revision of risk treatments and priorities; and identifying emerging risks. Progress in implementing risk treatment plans provides a performance measure. The results can be incorporated into the organization's overall performance management, measurement and external and internal reporting activities. The results of monitoring and review should be recorded and externally and internally reported as appropriate, and should also be used as an input to the review of the risk management framework*" (ISO 31000, 2009, p. 20).

Hinsch (2014) explains it in a more pragmatic way when he states that the organization should monitor and review information about external and internal issues, which can include positive and negative factors or conditions for consideration or so-called risks and chances, which can influence the company. Brühwiler (2001) sums up with the explanation that the top management should review the organization's quality management system at planned intervals, as the risk management takes place between the poles of customer requirements and customer satisfaction which builds the landscape of monitoring and review, to ensure its continuing suitability, adequacy, effectiveness and alignment with the strategic direction of the organisation, which will be carried out in this model during the construct, by CO (BSC), described in Chapter 6 and indicated in figure 32 by number 3 and will be explained as a tool in more detail in this chapter.

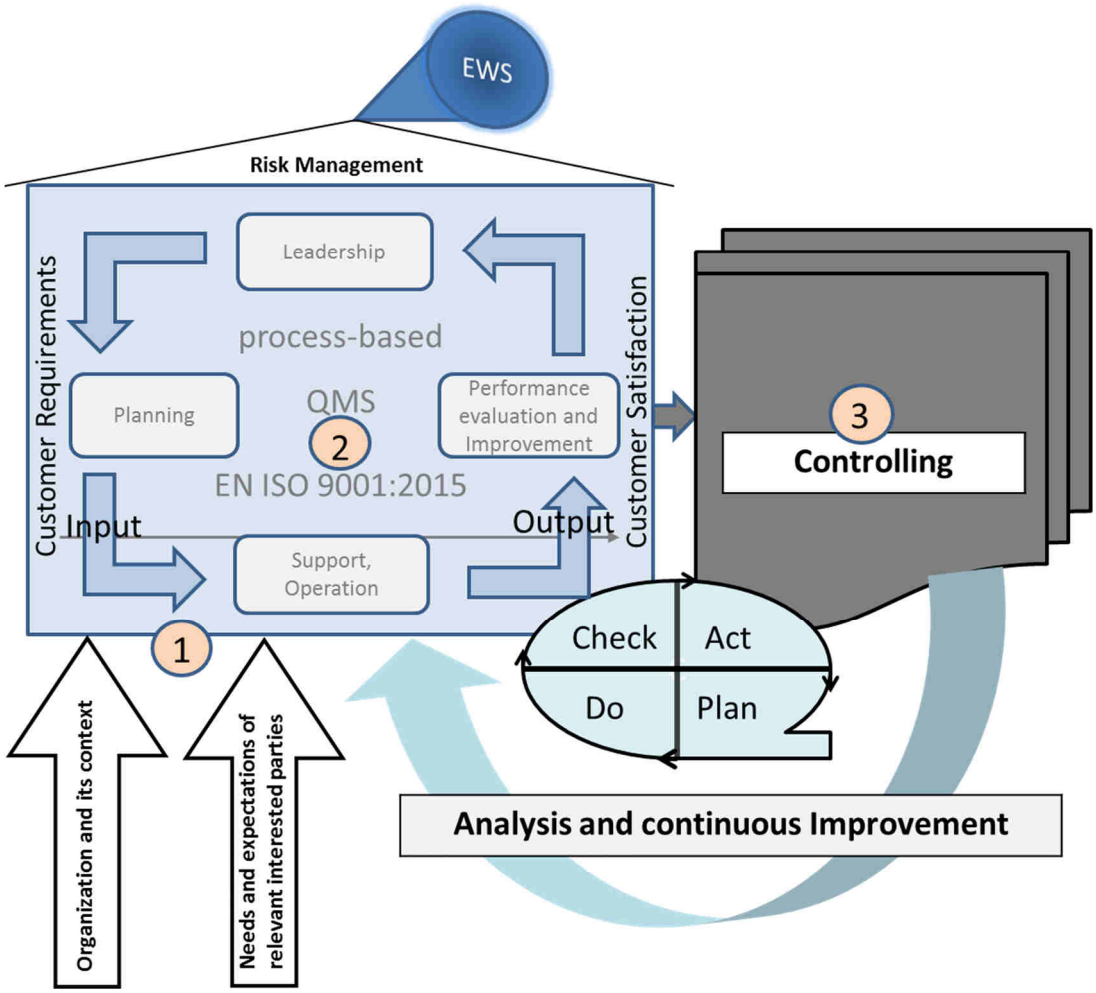

Figure 32 Methods for risk monitoring and review

Source: own illustration

6.4.1 Balanced Scorecard

Wolf (2010) states that BSC as CO tool is appropriate for monitoring and review and would accordingly fulfill the requirements mentioned above. He adds that the BSC is based on different characteristics by including the company strategy, overall view, connection of KPI's and perspectives by cause and effect, and would be appropriate as EWS. Brühwiler (2003) in contrast states that the BSC is not appropriate as "stand-alone" for an EWS, as it does not include the environment, and is more a target system, where the QM is a leading model, which describes

the important elements, processes and functions of a company by the determination of the organisation context, and together they can build the appropriateness for an EWS (Brühwiler, 2003).

However, the BSC was developed by Kaplan and Norton in the 90s, and moves away from the traditional one-dimensional structure by adding the Financial, Customer, Internal Business Process, as well as Learning and Growth, shown in the figure below, and combines Vision and Strategy with the Objectives, Measures, Targets and Initiatives (Weber & Schäffel, 2011).

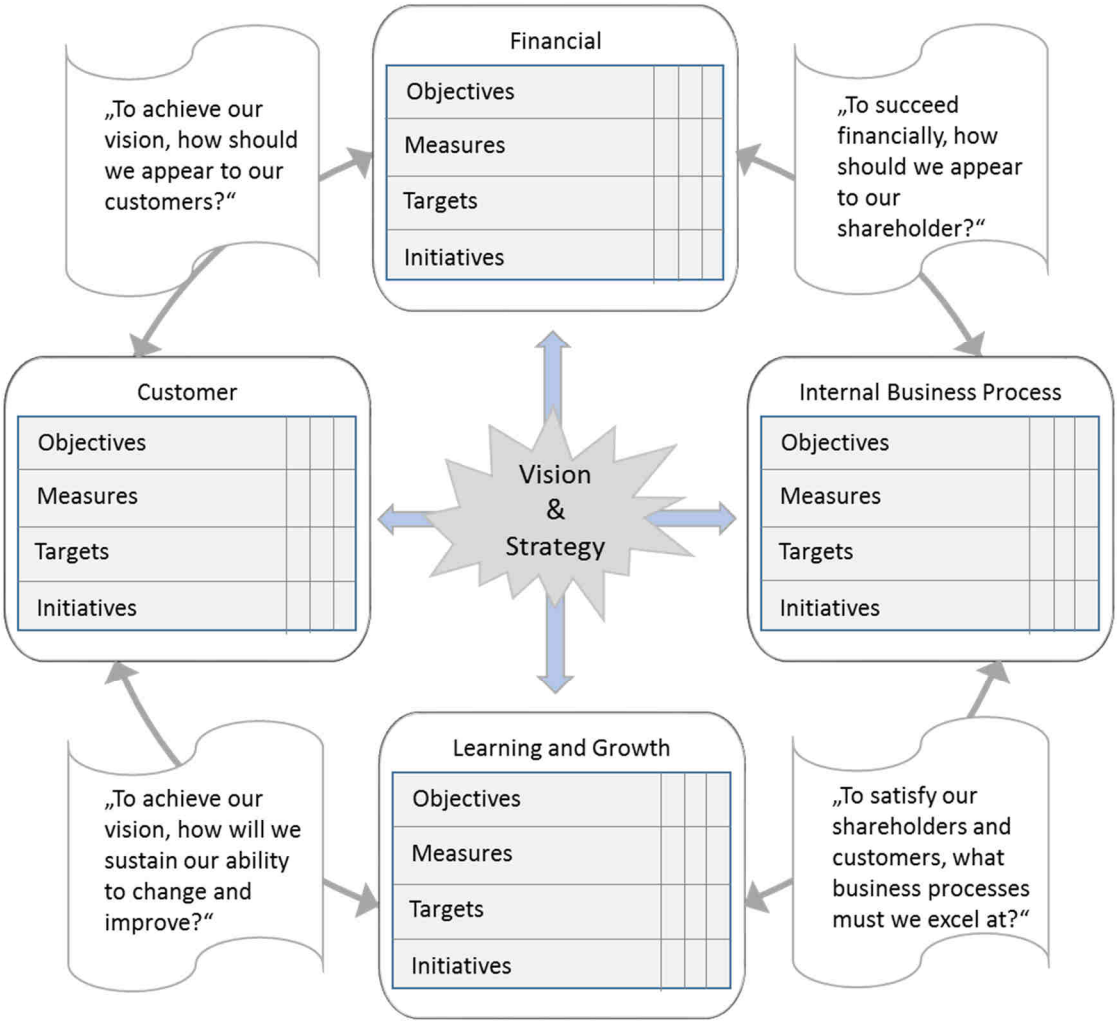

Figure 33 Balanced Scorecard

Source: own illustration, adapted from Kaplan & Norton (1996)

The BSC is a strategic tool, appropriate for designing the whole planning, monitoring, and control process, which combines the key performance indicators from the past with the future value drivers (Allenspach, 2006), measurable by Company Value = Shareholder, Market, Customer, People, Future Value (Töpfer, 2000). Schröder (2005) states that the BSC combines, in comparison with the Du-Pont-KPI concept (focusing only on KPI's), both the aims and KPIs. This means that in contrast to a traditional target agreement the BSC does not only focus on quantitative factors but also on qualitative, as the four stages, in the cause and effect networking as the previous design area also has to include the qualitative aims (Töpfer, 2000). Wolf (2010) adds that the conventional KPI-systems are past and figure/quantitative oriented, where the relation to the success process and company strategy is missing and the BSC in contrast, can be described as a link between strategy development and implementation in the operative business. This was described in the literature review within Concept of Hammer (1998) as a difficult point, without the naming of an appropriate tool.

Furthermore, Schröder (2005) denotes the BSC as an aim-, rather than a KPI-, system, where the qualitative aims play a big role, especially for risk management, where not all information is decision-based but can also be solely information-based. This means that all relevant risks have to be monitored and all possible changes to them should be recognized as early as possible (Altstetter, 2008). According to DIN EN ISO 9001 (2015, p. 9) "Risk-based thinking enables an organization to determine the factors that could cause its processes and its quality management system to deviate from the planned results, to put in place preventive controls to minimize negative effects and to make maximum use of opportunities as they arise". Reuvid (2013) states that the organization should establish procedures to monitor and measure the performance of the asset integrity management system, which should include qualitative and quantitative measurements: KPIs, audit findings, incident investigation, etc.

6.4.1.1 Extension of BSC

The Balanced Scorecard as a key performance indicator system combines the strategically significant result figures and performance drivers in four perspectives. These four perspectives, however, are not fixed. Thus, Kaplan and Norton expressly recommend providing an adjustment of the basic structure of the Balanced Scorecard according to corporate and strategic circumstances (Kaplan & Norton 1996). This means that, depending on the company size or structure, some further areas of the company could be important. These areas can be added to the existing BSC as a further perspective, but it is important to note that this should not become too granular, as otherwise the significance of the individual KPIs could lose value or the complexity of the BSC could increase - the choice of perspectives must be strongly geared to the formulated vision and strategy of the company. For example, each company is in close contact with credit institutions, but hopefully only a few of them have such strategic communication with the credit institution that it is necessary to work out key figures from a lender's perspective (Friedag & Schmidt, 2002).

The need for further perspectives is usually evident during the scanning phase or development of the company's vision and strategy, when the company will discover risks that are not covered by the four perspectives. However, examples of further perspectives could be:

- Supplier perspective
- Lending perspective
- Public Perspective
- Communication Perspective

6.4.1.2 Sustainability Scorecard

Another extension of the existing BSC could be the Sustainability Scorecard. In all sectors of the economy, a high value is now placed on sustainable trade and business. Also - or especially - in food production, this trend is gaining more and more weight, as more and more must be produced in less space and the

environment has to be protected. The sustainable and careful use of resources - both employees and the environment - is of essential importance. A food manufacturer, for example, is associated with ecological and social aspects of its products (ingredients, packaging) and production (production methods, suppliers, emissions, etc.) (Figge et al., 2001). A central task of corporate management is therefore the efficient handling of shortages.

In order to support appropriate decisions, a company's management generally establishes management systems. In addition to economic shortages, ecological and social scarcities are increasingly becoming part of management's activities. The overcoming of these three shortages is currently being discussed under the buzzword of sustainability (Nutzinger & Radke, 1995). Where companies voluntarily increase their environmental or social performance beyond the legally required minimum, image enhancements (which are difficult to monetarise) or similar competitive advantages are the major motivation. Environmental protection measures can also lead to cost reductions, especially in material- and energy-intensive sectors (Figge et al., 2001). Environmental management includes all systematic economic activities with the aim of an efficient reduction of the environmental impact (Schaltegger & Figge, 2000). The term "social management" means all measures that permit the efficient achievement of social goals. According to the 3-pillar concept, the concept of sustainability encompasses ecological, social and economic aspects (Nutzinger & Radke 1995).

Sustainability management would therefore include all activities that allow the achievement of sustainability goals, the achievement of environmental, social and economic goals. However, such a definition contradicts the current usage of the term "sustainability". In general parlance, sustainability today is understood primarily as its ecological and social aspects. We therefore refer to the management which aims at simultaneously achieving ecological, social and economic goals, as value-oriented sustainability management.

An integration of environmental and social aspects into the Balanced Scorecard offers the opportunity to manage environmental and social aspects in a value-oriented manner (Deegen, 2001). Thus, the Balanced Scorecard can be used for

identification and purposeful management of those environmental and social aspects that are complementary to the achievement of a company's economic goals. Through this integrative approach, such a Sustainability Balanced Scorecard meets the central requirement of the sustainability concept for a sustainable improvement of corporate performance in economic, ecological and social terms (Figge et al., 2001).

The special suitability of the Balanced Scorecard for value-oriented integration of all three sustainability dimensions results from the fact that the Balanced Scorecard extends the scope of success-related aspects beyond financial parameters. This also makes it possible to take into account non-monetarised and non-monetarisable as well as unquantified and non-quantifiable soft factors. Environmental and social aspects often point to these characteristics (Sepp, 1996). Interrelationships with the permanent success of a company can usually only be formulated qualitatively. It is, therefore, advisable to identify the environmental and social aspects relevant for economic success and to integrate them into the systematics of the Balanced Scorecard (Figge et al., 2001).

In principle, three options for integrating environmental and social aspects into the balanced scorecard are conceivable:

- Environmental and social aspects can be fully integrated into the existing four perspectives of the Balanced Scorecard and can be thus subsumed
- The Balanced Scorecard can be extended to include an additional perspective for the consideration of environmental and social aspects
- A special environmental and/or social scorecard can be derived

An additional separate perspective on the integration of environmental and social aspects should be introduced if these aspects explicitly constitute a strategic aspect of corporate performance.

However, according to Ruderer (2009) there follows, after risk identification, the determination, which is critical for the countable monitoring area, as well as the definition of the early warning indicators. The basic model for an indicator-oriented early recognition, outlined below, should be built to recognize patterns that predict an inadmissible risk that may take place in the future (Duckert, 2011).

6.4.1.3 Early Warning Indicators

The determination of an early warning indicator follows from the identification of risks/problems recognized as critical (Ruderer, 2009). For the use of early warning indicators, which are branch-, or company-, specific, the employees should be sensitized to the critical handling of recognized changes in the company and environment (Ruderer, 2009). Early warning indicators can be considered as diagnostic signs for the detection of hidden events, which could be various kinds of positive and negative trends or developments in the environment (Rothwell, 2010).

The following described approach will often be adopted in the research and literature and is also recognized/accepted in practice (Schlüter, 2004; Geissler, 1995). The determination of the organizational context, already explained in chapter 6.2, can be subdivided into different areas (external, intercompany and internal), followed by reasons/symptoms, indicators, and summarized in the table (Mischon, 1982). Ropega (2011) differentiates between reasons, which directly or indirectly evoke a phenomenon, and symptoms, which are the sign of a risk or of a beginning, as well as an already existing, crisis. Krystek (1987) adds the step of determination to the Early Warning Indicator for each monitoring area with required size and tolerances.

During the determination of the relevant indicators, the linking and networking of indicators should especially be considered (Gomez & Probst, 1997). Based on these causal chains, causes of opportunities and risks can be immediately identified (Schlüter, 2004). Krystek et al. (2007) point out that all indicator lists, which can be found in the literature, have only the character of a collective example, and emphasize the importance of individual intuition and personal experience in finding appropriate indicators (Hauff, 2010).

The chart below shows only a few possible indicators, which should be analyzed individually for each company.

External Pressure

Area	Reasons / Symptoms	Indicators
Economic cycle	Negative Development	Stock Index Money Quantity of Central Bank Planning and Building Permission International Economic Cycle (Levy-Livermore, 1995)
Structure crisis	Low Confidence in the Organization Bad Communication Lack of contribution for decision finding	Import Restrictions Trade and Payment Balance Sheet Consumer and Life Form (Tatje, 2001)
Political & Social Development	Health Policy Law Changes	Health Insurance System Unemployment Rate Social Climate Birth Rate Measure of Environment Protection Education and Qualification Standard (Wiedmann, 1984)

Table 10 External Pressure

Source: Compiled by author

The individual design of indicators should, as far as possible, also determine the time interval between the signal of the indicator and the signaled event in addition to the causal chains already mentioned (Krystek et al., 2007). The self-developed indicators should be reviewed for suitability based on relevance tests (Krystek & Müller-Stewens, 1993).

Besides the external area influence, the **intercompany scope** struggles with the company, which includes suppliers, customers, competitors and banks (Mischon, 1982), where the possible reasons and symptoms, with the indicators, will be summarized and shown in overview in the chart below.

Intercompany Scope

Area	Reasons / Symptoms	Indicators
Banks	Interest rate Exchange rate	Amount of money Savings rate Stock Exchange Prices Finance- and Money policy (Levy-Livermore, 1995)
Suppliers	Price Policy Conditions	Production capacity Creditworthiness of suppliers (Mischon, 1982)
Customers	Purchase behavior Demand volume Order-Quantity of Key Customer	Diversification of Key Customers IFO of Customers Business Policy of Key Customer (Krystek et al., 2007)
Competitors	Price Policy Program Policy	Market Share Research and Innovation Behavior of Competitors Marketing Activity (Wiedmann, 1984)

Table 11 Intercompany Scope

Source: Compiled by author

Ohligschläger & Below (2015) add that besides the customers, there are also people, owners, cooperation partners, society, occupational unions, and

associations. The ISO 9001:2015 also requires an understanding of the needs and expectations of interested parties, where "The organization shall monitor and review information about these interested parties and their relevant requirements" (DIN EN ISO 9001, 2015, p. 19). The company has to analyze the requirements and the expectations of the stakeholder and adjust their strategic plan according to the interested parties (Hinsch, 2014). Ohligschläger & Below (2015) add that the company has to monitor and review the information about the interested party.

In addition, the Information needed from **internal areas** should be searched for in the governance, organizational structure, roles and accountabilities; policies, objectives, and the strategies that are in place to achieve them; the capabilities, understood in terms of resources and knowledge (e.g. capital, time, people, processes, systems and technologies); information systems, information flows and decision-making processes (both formal and informal); relationships with, and perceptions and values of, internal stakeholders; the organization's culture; standards, guidelines and models adopted by the organisation; and form and extent of contractual relationships" (ISO 31000, 2009, p. 10). Understanding the internal context can also be facilitated by considering issues related to values and performance of the organization, which could be a combination of internal and external actors (DIN EN ISO 9001, 2015).

The **internal area**, shown below with the reasons/symptoms and indicators, will very often be ignored and not recognized as a crisis factor.

Internal Pressure

Area	Reasons / Symptoms	Indicators
Company management	Lack of Qualification / Skills Lack of Information feed Insufficient Knowledge of Leadership	Stubbornness (Mischon, 1982)
Company structure	Inefficient Marketing Complexity	Market Share Turnover Sales Trend Price and Costs Development
Resources / Supply	Focusing on one supplier	Resource Possibilities (Levy-Livermore, 1995)
Production	Old Products Delivery Delay High Claim Rate Lack of Product Variation	Product Mix Market-Share/Product Kind of Quality Degree of Efficiency for Engine (Krystek et al., 2007)
Sales	Market Share Decline Turnover Decline	Result/Area (Mischon, 1982)
Financial structure	Lack of Capital High-Interest Rate High Capital Commitment High Advance Payment	Working Capital Equity (Deppe, 1992)

Bookkeeping	Exact Collection of merchandise costs Neutral Revenue and Expense	Distorted Result (Müller & Müller, 2007)
Human Resources	Dependency of Employee Increase of Wages	Human Costs to Revenue Human Climate Number of Employees/Month (Wiedmann, 1984)

Table 12 Internal Area

Source: Compiled by author

An example of few additional internal indicators will be explained briefly:

New orders

This indicator is one of the oldest and most popular indicators. This provides an indication both regarding employment as well as the sales and earnings performance in future periods. Here, not only their own orders of interest but also of significant competitors, new orders from related parties or orders of so-called "Key industries" (Krystek et al., 2007).

Lead products

This indicator pulls information about sales and/or orders of relevant products from upstream and downstream production steps (Welter, 1979). This leads to the early recognition of the development for their own turnover/new orders and products (Krystek et al., 2007).

Employee-related indicators

In general, the employees contribute the highest proportion of a company's development. Significant changes can, with the help of indicators such as the labour turnover rate, status of employee's illness, absence and the incidence of general assemblies or discomfort, produce early information, so that any

downstream phenomena such as productivity reduction or fail, up to strike and plant occupations, can be counteracted (Krystek et al., 2007).

Furthermore, the crucial requirements for an indicator-based early detection are, according to Krystek et. al (2007) formulated as follows:

Earliness: The risks and chances must be received by the indicator sufficiently early so that there will be enough time for the planning and introduction of countermeasures. Furthermore, the foreknowledge of this, which should be constant, as far as possible, is of great importance.

Uniqueness: Changes or developments to be uniquely identified by the indicators in order to limit the danger of misinterpretation can be largely prevented and the loss of time for subsequent interpretation may be minimized or eliminated.

Completeness: The respective areas of observation of an indicator must each be fully covered.

Flexibility: indicators should be able to adapt, to a certain extent, to changes in their viewing area. This should be done as far as possible with the same efficiency of the statement.

Financial Defensibility: The acquisition and maintenance of an indicator are to be financially justifiable. This means that the information benefits of the indicator have to compensate this effort.

However, these selection criteria represent a maximum possible catalog, which cannot be met by all indicators used in practice (Krystek et al., 2007). Furthermore, after the determination of the early warning indicators, in order to implement a value-oriented management, control variables that drive the values of individual stakeholders need to be identified (Giebel, 2011). Töpfer (2000) distinguishes between value drivers, success factors, and value generators. Value drivers in this context are the internal reasons for customer-, and market-, based impact on the external success factors – both are operative and strategically focused- which are viewed together with the financial results (Giebel, 2011). The company never focuses on one aim alone but has to tie several aims together, beginning with the top strategic company aims by breaking them down

to the lowest level (Schröder, 2005). Töpfer (2000) describes the value drivers as Human Engagement, Customer Satisfaction, Cost Reduction, followed by Turnover, Cash Flow and Shareholder Value increase. Giebel (2011) adds that these value generators (internal/external) are elements which define the Free Cash Flow and, in the final analysis, the Shareholder Value.

6.4.1.4 Cause-and-Effect Relationships

In monitoring, it is not only important to observe and analyze the individual KPIs and their development, but also to be aware of the interactions of the KPIs. Some developments can already be explained quickly, because they are caused by the changes in one or more other KPIs. In order to own or build up this awareness, it is necessary for the established KPIs that have been worked out for the BSC to create a so-called Cause-and-Effect Map. This contains the information whereby KPI exerts an influence on one or more other KPIs (Gleißner, 2004). The Balanced Scorecard is not a loose collection of indicators in four perspectives. It should also ensure coherence between the perspectives. To this end, the perspectives are to be logically linked via cause-effect chains. This enables a better communication of the strategy and alignment of all company resources and activities with the implementation of the strategy. "The Balanced Scorecard provides a framework to describe and communicate strategy in a consistent and insightful way" (Kaplan & Norton 2001, p. 10).

The cause-effect chains clarify the causal assumptions of the chosen strategy. This allows two things: On the one hand, all corporate activities can be aligned with the strategy, and on the other hand, it can be checked early on whether the strategy is successfully translated (Kaplan & Norton 1996). Thus, the contribution also becomes softer, i.e. considering non-monetarisable and long-term success factors, transparent and controllable. The presentation of the interactions between the individual KPIs and the inclusion of risks or early warning indicators make it possible to examine deviations between the planned values of a key figure and the actually realised key figures ("actual values") for causes of deviations. This contributes decisively to an increase of acceptance to the responsible peoples. Experience has shown that the acceptance of a traditional

BSC suffers as a result of the fact that in the event of deviations from the plan, no distinction is made between factors that are attributable to the person responsible for the key figure and other (exogenous) disturbances (Gleißner, 2004).

Especially the external factors and their meaning have been mentioned and described in this thesis several times, but how should they be integrated into a BSC, as these are not KPIs that can be influenced? The described cause-effect chains help us here, as we can now create a representation - at least for the external factors with a quantitative character - which can be integrated into the BSC in analogy to the remaining perspectives and thus provide a cause or justification for a development when analyzing the actual KPI. However, it must be borne in mind that some of the indicators do not have an immediate, direct influence on the KPIs, but are subject to a certain lead time depending on the indicator.

Thus, the impact of individual indicators will only become "effective" several weeks or months after their observation to publication, to real GDP or to industrial production, as shown by the preliminary properties of various early warning indicators between 1992 and 2012 in the table below.

Preliminary properties of various early warning indicators between 1992 and 2012					
	Delay between publication and observation	Lead (-) and lag (+)			
		to real GDP		to industrial production	
	months	quarters	effective	months	effective
Ifo-business expectation	0	-1	-1	-3	-3
ZEW-Konjunkturerwartung	0	-3	-3	-8	-8
Early-Bird-Index	1	-3	-3	-8	-7

Table 13 Preliminary properties of various indicators between 1992 and 2012

Source: Rossen (2012)

These are few additional indicators to the chapter 6.4.1.3, which now will be explained briefly:

"Early Bird": This is a composite indicator, which has been developed by Commerzbank and the magazine "Wirtschaftswoche", which is published regularly. It includes not only the short-term real interest rate but also the so-called Purchasing Managers' Index (PMI), as well as indicators of price competitiveness (Krystek et al., 2007).

IFO indicator "business climate": This qualitative indicator is based on a large monthly survey, which expresses the expectations of participating companies in the survey for business development for the next 3 to 6 months (Nerb, 2001).

"ZEW-economic cycle expectation": This indicator is based on a survey that has been developed by the Mannheim Centre for European Economic Research (ZEW). Questioned here are 350 financial analysts and institutional investors in order to assess the current situation and the development of the next 6 months (Krystek et al., 2007).

Anyway, in the case of qualitative external factors (such as an embargo, for example), the effect cannot be (exactly) quantified, but also here causes or effects on parts of the BSC can be derived. Since risks, as well as earnings and growth perspectives, determine the value of a company to a large extent, risk ratios and individual risks must be consistently taken into account.

These are derived directly from the company's risk management system, which can be fully networked with the BSC. The risks are exactly the possible causes of deviations from the specified plan values of the scorecard. For each key figure of the scorecard, it has proven to be useful to consider which (exogenous) disturbance variables could trigger deviations from the plan. In this way, risks are automatically assigned to the key figures of the scorecard, which brings with it a link between corporate strategy and risk management (Gleißner, 2004).

In conclusion it could be said, that the advantage of the combination of QM and BSC, as described in chapter 6.1, lies in a holistic system of process building and result control and enables the company to monitor and measure much more purposefully, to establish the control criteria more holistically and makes it

possible to improve faster and more sustainably (Töpfer, 2000). The QM builds the infrastructure for the whole QMS and the BSC as a holistic Controlling, which focuses on strategy, planning figures and company development, subsequently translating the mostly qualitative information from QM into quantitative, meaning that the content result quality will be established and determined by BSC (Weber & Schäffel, 2011). Töpfer (2000) adds that the measurement results and performance indicators from the Quality Management will be transferred during the BSC into KPIs, which refer to all areas/perspectives, and enables the Quality Management to operationalize and make them more useful by score card. In conclusion, he ends with the explanation that QM measures to review and BSC reviews to improve, which means for the company that this combination only works when the combination of the components and criteria of QM and the indicators and measurements of the BSC is consistent and meaningful. The figures show the areas which need to be improved (Gehringer & Michel, 2000).

The following KPIs, which were described in the literature review as the most important (Nagel et al., 2013), are only given as an example, and have to be adjusted individually according to the requirements of the company.

6.4.1.5 Key Risk, Performance and Control Indicators

<u>Operating figures systems in procurement analysis</u>

Operating ratios in the evaluation of relative importance of procurement to an organization

Quota of good and material input = material input x 100 / turnover

Share of material costs = material cost x 100 / total cost

Purchase volumes = total value of purchase

Operating figures of economic efficiency

Purchase volume share = purchase volume x 100 / turnover

Procurement cost share = procurement costs x 100 / purchase volumes

Delivery cost share = delivery cost of a period x 100 / purchase volumes

Storage costs = purchase costs x 100 / average stock

P = price reduction of own selling price / reduction of cost price

Structural operating figures and framework ratios

Average purchase value by each supplier = total purchase volume / number of suppliers

Service level (%) = total number of satisfied need requirements / number of all need requirements

On schedule = total number of on schedule deliveries / total number of deliveries

Complaints quota = value of complaint supplies x 100 / total number of supplies

Rejection quota = number of rejected supplies x 100 / total number of supplies

Supply delay quota = number of late supplies x 100 / number of supplies

Average replacement quota = average time necessary for ordering and delivery + average delivery time + average check time, stocking time and retrieval time

Import share = imported materials x 100 / total sum of all materials

Average warehouse stock = (opening stock + closing stock) x 100 / 2

Turnover rate = cost of goods (goods turnover) / average warehouse stock

Operating figures in production analysis

Operating ratios in the evaluation of relative meaning of production for the company

Program spread = indicates a number of different products which are to be manufactured in a production period

Manufacturing depth = the extent to which adjoining production stages are established within a company

Manufacturing cost share = manufacturing costs x 100 / production cost

Material intensity = material costs x 100 / production costs

Salary share = direct labour costs x 100 / manufacturing costs

Production performance = actual output quantity of production pre-time unit, normally per day, on all products or for individual products

Operating ratios for economic efficiency

Production costs relation = current production costs / target production costs

Personnel costs share = personnel cost of production area / capital expenditure

Total performance per worker

On schedule delivery = number of on schedule deliveries x 100 / number of deliveries

Number of production disturbances

Variety of parts = number of required different types of materials needed in the production of a group of products or production program

Stock capital commitment = warehouse stock x calculated interest rate

Turnover rate = average turnover per period / average warehouse stock

Structural ratios and framework ratios

Structure of equipment' age = ∑ of age of all or specific equipment / number of machines

Number of installed machines of the same type in a production center

Fixed assets: absolute or average value of asset investments

Maintenance costs of all machines in a particular time frame

Maintenance costs of a machine per machine hour = maintenance costs per year / utilization period x operating time

Stock flexibility: degree of adaptability of available potentials

Development flexibility = degree of development flexibility of available potentials

Machine idle time = capacity – utility time

Share of idle time = production process conditioned idleness x 100 / total possible utilization time of the machine

Number and extent of production disruptions per year caused by machines

Extent of maintenance costs as a result of running the machines

Capacity utilization = real output quantity x 100 / maximal output quantity

Machine utility intensity = production quantity / number of machine hours

Level of training = number of unskilled workers x 100 / machine operating personnel

Control margin = number of staff members in production under a foreman

Effective work days per year on average

Overtime share = number of overtime x 100 / total work time

Average sick days per year

Training hours per worker

Improvement recommendations per worker

Waste quota = waste quantity of a position x 100 / total production quantity of a position

Number of different types of materials

Number of special form of energy = consumption of a particular form of energy / total energy consumption

Share of energy costs = energy costs x 100 / production costs

Manufacturing quality = quantity returned x 100 / total quantity manufactured

Average warehouse stock = (opening stock + closing stock) / 2

Material exploitation = used materials in products x 100 / total material input

Operating figure system in distribution analysis

Operating ratios of economic efficiency

Single-tier profit margin: turnover – variable costs = profit margin I – fixed costs = operating result (profit/loss)

Two-tier profit margin: turnover – variable costs = profit margin I – product fixed costs = profit margin II – general fixed costs = operating result (profit/loss)

Turnover rate of finished products = average turnover of an article / average warehouse stock of an article

Order processing costs = order processing costs / turnover

Average costs of customer processing

Distribution cost per order

Personnel efficiency = total turnover / average personnel population

Advertisement benefit = advertisement conditioned turnover / (profit margin – advertisement costs)

Order profitability = profit margin of an order x 100 / order volume

Order cost intensity = costs of the order x 100 / turnover with the order

Structural and scope operating ratios

Break-even-point = fix costs / (turnover – variable costs)

Break-even-point = fix costs / (1 – variable costs) / turnover

Turnover structure = part turnover x 100 / total turnover

Turnover structures relating to product groups = product group turnover of x dimension / total turnover of the product groups (x100)

Turnover main focus = product group turnover of customer groups / total turnover of customer groups (x100)

Customer turnover = total turnover / number of customers

Export quota = turnover in foreign markets / total turnover

Operating figures with reference to the sales object

Sales program = type and quantity of products which are to be sold in a certain period

Product program relation = sales program / production program

Market potential = the maximum absorption of a market concerning a certain product or a group of products

Sales potential = the maximum sales volume of a product or a group of products of an organization in a particular market

Market volume = the actual realized sales volume of an entire branch

Sales volume = the actual realized sales volume of an organization

Sales quota = sales volume x 100 / sales potential

Share of decrease in turnover = turnover decrements / turnover

Market share = turnover or sales of the company x 100 / turnover or sales of total market

Relative market share = market share of the company x 100 / market share of strongest rival

Degree of familiarity = positive feedback tempo x 100 / number of those interviewed

Share of new products = turnover with new products x 100 / total turnover

Product profitability = profit margin of the product / total profit margin

Share of product turnover = turnover of a product / total turnover

Operating figures with reference to sales activities

Preparedness to deliver = total sum of immediately delivered demands / total sum of demanded products (x100)

Order entry for each article group

Orders development = actual order entries x 100 / order entries of comparable period

Order range = order stock in days / daily production

Average order size = turnover x 100 / number of orders

Average delivery time

Complaint quota = value or number of complaints x 100 / value of number of total deliveries

Complaint structure = value or number of certain complaints / value or number of all complaints (x100)

Intensity of sales promotion = input into sales promotion / product turnover

Advertisement benefits = advertisement input / product turnover

Degree of exhaustion of area = number of customers in a region x 100 / number of customer of a possible region

Rebate intensity = turnover decrement in monetary unit / part turnover (x100)

Service intensity = number of customers x 100 / number of service personnel

Operating ratios with reference to customers

Share of customers = number of customers of a specific customer group / total number of customers (x100)

Customer index = number of customers in the examined period / number of customers in base period (x100)

Customer profitability = profit margin / customer turnover (x100)

Operating figures for financial analysis

Investment ratios

Capital constitution = fixed assets x 100 / current assets

Investment intensity = fixed assets x 100 / total assets

Intensity of current asset = current assets / total assets (x100)

Analysis of investment policy

Investment quota = net investment in tangible assets / opening stock of tangible assets (x100)

Investment coverage = amortization on tangible assets / additions to tangible assets (x100)

Rate of amortization = amortization on tangible assets / closing stock of tangible assets (x100)

Turnover-related investment analysis

This ratio examines the relationships between asset and turnovers of a company:

Plant utilization = turnover / tangible assets (x100)

Supply inventory = stocks / turnover (x100)

Turnover rate of fixed assets = (amortization of fixed assets + asset disposals) / average stock of fixed assets (x100)

Turnover rate of current assets = turnover / average stock of current assets

Turnover rate of total assets = turnover / total assets (x100)

Whereby the average stock = (opening stock + closing stock) / 2

Duration of claims = average stock in goods claims x 100 / turnover

Financing ratios

Analyzing financing structure

Own capital quota = own capital / total capital (x100)

Strain co-efficiency = credit capital / total capital (x100)

Statistical debt to equity ratio =credit capital / own capital (x100)

Dynamic debt to equity ratio = credit capital / cash flow (x100)

Reserve quota = reserves / total capital (x100)

Analysis of the duration of financing

Supplier credit duration = average number of creditors / stock receipt (x360)

Duration of bill credit = average number of bill credit debt / stock receipt (x360)

Duration of debt redemption = (credit capital – available funds) / year's cash-flow

Liquidity ratios

Statistical liquidity analysis

Coverage degree A = own capital x 100 / fixed assets

Coverage degree B = (own capital + long term credit capital) / fixed assets (x100)

Coverage degree C = (own capital + long term credit capital) / (fixed assets + long term committed current assets) (x100)

Liquidity first degree (cash liquidity) = means of payment / short-term commitments

Liquidity second degree (short term liquidity) = (means of payment + short term claims) / short-term commitments

Liquidity third degree (medium term liquidity, working capital ratio) = (means of payment + short term claims + stocks) / short-term commitments

Working capital = + current assets (assets convertible to cash within a year) – short-term commitments

Dynamic liquidity analysis

Cash flow

+retained profits + newly accumulated reserve funds + amortization + flat rate value adjustments = Cash flow in the strict sense

+Year profit or loss – accumulated profits (profit brought forward) + accumulated deficit (deficit carried forward) + reserve allocation – release of reserve + increase in long-term provisions – release of long-term provisions + amortization and adjustment of value of fixed assets and participations – appreciations + extra

ordinary, operative expenses in other accounting periods – extra ordinary, operative incomes in other accounting periods = Cash flow in broader sense

Cash flow statement

Source of funds
+allocation in reserve (compulsory reserves, reserves for own shares, statutory reserves, other profit reserves) – withdrawals from reserves + amortization on fixed assets + amortization on participations + increment of initial capital (capital stock) + rise in long-term commitments + rise in medium-term commitments + increment of provisions (reserves) + reduced warehouse stock = Total sum of available funds

Profitability indices

Profit oriented profitability indices

Return on equity = profit / own capital (x100)

Overall capital profitability = (profit + interests on credit capital) / (own capital + credit capital) (x100)

Turnover profitability = profit / turnover (x100) or = orderly operating results / turnover (x100)

Return on investment or the DuPont Operating ratio system:

1) Turnover profitability = profit / turnover
2) Capital turnover = turnover / capital
3) ROI = profit / capital

Cash flow oriented profitability ratios

Own capital profitability = cash flow / own capital (x100)

Overall capital profitability = cash flow / (own capital + credit capital) (x100)

Turnover profitability = cash flow / turnover (x100)

Results ratios

Personnel intensity = personnel expenses / total expenses (x100)

Material intensity = material expenses / total expenses (x100)

Turnover predominance = turnover x 100 / total returns

Miscellaneous operating figures

+Turnover + increment of stock of finished and unfinished products – decrement of stock of finished and unfinished products + self-produced machines, equipment = Total performance + miscellaneous returns = Company performance – expenses on raw materials and utilities – external aggregates – services = Gross additional value created – amortization = Additional value created (Net additional value created)

Shareholder Value = Value of the company – Credit capital (external capital)

Operating figure system for the analysis of technological potentials

R&D – Potential

Number of employees in the R&D (division)

Qualification of R&D staff

Fluctuation rate

R&D division = retiring staff members (R&D) / average number of staff members (R&D) (x100)

Number of hours for further training of employees in the R&D division

Extent of running costs of R&D division, classified according to individual technologies or products or product groups

Extent of investment costs in the R&D division

Employee contribution = employees in the R&D division / total number of employees (x100)

Research intensity = investment in R&D / year's turnover (x100)

Innovation strength = working hours of R&D staff on new development, further development and care of assortment

Creativity of staff or R&D

Number of introduced ideas (in total, per staff, per team)

Number of actualized ideas (in total, per staff, per team)

Number of attempted models or prototypes

Number of actualized prototypes

Number of patents

Success ratios

Innovation rate = share of turnover of new and improved products in % (products younger than five years)

Share of profit of new and improved products in %

Earnings from sale of patents

Received license fees

Success of R&D activities = finished products x 100 / begun projects

Time to market = development duration of new products unit they appear on the market (in months)

Operating figure system for personnel analysis

Personnel requirement and structure

Personnel intensity = personnel costs / turnover (x100)

Net personnel requirement is estimated as follows: +gross personnel requirement – personnel stock at period t0 + departing/retirements – confirmed new personnel

Capacity utilization = work volume (required working hours) / working hours (available hours per worker)

Qualification structure = number of workers with certain qualification / total number of workers (x100)

Average age of personnel (years) = total sum of ages of the personnel / average age of the personnel

Degree of personnel provision = actual number employed / required number of workers (x100)

Employee based productivity

Turnover per staff

Profit per staff

Additional wealth generation by staff

Personnel input

Performance index = observed current performance / normal performance (x100)

Overtime rate = overtime / normal working hours (x100)

Management spread = 1 / number of personnel

Rate of idle time = time at work place without working / available time (x100)

Staff contentment

Number of relocation requests per department

Fluctuation rate = number of voluntary retirements per year / average number of employees (x100)

Average duration of membership in a company (years) = total sum of duration of membership in the company / total number of personnel

Rate of absence = number off missed work days in a year / number of possible working days in a year (x100)

Motivation and competence development

Suggestions for improvement rate = submitted improvement suggestions / total number of workers in annual average (x100)

Intensity of further training = total number of further training days / total number of employees (training time)

Qualification structure

Content and boundary of the terms economic efficiency, productivity, profitability and return on investment

Principle of economic efficiency

Economic efficiency = output / input

Economic efficiency = return / expenditure

The Principle of productivity

Productivity = performance quantity (output) / resources (output) or output quantity / resources

Labor productivity = performance / quantitative labor input

Material resource productivity = performance / quantitative material input

Principle of profitability

Profitability = profit / capital (x100)

Return on equity = profit / equity capital (x100)

Total capital profitability = (profit + interest on credit capital) / total capital

Return on investment (ROI)

ROI = turnover profitability x capital turnover x 100 (Nagel et al., 2013).

6.4.1.6 Monitoring of the defined Indicators and KPIs

Specifying the tolerances of each indicator according to the target value

To be able to recognize the deviation from the target value, which should be determined and defined during the first step, the areas where the indicator is allowed to move without triggering a signal must now be defined. Once the indicator leaves the upper or lower tolerance range, a signal is triggered (Hauff, 2010). In addition to the warning area, an area identified as critical for survival can be set with a higher priority. As shown in the figure 34, could it be done as

visualization by a traffic light for each area/perspective during the BSC as a Manager Cockpit (Gehringer & Michel, 2000). It shows the connection and visualization during the BSC (Schelz & Seidel, 2011) of some KPIs (Return on Investment, Cash flow, On schedule delivery, Share of idle time, Customer index, Market share, Suggestions for improvement rate, Training hours per worker), which were described in chapter 6.4.1.5.

Figure 34 BSC as Manager Cockpit

Source: own illustration

The determining of all values must be done extremely carefully. If the limits are set too tightly, a high incidence of partly unnecessary signals will occur. If the limits are, in contrast, set too wide, the company runs the risk of receiving no warning signals or of getting them too late (Schlüter, 2004).

Nomination of observers

Once all observation areas, indicators, and limits have been set, the indicator values must be observed and followed. To this end, employees must be nominated who, part-time and with the least possible expenditure of time, pursue the development of the indicator values of their work environment and file reports, as soon as the tolerance limits have been exceeded or fallen below (Krystek et al., 2007). However, this means, consequently, that the success of an early warning system depends, not insignificantly, on the motivation and commitment, as well as the qualification, of the employees (Hauff, 2010).

Definition of tasks of information processing sites

Next, the task which information processing bodies must perform, the so-called peripheral (sensor) units of observers and headquarters are defined (Schlüter, 2004)

An approximate summary of these tasks is as follows (Hauff, 2010):

- Receiving, downloading and checking of incoming signals
- Conducting plausibility checks
- Impact analysis
- Initiation of appropriate strategies and measures

The first point is usually the observer's task, the central office is responsible for the other three tasks (Schlüter, 2004).

Configuration of information channels

Finally, all remaining lines of communication for the acquisition, processing, and dissemination of early information must be set up (Geissler, 1995). The target is a flow which is a flow of information between the business environment, the early warning system and the companies that can be guaranteed to be present in a

smoother, more comprehensive and complete way (Hauff, 2010). This includes the design of information exchange between observer and central office in the form of channels of communication and the reporting frequency (Krystek et al., 2007).

Far-sighted corporate management requires early information so that the company's management has a larger field of action for crisis-prevention or opportunity tackling (Jacob, 1986). The CEO has to set up appropriate reporting obligations for the responsible divisions, which include all major risks and elements of risk management and amendments thereto (Schmidt, 2015). "What is even more important is that, in addition to developing such measures, they be a part of the reports that reach top management so that awareness is created at the highest level" (Gopinath, 2005, p. 26). Hinsch (2014) explains it in more detail, where he says that the PDCA cycle begins with the Input as Customer Requirements and ends with the Output as Customer Satisfaction; here the Input is planned (Plan) by the Resource Management, Production (Do) by the value-added process and the Monitoring, Measurement, and Analysis of process performance (Check) of Customer Satisfaction, where the top management has to take action (Act) resulting from awareness.

In summary it can be said that the increase of the company value is only possible by the interrelation of Shareholder Value, Market, Customer, People and Future Value (Töpfer, 2000). Gleißner (2004) adds that the BSC shows value drivers such as the market, people and process perspective, which influence the turnover, costs (effective for payment) and finally the company value is determined by Free Cash Flow, which will be discounted by WACC (weighted average cost of capital) depending on risk. Wolf (2010) confirms that for value-oriented management it is important to have a holistic view by including Risk Management and the development of value drivers, which are measurable by DCF (Discounted Cash Flow). A value-oriented management requires a deliberate reflection of strategic and operative risks, which helps to make realistic decisions, increasing the competitiveness and the company value (Gleißner & Meier, 2001).

However, Meier (2007) states that no method exists which displays the complete process; in conclusion, this means that the single methods (here: tools) can be used as modules/components for the whole process.

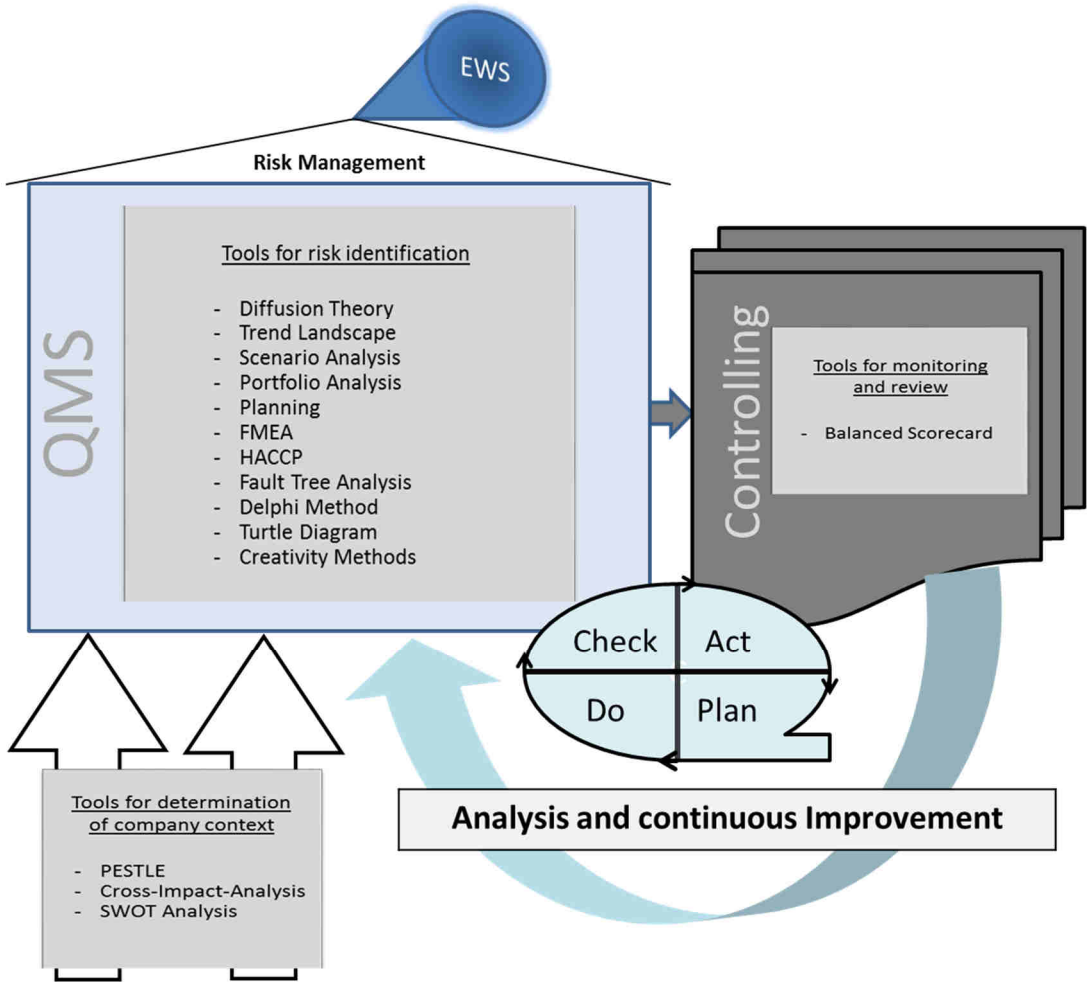

Figure 35 Tools overview during QMS & CO

Source: own illustration

The appropriate tools, as shown in figure 35 above, for ‘determination of context' (PESTLE, Cross-Impact-Analysis, SWOT Analysis) and ‘risk identification' (Creativity Methods, Planning, Diffusion Theory, Trend Landscape, Scenario, FMEA, Delphi-Method, Fault Tree Analysis, HACCP, Turtle Diagram) which were already shown and explained above and at the end the BSC as ‘risk monitoring

and review' tool builds, by using the QMS as basis, a holistic EWS for German food production SMEs. Töpfer (2000) adds that the advantage of this multi-level, networked with regards to content-integration, approach is that the risks will be recognized on time and are controllable according to the formulated aims.

According to the literature review and interviews, no EWS software, appropriate for SMEs exists. The recommendation is, in general, to use Office applications (Ruderer, 2009), such as Excel, Visio, etc., as named by an interviewee. This EWS approach was developed by the writer on the basis of literature/interview, own logical approach and then validated by the informal exchange of ideas with experts. From the experience of company practice, and also derivable from the research, it seems that there does not exist a perfect tool, as all tools contain "fuzziness" due to the measurements of soft (qualitative) factors, which are very important for company success, but much more difficult to measure than the hard (quantitative) factors (Töpfer, 2000).

The implementation in practice begins with the leadership giving information about the introduction of BSC through human interaction (Töpfer, 2000).

7 Phase III: Case Study approach

The previous phases, including a systematic literature review and semi-structured interviews, helped to identify best-practice elements for the development of an EWS. In the present Phase III two case studies have been used in order to confirm or disconfirm the identified best-practice elements. The relevant findings were used as a template with which to confirm, disconfirm or refine the empirical results by the case studies.

The advantage of case study is that the researchers test or explore theories of real-life situations (Kumar, 2011). Gerring states that a natural advantage of a case study research is the exploratory nature, which “is all about ‘casing’ – defining the topic, including the hypothesis of primary interest, the outcome, and the set of cases that offer relevant information vis-à-vis the hypothesis” (Gerring, 2009, p. 41). "Gathering information through face-to-face contact with individuals goes back many years" (Zikmund, 2010, p. 209), where a case study researcher should be able to ask good questions, to be a good listener, adaptive, flexible, unbiased by preconceived notions, must have a firm grasp of the issues being studied and bring high ethical standards to the research (Yin, 2014).

"Listening, therefore, goes beyond the mere hearing of spoken words and requires an intuitive understanding of the interviewee`s actual meaning" (Ng & Coakes, 2014, p. 64). In sum, it is important to have enough theoretical knowledge and to be a good listener in order to be able to handle the challenge in a case study.

However, the bounding of the case, which is important to determine the scope of data collection (Quinlan, 2011), was realized by the knowledge-gain of two Food Production Companies. From this, I obtained answers to research question from experts' practical experience for practical appropriateness.

7.1 Phase III: Case Studies

Two studies were used in Phase III to confirm and refine best-practice elements for EWSs (Yin, 2014). The two studies were within two separate and independent medium-size companies. The first study was in a company, which is specialized

in food production industry for fruits and vegetables, and the second study within an organization, which is also active in the food production industry, this time for milk products. The studies involved three semi-structured interviews per study of the senior management of relevant functions: quality, controlling and the general management. German was used both for the interview questions and interviews themselves, as German is the corporate language within these companies.

The EWS approach was developed during the Phase II by the writer on the basis of literature/interview, own logical approach and then validated by the informal exchange of ideas with experts. The development was based on the findings from Literature Review and for practicable development of the final EWS approach, with the help of CO and QM experts, best-practice CO and QM tools, appropriate for an EWS within the food production industry, were explored. The developed model was shown to the companies with the aim of analyzing the appropriateness of implementation and use in SMEs of best-practice elements designed by experts and literature review.

The responses of the interviewees in the face-to-face interviews were recorded by writing, as the audio recording was unwelcome. The notes were made by the interviewer, which were read to the interviewees after each answer for verification. This approach was shown during the interview to the participants, where the answers from Phase III were used subsequently for confirmation and refining of the EWS for practical appropriateness in Phase IV.

7.2 Expert Interviews within the Case Study

The following main results for the practical use of an EWS in the Food Production Industry were given by the CO, QM and General Managers (Interview answers from Phase III):

7.2.1 EWS-Existing in the company

All interviewees agreed that EWSs are definitely an important topic in the Food Production Industry. Ruderer (2009) shares this view by stating that EWSs are information tools, which have the aim of recognizing the negative development at

an early stage so that the company has enough time for the reaction before the damage sets in. *The thirteenth interviewee pointed out the following regulations:*

EG 178/2002 *(general principles and requirements of food law, establishing the European Food Safety Authority and procedures for food safety), which takes the following factors into account:*

- *The normal conditions under which food is used by the consumer;*
- *Information provided to the consumer;*
- *The effect on health, in the short and long term;*
- *Cumulative toxic effects;*
- *Specific sensitivities of certain consumer groups, for example, children.*

EG 2073/2005 *(microbiological criteria for foodstuffs), which lays down the microbiological criteria for certain micro-organisms and the implementing rules to be complied with by food business operators when implementing the general and specific hygiene measures.*

LFGB *(Lebensmittel- Bedarfsgegenstände- und Futtermittelgesetzbuch ➔ German Code on consumer items and animal feed).*

This builds the framework for the evaluation of food and further proceedings during a company's Crisis Management, which is a part of the HACCP concept. All participants confirmed that Crisis Prevention occurs by fundamentals of HACCP, where all manufacturing processes are regularly verified. This is in line with the literature review by Romeike & Hager (2013) and their statement that HACCP is a method which aims to save the food production industry and in the end to protect the consumer.

The tenth interviewee added that it helps to prevent large-scale disease by the improvement of information on, and thus prevention of, health hazards that are causally attributable to food consumption. Reuvid (2013, p. 151) agrees with this opinion, as shown by the statement "HACCP has been recognized internationally as a logical tool used in the food industry to identify potential food safety hazards so that preventive actions can be taken to mitigate the potential risks. The system continues to be used at all stages of the food supply chain". *To be able, in both a*

timely and complete way, to protect the health of consumers, the company has to get warnings on prominent food and possibly product recalls of dangerous food. This view is also confirmed by the literature review, where it is stated that the information about risk coming from different sources should be combined to form a holistic system (Brühwiler, 2001). The work of Ruderer (2009) where he emphasises early stage recognition in order to give ample time for reaction is also pertinent, together with Hampton's (2009 p. 63) comments on the use of a risk dashboard, as stated previously.

7.2.2 Tools use for EWS

HACCP, Planning, ERP were named by the ninth, tenth and thirteenth participant. The HACCP and Planning as tools for EWS were also named by the literature review authors such as Ruderer, 2009; Reuvid, 2013 and Romeike & Hager, 2013 (HACCP), as well as Hauff, 2010; Krystek, 1987 and Ohligschläger & Below, 2015 (Planning). The ERP could be seen as confirmed by Dahm & Haindl (2001), where they state, that whatever the aim of the single system is, the company has to be able to tailor the framework to their needs.

7.2.3 Satisfaction with current tools

All interviewees agreed that EWSs should be holistic (strategic and operational) and practicable – the current tools focusing either on QM or to CO. Several authors also pointed out the need for a more holistic approach (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015).

The eleventh interviewee added that the system could bring together more additional information, such as market information, which would help to check the direction in which the values go for a quick response. This generally corresponded with the literature review of Bedenik et al. (2012, p. 672) and the statement "The role of EWSs as an instrument for crisis aversion is in: revealing weak signals, transferring important information about environmental changes, prevention of business crisis, and constructing a creative base for timely and appropriate response." Löhneysen (1982) states that an EWS should identify both

internal and external dangers at an early stage. The operative EWSs are based on KPIs relating to past performance, and the strategic EWSs predict the future development of market, competitors, and company by supplementing each other (Berndt, et al., 2011).

7.2.4 Critical interfaces

All participants confirmed that a standard tool or software for SMEs does not exist and so this obliges companies to utilize self-made solutions. This matches the findings during the literature review, that the recommendation is, in general, to use Office applications (Ruderer, 2009), such as Excel, Visio, etc., as no EWS software, appropriate for SMEs, exists. *They added that the company has to bring the strategy, performance, and operational, financial, economic area more closely together, to be more future-oriented, which is sometimes not easy.*

7.2.5 Used tools for communication and cooperation of involved party

All interviewees agreed that Meetings, E-Mail, and Phone are used for communication concerning this topic. The literature review in general shares the view of Kelders (1996) that it is important to have appropriate processes for information search.

7.2.6 Medium for obtaining of information for the company's protection

The eighth, twelfth and thirteenth participant named Articles and Meetings as an appropriate medium for obtaining information for the company. The literature review names journals, books, radio, TV, Internet, blogs or social media as the source for the location and recognition of relatively weak signs (Trustorff, 2012). Rocha-Lona et al. (2013) recommend during the selection criteria process not only to evaluate whether the selected tools are needed, but also whether the SMEs have the required resources and capabilities for their implementation.

7.2.7 Information process provided for the external company protection

The thirteenth participant indicated that the Crisis Management System describes the process of communication. This generally corresponds to the literature review, where Donnersmarck & Schatz (1999) state that it is important to focus on organizational communicative aspects, where all relevant factors have to be identified and dealt with. *The EWS is designed for internal and external stakeholders with different reports, based on central systems. The twelfth interviewee added that some processes are extended to external suppliers and their value-added processes; other risks, barriers to trade or from natural disasters are checked and adapted if necessary.* Hauser (1989) shares this view and states that the company has to fix both the external and internal areas of monitoring and, for each area, there should be developed an indicator that sends a signal every time access changes. Kirschkamp (2007, p. 13) states that “A holistic view is used where all relevant factors and their interdependencies have to be identified and dealt with”.

The eight participants summed up with the explanation that data is prepared in accordance with demand, especially in small businesses. This corresponds with the literature, where the CEO has to set up appropriate reporting obligations for the responsible divisions, which include all major risks and elements of risk management and amendments thereto (Schmidt, 2015). *The eight participant added, that the top management is interested in liquidity figures, etc.* This view is confirmed by the literature, that far-sighted corporate management requires early information so that the company's management has a larger field of action for crisis-prevention or opportunity tackling (Jacob, 1986). "What is even more important is that, in addition to developing such measures, they be a part of the reports that reach top management so that awareness is created at the highest level" (Gopinath, 2005, p. 26).

At this point, the developed EWS was presented

7.2.8 Critical comments on the developed EWS

All interviewees agreed that EWSs should be not too complex. This matches the statement of Kelders (1996) that the information search process of a company has to be realistic, clear and simple. *They added that EWS has to fulfill the claim of providing the possibility of reacting to information quickly, which means that the analysis of the information should be easy to handle.* "In the SME sector, the company's crisis identification is specific because of the nature of SME business management which creates the strong dependability of business results on human resources and environmental factors" (Kurschus et al., 2015, p. 152). Furthermore, the information search and information processing expenditure is enormous, so that it is not manageable for SMEs for the reason of lack of sufficient technological and human resources, in comparison to big companies, to overview the whole area (Schlüter, 2004). The management has to start with the company policy and strategic plan, reducing complexity, so that the exploration of information could be found close to the symptoms, without an endless search for alternative problems (Kelders, 1996). *The thirteenth participant indicated that some tools demonstrated require a certain knowledge, which is often not available in SMEs.* This is in line with the literature review where Rocha-Lona et al. (2013) recommend during the selection criteria process not only to evaluate whether the selected tools are needed, but also whether the SMEs have the required resources and capabilities for the implementation. The literature reveals that "Board members, CEOs, and divisional directors are the main users of early warning systems, while the lack of experts for gathering and analysis of indicators, as well as the absence of management initiatives, are the crucial reasons for deficiency in early warning systems implementation" (Bedenik et al., 2012, p. 672).

7.2.9 Additional requirements for the developed EWS according to the requirements of the Turnaround Consultants (see Phase I)

Additional requirements for the Phase I, which were already named by Turnaround Consultants, Interim Managers and Lectures, and shown to other interviewees, were not named.

7.2.10 Realizable constellation of this system in praxis

All interviewees indicated that all business areas have to be monitored. The literature reveals that the Scanning and Monitoring should include the micro and macro environment (Trustorff, 2012). *The necessary risk indicators must be identified, properly selected and analyzed, which could be done by an integrated financial Controlling system.* Krystek et al. (2007) explain that early warning indicators have to fulfill some demand and demonstrate the following attributes; singularity, completeness, timely availability of information and economic justification. *The internal and external risks for all business processes and relevant support processes must be taken into account, which could be done by QM and GM. However, the whole thing will need effective and efficient communication to internal and external areas.* This generally corresponds to the literature review, that especially during the SMEs, the management has to start with the company policy and strategic plan, reducing complexity, so that the exploration of information could be found close to the symptoms, without an endless search for alternative problems (Kelders, 1996).

7.2.11 Measurable risk criteria, which should be integrated into this system

All participants agreed that all risks, which could be of danger for the company should be included. This is in line with the literature review by Schmidt (2015) that the risk identification should include all risks which need to be considered during the decision-making process by management.

7.2.12 Additional benefit for the company through use of this EWS

The benefits of the use were named by the interviewees especially in a holistic EWS by the inclusion of external and internal, strategic and operational, qualitative and quantitative, factors. These main points were also shown during the Phase I as requirements which an EWS in the Food Production Industry has to fulfill, by Literature Review, Turnaround experts, Interim Managers and Lecturers, where the EWS should help recognize risks in a timely fashion and prevent them at an early stage, to be holistic (strategic and operational) and

practicable, future-oriented, include quantitative (hard) and qualitative (soft) factors, be able to monitor all business areas, consider internal and external factors and it should be designed for internal and external stakeholders with different reports.

7.2.13 Additional effort, which participants have to bear for the system use

All participants agreed that the management should take the responsibility for the use and suitability of an EWS. According to theory, Brühwiler (2001) states that the CEO is responsible for the risk management, which is the first step in any process or, to be precise, a management process. According to COSO II, the management has the responsibility for identifying all external and internal risks which could have an effect on the strategy or company aim (Hillebrand, 2005). Monitoring is not a backroom function but instead an active process involving managers at all levels who share an awareness of the risks that the organization faces by providing them with necessary organizational flexibility (Bedenik et al., 2012). *The eighteenth participant indicated that some additional education of some users would be needed.* This is in line with the literature review, that often SMEs lack of sufficient technological and human resources, in comparison to big companies (Schlüter, 2004). *It should be a top management information system – monitored by management.* The literature indicates that the CEO has to set up appropriate reporting obligations for the responsible division (Schmidt, 2015). "The purpose of the early warning systems is to indicate all the possible changes in the earliest crisis phase, in order for management to have enough time to consider reactive activities and to provide the largest possible number of measures available for countering the crisis, which increase the manager's sensitivity to changes" (Bedenik et al., 2012, p. 675).

7.2.14 Aspects, which could make the use of this system difficult in praxis

The thirteenth interviewee pointed out that the beginning of early risk recognition lies rather in an attitude question and a question of open communication, of a readiness to scrutinize existing things of the importance of critical discussion throughout the company, which is often missing, especially in SMEs. This

generally corresponds to the literature review by Ruderer (2009) that a modern EWS does not only predict as early as possible the future development but is also an entry point for critical discussion of cause and effect relationships, where the employees have continuously to deal with changes occurring in the company environment. *The thirteenth interviewee added that this system requires a background of knowledge or methods, where the responsibility for the suitability of an EWS is definitely a management matter, which is often questionable.* The literature reveals that "Board members, CEOs, and divisional directors are the main users of early warning systems, while the lack of experts for gathering and analysis of indicators, as well as the absence of management initiatives, are the crucial reasons for deficiency in early warning systems implementation" (Bedenik et al., 2012, p. 672). Kurschus et al. (2015) add that ”In the SME sector the company’s crisis identification is specific because of the nature of SME business management which creates the strong dependability of business results on human resources and environmental factors“.

7.2.15 Increased assurance of the company survival

All participants claimed that the (working) world is becoming increasingly complex: inconstant, uncertain, ambiguous and complex environment and the only way to respond to such developments in good time, without trying to dominate the uncertainty, is to recognize risks in a timely fashion and prevent them at an early stage. This is consistent with past studies. In his study, Abebe (2012) defines environmental scanning as "the managerial activity of learning about events and trends in the organization's environment". “The purpose of the early warning systems is to indicate all the possible changes in the earliest crisis phase, in order for management to have enough time to consider reactive activities and to provide the largest possible number of measures available for countering the crisis, which increase the manager’s sensitivity to changes” (Bedenik et al., 2012, p. 675). Pedler & Abbott (2013) describe the connecting of feelings and lived experience with awareness of our ‘theory-in-use’ as ‘thinking on one’s feet’ by reflection-in-action that builds new understandings which inform our actions in evolving situations. "This provides a basis for future action and generates new or modified ideas in the process" (Reynolds, 1998, p. 186). *All*

interviewees agreed that EWSs help to detect crises and counter them in order to control early, which increases the possibility of protecting assets and, in the end, of securing jobs. This is in line with the literature review and Hampton (2009) where he states that good risk information can be used to develop early warning systems that alert an organization to potentially dangerous situations. *The eighth interviewee indicated that EWSs have to meet the requirements of risk management and help to connect to the future through information sampling.* This view is also shared by Bedenik et al. (2012, p. 672) in the explanation that "Indicators and EWSs are becoming more important as they can predict possible future changes in their early stages and thereby reduce the time needed to make adequate decisions".

The interviewees of the last validation round confirmed that the developed EWS approach is appropriate as a holistic model by including qualitative and quantitative tools, for risk/crisis identification, as well as for monitoring and review of them. The interviewees recognized that this EWS could lead to better communication and in the end help to connect to the future through information sampling, which helps recognize risks/crises earlier.

The gain of internal and external information was named by interviewees as confirmation of the suitability of daily use for this EWS. The demonstrated tools of the EWS were also confirmed, except for a few comments, as appropriate for practical use during this topic.

8 Phase IV: Refining

Phase IV is the last of four phases and deals with the Refinement of best practices in the respective categories. For the purpose of analysis and confirmation, the interview protocols were transcribed and categorized. Thus the research so far has identified the following best practice elements and aspects in the respective industry, which were also confirmed by the case studies:

- PESTLE
- SWOT Analysis
- Planning
- FMEA
- HACCP
- Turtle Diagram
- Fault Tree Analysis (FTA)
- Creativity methods
- Balanced Scorecard (BSC)

As Yin (2009) recommended further investigation and refinement of best practices, subsequently, the aggregated results of the interviews were integrated into the corresponding model by analysis consideration of the theoretical basis and recognition with the statements from the practice. For this reason, the technical, financial, organizational, and operational sight were taken into account. At the end, this approach enables the verification of a practicable EWS, which was compared, validated and now refined appropriately by suggestion for implication as follows:

Practical appropriateness from a technical point of view

For the practical use of the EWS it is necessary to fulfill some technical requirements. The use of the tools is Microsoft-based, where an interface to the company software/ERP and to the internet is necessary, which should be no problem nowadays. All participants should have access to the system. Besides

the technical restrictions, it is important that the participants are motivated for open and cooperative teamwork. In conclusion, the EWS is basically appropriate, from a technical point of view, for practical use.

Practical appropriateness from an organizational point of view

According to figure 14, it is fundamental that an interface to QM and CO systems exists. For the introduction of the EWS in a company it is important to consider the company culture and common understanding. In summary, according to the interviews, the appropriateness from an organizational point of view can be confirmed.

Operational capability of the tools

In general, it can be said that the developed tools are appropriate as best-practice for use during the EWS.

Practical appropriateness from a financial point of view

As the EWS is Microsoft-Office based, the writer assumes that most companies fulfill the requirements for it and that no further investment would be necessary.

The developed EWS could not, due to the time constraints, be tried/implemented in practice. For this reason, it is not possible to say with 100% guarantee, whether the approach is workable in practice. From the literature and interviews, it was possible to ensure the practical basis of the EWS approach, and this can be used for further research of validation. The possibility of new factors arising cannot be excluded and, in this case, those new factors should be taken into account by modification of the approach.

9 Conclusion

This chapter provides a conclusion from the findings generated in this thesis and provides an overview of the contributions arise from this research, limitations of this thesis, as well as possibilities for further research.

9.1 Summary and Discussion of the Results

The aim of this thesis was to develop a holistic EWS approach for the food production industry. It starts with the initial literature review to capture both the theoretical and empirical aspects of this topic, which makes explicit the philosophical stance taken in the development of the early warning system. It considers the development stages of EWS in the Business Economics literature, forms of appearance, followed by the description of different models and finishing with the EWS approaches. In addition, it includes a synthesis section, which demonstrates to what extent there is agreement between workers and to what extent there is disagreement, summarized in a table with key literature sources and the contributions they have made. Finally, the literature review finishes with an indication of what gaps in knowledge exist and which of these gaps this work aims to fill. This is summarized during a conceptual framework developed from the results of the literature review, where the research questions and objectives can be shown with regard to what they specifically address. The first research question and research objective aim to establish requirements for a successful EWS and added knowledge on the objectives with regard to having a framework for EWS building. The second research question and objective address points about knowledge creation on the best-practice CO & QM tools and the appropriate combination of them. The last question and objective analyse the practical and integrative approach, which builds a contribution to practice. This is displayed in Figure 36.

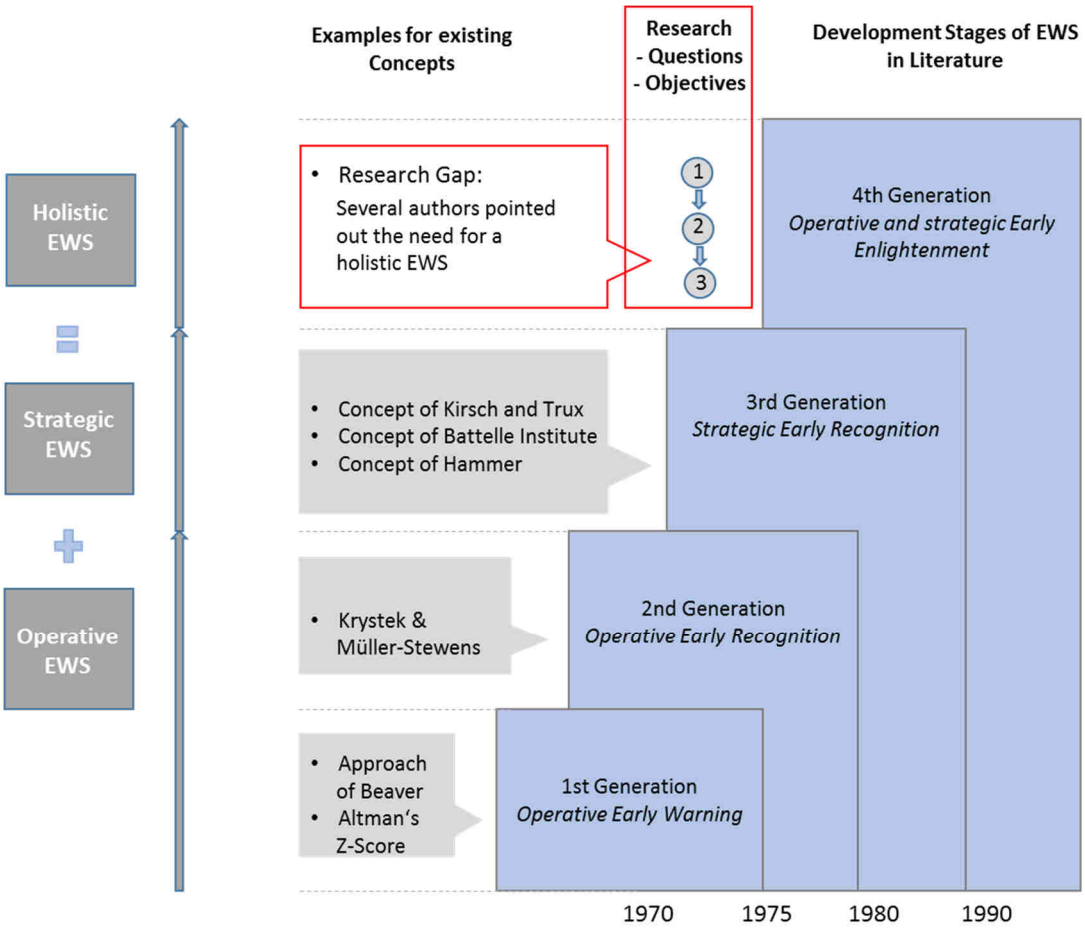

Figure 36 Conceptual framework - context of the research questions and objectives

Source: own illustration

This structured literature review on this given topic, the identified specific need for research in this area as well as the connections between topics displayed as shown in Figure 36 thereby demonstrate the first contributions of this thesis to knowledge and practice.

However, based on the literature and the resulting gap in research, three research questions were deduced:

1) What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround/interim managers?

2) Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production

industry and how they can be combined to form an integrated framework?

3) Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

To answer these research questions theoretical and empirical analysis were conducted, where the research was split into 4 phases, which was developed sequentially. Each phase, however, uses semi-structured interviews as its core data generation mechanism. Such an approach to interviewing enabled me to address the complexities of the topic through conversation with experts and at the end reach the objectives. It will be systematically shown how in turn each of the research objectives was met.

For the answering of the research questions, the most important results will be summarized and discussed.

1) What are the requirements for a successful early warning system (EWS) with respect to company crisis in SMEs within the food production industry, as identified by turnaround / interim managers?

Besides the requirements found during the literature review, which also formed the structure of the interviews, the results from both sources were defined and categorized, followed by the development of the following unified listing.

Requirements, which an EWS in the Food Production Industry has to fulfill, identified the following main points by the Turnaround experts which also comply with the literature review:

EWSs should:

- help recognize risks in a timely fashion and prevent them at an early stage
- be holistic (strategic and operational) and practicable, so not too complex
- be future-oriented
- include quantitative (hard) and qualitative (soft) factors
- monitor all business areas

- consider internal and external factors
- be a top management information system – monitored by management
- be designed for internal and external stakeholders with different reports
- match characteristics of the company (culture, structure, size and type of management)
- be under the responsibility of the management with reference to its suitability

The **1st research objective** was to identify the requirements for EWSs in SMEs in the food production industry. This was first addressed during the first phase in Chapter Four with the identification of requirements for a successful EWS from literature review. To be able to meet this research objective, besides the requirements found during the literature review, which also helped to form the structure of the interviews, three turnaround/interim management experts participated in semi-structured interviews. This method generated rich data, which were exploratory in nature. As DIN EN ISO 9001:2015 only came in in October 2015 and mandates a risk - oriented quality management system, this research required an approach that is able to explore tools that might have been not considered as relevant, or important, previously. Issues that emerged from the interviews were also examined within the literature (Yin, 2014). The requirements for EWS, as a result, were defined and categorized, compared these to those identified in the literature and developed a unified listing drawing on both sources, which was shown to the interviewee during Phase II for answering the second question.

2) Which controlling (CO) and quality management (QM) tools are appropriate for a successful EWS for SMEs in the food production industry and how can they be combined to form an integrated framework?

The toolkit of CO and QM is very large, and it was necessary, with the help of two CO and QM experts, to identify these tools most appropriate for EWSs, which match the requirements identified by turnaround/interim management experts and literature review. In chapter five, during the second phase, the unified list of

the requirements from phase one, which was the starting point for the third stage of literature review and also for the semi-structured interview, was shown to the interviewees before interview. It was important to explore CO and QM tools not only from the literature but also from the empirical view as best-practice with the help of two CO and two QM experts, independent of the case companies, appropriate for recognizing risk factors of company failure and matching the requirements of a successful EWS. Here, too, were the findings from both sources defined, categorized, compared and unified for the subsequent development of an EWS.

Before the tools are shown, the following comment from an interviewee should be noted:

The beginning of early risk recognition lies rather in an attitude question and a question of open communication, of readiness to scrutinize existing things, and in the importance of critical discussion inside the company. The tools can only help to support when the company has an appropriate framework for them. Employees must be sensitized to an openness of critical discussion by cause and effect relationships. Employees continuously have to deal with changes occurring in the company environment. This all requires analysis or understanding of the new situation, and this knowledge, especially in SMEs, is often lacking. Companies should pay attention to communication and information policy, wherein the risk policy of the company should be written. The tools can help identify, describe and control the risk, but the employees should be able to use the tools and to notice signs, coming from the company and environment.

As a result, the following tools were classified as 'best-practice-elements' by the interview of CO & QM experts (integrated framework of this tools is shown in chapter 7):

- *PESTLE is a model which adds to the environmental analysis and considers the political, economic, social, technological, legal and ethical (or environmental) risks faced by the organization.*
- *SWOT is helpful for a company to understand their Strengths and Weaknesses, to be ready to grasp the Opportunities and overcome the Threats.*

- *Planning helps to rethink all possible events/developments with crisis potential in advance in order to react fast when a crisis arrive.*
- *FMEA is used to identify ways a process or product can fail to meet critical customer requirements.*
- *TURTLE analyses processes by recognition of their weaknesses, effectiveness, and efficiency, as well as the interfaces and their dependencies.*
- *HACCP is used in the food industry to identify potential food safety hazards so that preventive actions can be taken to mitigate the potential risks.*
- *Fault Tree Analysis is a failure analysis, which analysis all possible reasons for an undesired deviation (a major event), which by interrelation cause the disruption.*
- *Creativity methods, such as Brainstorming or Brainwriting can be used for supporting the above methods, by data-gathering.*
- *BSC is a strategic tool appropriate for designing the whole planning, monitoring, and control process, which combines the key performance indicators from the past with future value drivers.*

The interviewees also pointed out that

In the end, the CEO must have a Management Cockpit, which delivers him an overview of the whole company, where environment information is included and enables him to make appropriate decisions as well as react to changes in time. The internal and external risks for all business processes and relevant support processes must be taken into account, and efficient communication to internal and external areas should be ensured.

However, the **2nd research objective** was to combine the explored CO and QM tools appropriate for an EWS for a German food production to a holistic approach. To meet the second objective, the aggregated results from the literature and interviews were integrated into the corresponding chapter 6, where a holistic EWS was developed by the combination of the tools. The development approach

was divided into 3 stages: determination of the context, followed by risk identification and finished by risk monitoring and review. The EWS approach was developed by the writer on the basis of literature/interview, own logical approach and then validated by the informal exchange of ideas with experts. Each stage shows the recommended best-practice tools, which were explored by the CO and QM experts, and also tools additionally found in literature, by an explanation of their uses and aims.

3) Which tools can be used to anticipate and define a potential company crisis in SMEs in the food production industry?

For answering the third research question, the developed model was shown to the companies during the Case Study with the aim of analyzing the appropriateness of implementation and use in SMEs.

The **3rd research objective** was to analyze implementation issues and considerations relevant to EWS tools in the food production SME context. For this reason, two Case Studies were used within two separate and independent medium-size companies. The first study was in a company, which is specialized in food production industry for fruit and vegetables. The second study was within an organization, which is also active in the food production industry, this time for milk products. The studies involved three semi-structured interviews per study of the senior management of relevant functions: quality, controlling and general management.

The interviewees of the last validation round confirmed that the developed EWS approach is appropriate as a holistic model by including qualitative and quantitative tools, for risk/crisis identification, as well as for monitoring and review of them. However, the following comments from the interviewees should be taken into consideration:

Whatever the tools of any system are, the company has to be able to tailor the framework to their own needs. The most important goal for this system should be an overview of the whole area.

Finally, after confirmation for practical appropriateness of the developed EWS approach by case studies, the model was refined, and a recommendation for

implementation was described. The recommendation implementation takes into consideration the financial, organizational, operational and technical aspects.

9.2 Limitations

The research limitations within the context of the current study refer to the aspects that have not been completely attained or were only achieved to a certain extent. Overall the current study is constructed from strong evidence including literature review, interviews, and case studies.

The first level of limitations is created by the research philosophy, i.e. constructivism; research methodology, i.e. inductive, qualitative, multiple case study research. This means that the development of the EWS approach was based on the literature review and interviewees with different professional backgrounds, such as Tunaround Consultant, Imterim Managers, Lecturer, Interim Management Advisor, Controlling, Controlling Advisor, Business Manager for Competence Center Controlling, DIN EN ISO 9001 ff./ HACCP lead Auditor, DIN EN ISO 9001:2015 Advisor. Furthermore, two Case Studies with professionals from Controlling, Quality Management and General Management departments, were involved. These results provide a baseline that can be utilized for this purpose, however, it is limited to the named professional area. To interview even a wider circle of professionals, such as e.g. bank or tax consultants, who are also involved in risk or early warning areas, but only limited to a very narrow sector, would possibly contribute additional/different content.

Based on the outlined problem, this work, according to the described sector and requirements, delivers a model of a holistic EWS integrating both a QM and CO tools for food production SMEs. For this reason, the results of this research are only applicable to the defined sector; any transfer to other industries requires further investigation. This could be done by further research, such as Case Study or Action Research e. g., where developed EWS approach could be analysed and refined for further branches, large or internationally-active companies.

Furthermore, the EWS has not been implemented and tested within an SME environment to find out how effective it is in practice. Through implementing this

EWS in practice, it would be possible to test and improve it accordingly. The use of the recommended tools with their appropriate use was described, verified and confirmed as best-practice tools by practical experts during interviews and case studies. As the developed EWS could not, due to time constraints, be tried/implemented in practice, it is not possible to say with 100% guarantee, if this approach is workable in practice. From the literature and interviews, it was possible to ensure the practical basis of the EWS approach, which can be used for further research of validation. The possibility may not be excluded that during its use new recognitions could arise, which have to be considered. In this case, the recognitions should be taken into account by the modification of the approach, which could be done by further action or modification of this model during further research.

After this summary and discussion of the results of this work, the Contribution to Knowledge and Practice will be described.

9.3 Contribution to Knowledge

From the literature review during Chapter Two, as already summarized in the overview and presented in a chronological sequence, it has been shown that the development of EWS has grown historically and has been formulated in more detail and partly adapted to the circumstances. With the awareness that risks exist for companies and that they can be detected even at an early stage in order to initiate adequate countermeasures, it was seen that it was necessary to come to a very detailed division between operational, strategic, qualitative and quantitative, internal and external areas and EWSs. Numerous tools, concepts and methods have also been developed in the literature, in order to identify individual risks and risk areas within a company, branch, etc. (Ruderer, 2009), but a holistic EWS, shown in figure 37 below, including all mentioned factors, was missing.

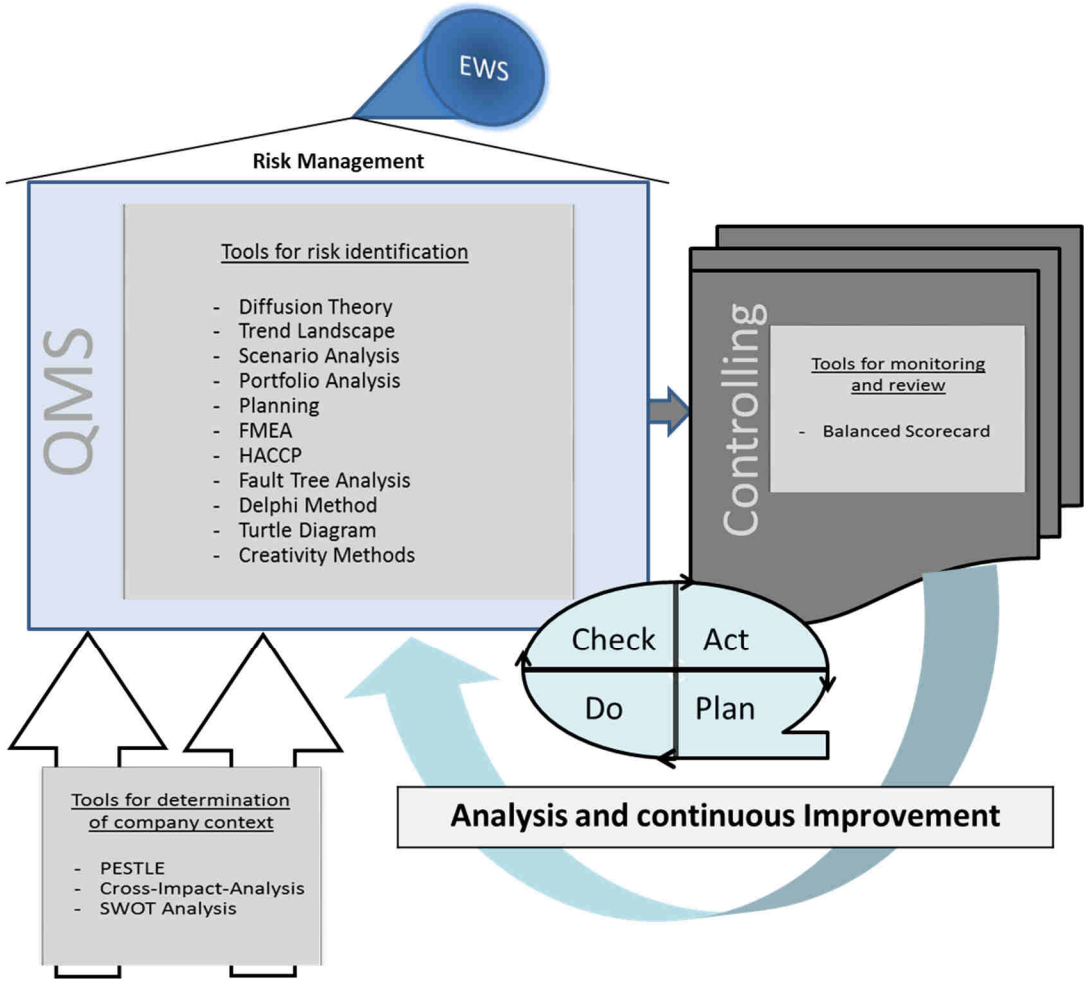

Figure 37 Holistic EWS

Source: own illustration

Figure 37, above, illustrates the main contribution, based on the identified gap, where a holistic EWS was developed during Chapter Six by the combination of explored tools,

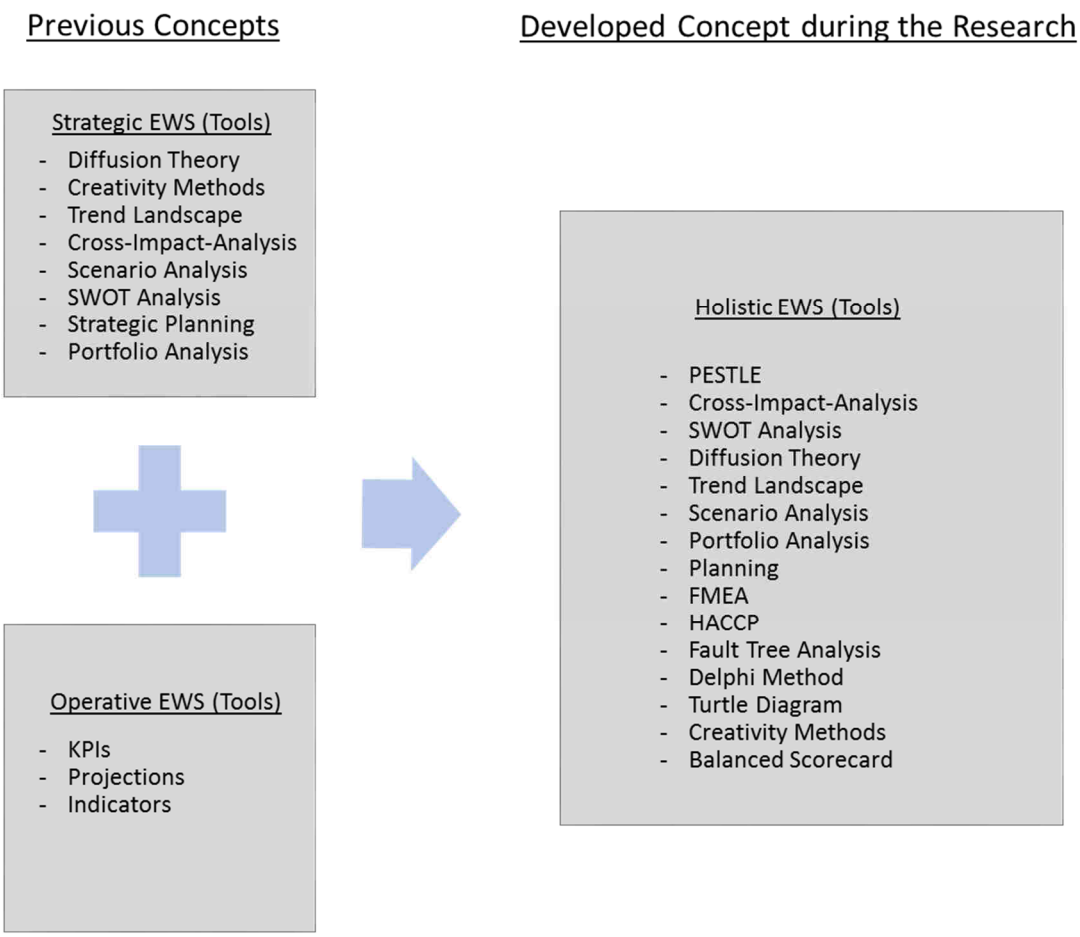

Figure 38 Comparison of tools from previous concepts and developed model

Source: own illustration

Figure 38 illustrates the comparison of previous tools and the developed model. Previous tools thus, operative (KPIs, Projections, Indicators) are included in the BSC and strategic (Diffusion Theory, Creativity Methods, Trend Landscape, Cross-Impact-Analysis, Scenario Analysis, SWOT Analysis, Strategic Planning and Portfolio Analysis) are reinforced by additional tools (PESTLE, FMEA, HACCP, Fault Tree Analysis, Delphi Method, Turtle Diagram and BSC). The link between strategy development and implementation in the operative business, which was described during the literature review within Concept of Hammer (1998) as a difficult point without naming an appropriate tool, as previously noted, was solved by BSC.

Furthermore, based on the answers to the research questions, a contribution to knowledge is also presented by the requirements for a successful EWS and the exploration of appropriate QM and CO tools for EWS, which match the identified requirements and are appropriate to recognize risk factors of company failure. This contribution will be now described specifically.

The first contribution to knowledge was achieved through the first phase of this research, by the identification of requirements for a successful EWS from literature review, followed by the semi-structured interview. The findings from the theoretical and empirical area were compared, categorized and established to a unified list. The outcome helps to establish a basis from both points of view, theoretical and practical, for requirements, which can be considered during EWS development.

The second contribution to knowledge arises from the second phase of this research, where the unified list of the requirements from phase one, were used as a starting point for the exploration of the CO and QM tools, appropriate for recognizing risk factors of company failure, from the literature review and also from the semi-structured interview. The findings from both sources were defined, categorized, compared and unified for the subsequent development of an EWS. The aggregated results from the literature and interviews can be used for an integration into an existing system or combined to form a holistic EWS, which is limited to German food production industry.

The third and main contribution was created through the sequential use of the data from the research phases by consideration of requirements for an EWS, inclusion and combination of explored CO and QM tools, which offers an holistic EWS for German food production industry. The evidence was gathered from the empirical study within the SMEs, in order to review how it could be implemented and used in practice.

There is no evidence in the literature from previous theoretical or empirical studies that a holistic EWS exists which includes CO and QM tools. The framework matches the phases of ISO 31000 by starting from the ‘Determination of Context’, through ‘Methods of Risk Identification’, to ‘Methods for Risk Monitoring and Review’.

Moreover, it fulfills the requirements of several authors, who point out the need for a more holistic approach including both quantitative (operative) and qualitative (strategic) factors (Bedenik et al., 2012; Purvinis et al., 2005; Kurschus et al., 2015).

9.4 Contribution to Practice

This work makes a seminal contribution to the EWS in business. Such a comprehensive, systematic approach (CO + QM) is currently unknown, both in research and also practice. Therefore, the work represents a new, innovative and implementable practical model.

First, the practical part of the current study is concerned with the analysis of the interviews collected from Consultants, Interim Managers, CO and QM experts, as well as GMs from the SMEs. To validate the results of the interviews the researcher categorized each interview, according to activities of the development of the EWS. This allowed a comparison of the interviewees and determined whether they had views which were compatible, or contradictory. The case study also contributes by being based on interviews.

Second, the developed EWS may support managers by recognizing risks/crises at an early stage within the SMEs, as follows:

Synthesis of development phases

This framework enables the development of the EWS as a process, by interconnecting the development phases. The results of one phase are the input for the next phase, such that they depend on each other. The EWS allows a holistic view of the phases, as it starts with the 'Determination of Context', followed by the 'Identification of Risks' and finishes with 'Risk Monitoring and Review'.

Activity in each phase are highlighted and positioned

A set of tools is suggested for each phase, where the unified list of the requirements from phase one were used as a starting point for the exploration of the CO and QM tools, appropriate for recognizing risk factors of company failure,

from the literature review and also from the semi-structured interview. The findings from both sources were defined, categorized, compared and unified for the subsequent development of an EWS. However, for the first stage (Determination of Context) the best practice tools were identified as PESTLE and SWOT; for the second stage (Risk Identification) Planning, FMEA, HACCP, Turtle-Diagram, FTA and Creativity methods; for the third stage (Risk Monitoring and Review) BSC. The aggregated results from the literature and interviews can be used for integration into an existing system or combined to form a holistic EWS, limited to German food production industry. This provides guidance to managers for every activity.

Tools related/connected to phases

Each of the tools during the EWS has a specific purpose and are joined together on the basis that they would overcome each other's limitations. While PESTLE analysis, for example, is only used at the beginning of the process, the BSC, in contrast, is responsible for risk/crisis monitoring and review.

A flexible and coherent process

The suggested framework allows for the simultaneous application of phases in a dynamic process. By using this framework, the manager is able to deal with every stage by different tools, as they address different activities or tasks.

The possibilities of implementation are explicitly considered

The suggested EWS was analyzed for practical use during the Case Study, where the developed model was shown to the companies with the aim of analysis of its appropriateness for implementation and use in SMEs, as well as for refinement. The two studies were within two separate and independent medium-size companies. Both companies are German producers of food with QM and CO departments, which confirmed the EWS for practical implication. Furthermore it would be refined by inclusion of the technical, financial, organizational, and operational sight.

After a summary and contribution to knowledge and practice, the findings are critically assessed, and the need for further research necessity is explained.

9.5 Critical Assessment and Further Research Possibilities

Based on the outlined problem, this work, according to the described sector and requirements, delivers a model of a holistic EWS integrating both a QMS and CO tools for food production SMEs. The results are based on literature review and empirical research. The recommendations for the different phases were based on the food sector and SMEs, which were also taken into consideration during the empirical research.

First, the EWS, developed during this work, enables companies in the food production industry to use the framework by individual tailoring suitable for the company. The use of the recommended tools with their appropriate use was described, verified and confirmed as best-practice tools by practical experts during interviews and case studies. As the developed EWS could not, due to time constraints, be tried/implemented in practice, it is not possible to say with 100% guarantee, if this approach is workable in practice. From the literature and interviews, it was possible to ensure the practical basis of the EWS approach, which can be used for further research into validation. It is not excluded that new factors could arise during use, which has to be considered. In this case, the factors should be taken into consideration by modification of the approach, which could be done by further actions or modification of this model during further research, where Action Research in this context would possibly be suitable and which will be explained shortly below.

Case Study is different to Action Research (AR). Whereas Case Study considers organizational phenomena without changing them, Action Research intervenes by creating organizational change and simultaneously studies the impact, where it is directly involved (Kock, 2007). AR is a methodology based on philosophy and practice, which can be enhanced by learning improvement and articulation of the reasons for, and potential significance of the research (McNiff & Whitehead, 2010). Practice means working with other people in sets and including one's own personal reflective practice (Pedler & Abbott, 2013).

Weick (2005) narrows it further by stating that Practice is equated with doing, concreteness, understanding, and know-how as opposed to Theory which is equated with thinking, explanation, knowing that, and dissection into parts. "If you

want to get ahead, get a theory" (Schön, 1983, p. 56). "The relationship between theory and practice is a correspondent, complementary, incommensurable, coordinate, parallel, reciprocal, conceptually equivalent, and methodologically equivalent" (Weick, 2005, p. 454).

All research has the objective of creating new knowledge, testing the validity of knowledge claims, and generating new theory (McNiff & Whitehead, 2010). Kurt Lewin, known as the father of AR (McNiff & Whitehead, 2010) defined action research as "…a way in which researchers could bridge the gap between practice and theory" (Donnelly et al., 2012, p. 8). The recent description of AR is presented as a way of improving practice through knowledge creation in contrast with traditional forms of research by manipulating variables in order to demonstrate a causal relation between them (McNiff & Whitehead, 2010).

A further definition, which is complicated, but more detailed, agreed by Whitehead (2009, p. 86), is the idea that: "…if yours is a situation in which: people reflect and improve (or develop) their own work and their own situations; by tightly interlinking their reflection and action; and also making their experience public not only to other participants but also to other persons interested in and concerned about the work and the situation, i.e. their public theories and practices of the work and the situation, then yours is a situation in which action research is occurring".

The practice base of AR means that all people, who are investigating the situation they are in, can become researchers (McNiff & Whitehead, 2010). The difference to empirical research, where the real question will be asked about the experimental methods, is found in AR in the query about discourse (Moser & Zedler, 1983). Moser & Ornauer (1978) describe 'reproductive AR' as the overcoming of a worker or other people resistance and 'dialectic AR' as the transformation of passive resistance into active opposition. Revans (1966) explains it in a very simple way by the possibility of change for everybody after recognizing its necessity.

Even though there is a lot of literature about AR, which states that it should be a qualitative research method that emphasizes collaboration between researchers and practitioners (Kock, 2007). Moser (1977) in contrast states that AR offers a wide range of methods, which can be quantitative or qualitative. Frei (1984)

claims that AR can only be a methodology to ensure the growth of knowledge, but not a method, which was often mixed in the past.

“AR combines theory, research, and practice” (Donnelly et al., 2012, p. 3). In contrast to this quite broad description, Huang (2010) does not separate understanding and action and states that legitimate understanding is only possible through action.

McNiff & Whitehead (2010) posed a lot of questions about appropriateness, generation, validation, and qualification to produce a theory. In traditional terms, ‘theory' has a normative status, which has to fulfill the criteria with regard to the best-practice element so that it can be accepted in the research area (Sandberg, 2012). Huang (2010, p. 93) narrows this definition by stating: "Theory without practice is not a theory but speculation".

Senghaas-Knobloch (2001, p. 155) distinguishes between organizational and action theory: "When someone is asked how he would behave under certain circumstances, the answer he usually gives is his *espoused theory* of action for that situation. This is the theory of which he gives allegiance and which, upon request, he communicates to others. However, the theory that actually governs his action is his *theory-in-use*, which may or may not be compatible with his espoused theory; furthermore, the individual may or may not be aware of the incompatibility of the two theories”.

A different understanding of theory could be arrived at by the use of multi-media explanations from action research (Whitehead, 2009). However, Kock (2007) summarizes the different explanations and states that theory, and most of its forms, provides a basis for action as validation.

Action is the intended change of existing reality and research is a production of knowledge (Moser & Ornauer, 1978). For this reason, AR is a perfect model to use as an opportunity for the combination of theory with action (Cremer, 1980). Some of the best organizational ARs are also known to business leaders as consultants, who do work for practitioners, which can overlap and engage more systematically with knowledge creation (Huang, 2010). The appropriateness of AR for consultants is also affirmed by Senghaas-Knobloch (2001), where she explains that the association as “joint reality” between client and consultant is

necessary as a basic requirement. Kock (2007) in contrast narrows it by the explanation that consultants could make some significant contributions to AR and can envision that some consultants will add AR to their toolkit.

An iterative cycle of AR was characterized by the problem of identification/diagnosis, planning, action taking, and evaluation of the outcomes (Donnelly et al., 2012). In contrast, the exploratory action research approach for practical and industry-based research, iteratively plans (theorizes), acts, (teaches practice/theory), observes (barriers and opportunities) and reflects (documents/disseminates), whilst integrating design thinking (Price et al., 2013).

AR also brings problems particularly between the intentions of the researchers and the intentions of the members of the host organization, because the researchers and practitioners may not share the same values and they are likely to have different goals (Kock, 2007). For this reason Pieper (1977, p. 314) states that “ideally action-research should be undertaken by a team which is small enough to function as a group but which is sufficiently large to represent different personality types, social values, and talents”.

When making a decision to act, the researcher has to be clear about how to proceed. It is not possible to act out of a desire to have things, or manipulate others or to implement a certain policy. To be an Action Researcher, means constantly to evaluate, check and act honestly and openly for the benefit of others (McNiff & Whitehead, 2010). Furthermore, the researcher should be a "real researcher", which means, being interested in the scientific knowledge gained during AR and not only taking the view "I don`t know, but I do know how to study the problem" (Pieper, 1977, p. 291). The action researcher, seeing the intervention as a necessary component at work, creates organizational change and simultaneously studies the impact of this change (Kock, 2007).

The basis is that analysis, intervention, organization theory and intervention theory combine together (Cremer, 1980). When someone reflects-in-action, when he does not separate thinking from doing by being independent of the established theory, he becomes a researcher in practice (Schön, 1983). "Intervention produces practical improvements" (Huang, 2010, p. 100). It is an interesting and relevant method of AR, which should be done by insider-as-researcher,

especially in the diagnosing and reflective learning stages of AR because they can modify and hopefully improve their direction setting process (Kock, 2007).

In a practitioner's reflective conversation, where he is a part of it, he acts as an agent by including his own contribution, which may foil his projects and reveal new ideas (Schön, 1983). Gosling & Mintzberg (2003) put the 'self' as a subject for reflection, where through the process of change, action pulls relationships, organization, self and context together. "Through the unintended effects of action, the situation talks back – the practitioner, reflecting on this back-talk, may find new meanings in the situation which lead him to a new reframing" (Schön, 1983, p. 135).

Rosner (2007) describes three types of intervention such as structure work, process work, and test, where each of them has a different task, such as test e.g. the test of a hypothesis. Cremer (1980) states that the intervention method, including group dynamics, plan/decision, and empirical process, structures the action methodically and in content.

Kock (2007) makes it clear to his readers early on that there is no consensus about AR being compatible with many epistemologies, positivism included. Creswell (2009) narrows it by the statement that Positivism represents the traditional form of research, which goes more in the direction of quantitative and not qualitative research.

If it were possible for somebody as a researcher to do AR, it would help to confirm and validate best-practice elements of EWS in practice. The internal researcher can provide access to sensitive data and is capable of systematically evaluating organizational interventions, accompanied by sufficient trust or organizational knowledge (Kock, 2007).

As a constructivist researcher I see reality as being constructed, and especially with AR, there will be a changing of predictable and unpredictable factors in spite of it (Creswell, 2009). This will start with guidance by an explicit framework of ideas, identification of an appropriate real-world problem situation and, guided by an appropriate methodology, initiation of actions which bring improvements in the situation. Reflection on the changes will lead to learning which, in turn, will

generate new insights, new understandings, and new knowledge, where the researcher has judge the chosen methodology (Kock, 2007).

As previously stated, my goal is to confirm and validate best-practice elements of EWS in practice, which could be best done by an AR. It could start with the analysis of the explored CO and QM tool and finish with the implementation of the developed EWS by consideration of the main problem of time for counteraction.

Following a concrete description of suggestions for implementation steps, it will enable the researcher to further develop, if appropriate, the EWS from this research. It is important in this way to show if the developed EWS includes weaknesses, which should be to change into strengths if possible. The further steps will define the application scenarios for the refining of the developed system.

The plan will include the theoretical part from the point of view of the manager, who will use it in practice, the analysis results for the implementation of the developed EWS by including Controlling and Quality Management as a tool. These tools will then be implemented in the praxis as Action, which will be observed, evaluated and discussed with the possible decision of a new loop if necessary.

However, it would make sense to have several loops during the AR cycle to make sure that it is appropriate for practice, even if it will be very challenging and time-consuming.

Second, further research could also be carried out by the analysis of the process along the complete supply chain by the consideration of suppliers, clients, etc. It would have the advantage that upstream and downstream risks, especially those which cause each other, would be recognized much earlier. This is an additional area for further research, which should begin with a broader analysis of the organizational context, through the analysis of tools, which are used for identification, as well as for monitoring and review of the risks by both suppliers and customers. In the first phase, the tools from suppliers and clients could be identified and analyzed. This would be followed by the identification for appropriateness, followed by the third phase, by analysis of appropriateness for

implementation or the linking of the identified tools to the EWS developed during this research. This would be followed for practical verification by a Case Study or Action Research, where the research processes were already described above. It would enable the researcher to extend, in the best case, the developed EWS in this research, from one for only one-company to the cross-company EWS.

Third, the development of this work was only based on German SMEs. Based on the outlined problem, this work, according to the described sector and requirements, delivers a model of a holistic EWS integrating both QM and CO tools for food production SMEs. For this reason, the results of this research are only applicable to the defined sector; any transfer to other industries requires further investigation. This could be done by further research, where the developed EWS approach could be analysed and refined for further branches or internationally- active companies. In particular, the international aspect was not considered, and so this could be extended to the international arena. Internationally-active companies, working globally and also producing products, which are in response to the demands of the international market, will raise further questions and considerations and will need to have different systems of analysis and monitoring. This is an additional area for further research, which should begin with a broader analysis of the organizational context, through the analysis of tools for identification of the risks coming from abroad, to the method of risk monitoring and review. In the first phase, the risks from abroad could be identified and analyzed. This would be followed by the identification, if appropriate, of additional tools for identification and monitoring of them. The third phase could include the analysis of the implementation of the identified tools to the EWS developed during this research. This would be followed by the practical verification by a Case Study or Action Research. It would enable the researcher to extend, in the best case, the developed EWS in this research from one for only the German Sector to the International.

The results of this study may hopefully facilitate future research that can expand on its findings and be conducted in different sectors.

After these critical comments and further research possibilities, the implications for practice are presented.

9.6 Implications for Practice

The success of EWS is of essential importance for organizations, where companies should consider Early Warning information throughout the whole company. The companies should consider company structure, try to implement the EWS in an already existing system (here: QMS), analyze the practicability and avoid complexity.

For the success of the EWS it is not only important to look at an appropriate structure and suitable processes, but more important is the culture of the company, the qualification of employees and the communication process. To secure the workability of the EWS the commitment of CEOs, as well as the acceptance from the employees, which have to handle them, is of great significance.

EWS does not prevent failure, but it helps to recognize risks/crises at an early stage before it is too late. Most business failures happen as a knock-on effect from outside or inside a company (Ropega, 2011). "… in today`s world, it is not a question of if or whether an organization will experience crisis; it is only a matter of what type of crisis will occur, what form it will take, and when it will happen" (Roselieb, 2008, p. 135).

Companies should try to use external, personal as well as internal, impersonal sources more to get data about future trends. They should try to scan with a broader scope, interpret the information during an open communication and analyze the variables further if necessary. Only companies, which are able to identify, monitor and handle risks/crises, as well as opportunities at an early stage, will be able to survive.

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Annex

Interview guideline

Datum:	*Ort:*
Unternehmung / Organisation:	*Gesprächsbeginn, -ende:*
Gesprächspartner:	*Position des Gesprächspartners:*

Einführung

„Bei Unternehmenspleiten bzw. Beinahezusammenbrüchen wurden in vielen Fällen Risiken nicht rechtzeitig erkannt oder die Frühwarnindikatoren ignoriert oder ausgesessen. Reagiert wurde – wenn überhaupt – erst, als die Katastrophe da war. Nur wenige Unternehmen greifen zur Einschätzung ihrer Risikolage auf Frühwarnindikatoren zurück, obwohl Frühwarnsysteme ein unverzichtbares Element jeder gezielten Unternehmenssteuerung sein sollten. Doch wie funktionieren Frühwarnsysteme in der Unternehmenspraxis am effektivsten?“ (Romeike, 2005, p. 22).

Phase I

(Anforderungen an das Frühwarnsystem in der Lebensmittelindustrie)

I.1 Sind Frühwarnsysteme ein Thema in der heutigen Zeit?

I.2 Welche Anforderungen muss ein Frühwarnsystem in der Lebensmittelindustrie erfüllen?

I.3 Welche betriebswirtschaftlichen Bereiche muss es erfassen können?

I.4 Welchen Stellenwert sollte es im Unternehmen einnehmen?

I.5 Auf welche Interessensgruppen muss es abgestimmt sein?

I.6 Gibt es für ein Frühwarnsystem eine geeignete Software?

I.7 Wer sollte die Verantwortung für die Eignung des Frühwarnsystems tragen?

Phase II

(CO-tools)

II.1 Sind Frühwarnsysteme ein Thema in Ihrer Praxis?

II.2 Folgende Anforderungen wurden uns an ein Frühwarnsystem durch die Sanierungsberater für die Lebensmittelindustrie aufgelistet (Interviewantworten v. Block I):

- FWS sollen helfen Risiken rechtzeitig zu erkennen um diesen frühzeitig entgegensteuern zu können.

- Sollten umfassend (strategisch und operativ) und praktikabel sein➔ nicht zu komplex.

- Zukunftsorientiert sein.

- Quantitative (harte) und qualitative (weiche) Faktoren berücksichtigen.

- Alle betriebswirtschaftlichen Bereiche erfassen.

- Interne und externe Faktoren berücksichtigen.

- Es muss ein Topmanagement-Informationssystem sein und von der Geschäftsleitung überwacht werden.

- Grundsätzlich auf alle internen und externen Beteiligten mit unterschiedlichen Reports ausgelegt sein.

- Passend zu den Unternehmenseigenschaften sein (Kultur, Struktur, Größe und Führungsstil).

- Für die Eignung des FWS ist die Geschäftsleitung verantwortlich.

Würden Sie dem zustimmen?

II.3 Welche CO-tools können Sie hierzu als ‚geeignete Tools' abgestimmt auf die Anforderungen empfehlen? Was sollen diese bezwecken?

II.4 Welche davon würden Sie als ‚best-practice-elements' einstufen?

II.5 Wie können diese in das Unternehmen integriert werden?

II.6 Gibt es hierzu eine geeignete Software?

II.7 Wer sollte die Verantwortung für die Eignung der CO-tools tragen?

(QM-tools)

II.8 Sind Frühwarnsysteme ein Thema in Ihrer Praxis?

II.9 Folgende Anforderungen wurden uns an ein Frühwarnsystem durch die Sanierungsberater für die Lebensmittelindustrie aufgelistet (Interviewantworten v. Block I):

- FWS sollen helfen Risiken rechtzeitig zu erkennen um diesen frühzeitig entgegensteuern zu können.

- Sollten umfassend (strategisch und operativ) und praktikabel sein➔ nicht zu komplex.

- Zukunftsorientiert sein.

- Quantitative (harte) und qualitative (weiche) Faktoren berücksichtigen.

- Alle betriebswirtschaftlichen Bereiche erfassen.

- Interne und externe Faktoren berücksichtigen.

- Es muss ein Topmanagement-Informationssystem sein und von der Geschäftsleitung überwacht werden.

- Grundsätzlich auf alle internen und externen Beteiligten mit unterschiedlichen Reports ausgelegt sein.

- Passend zu den Unternehmenseigenschaften sein (Kultur, Struktur, Größe und Führungsstil).

- Für die Eignung des FWS ist die Geschäftsleitung verantwortlich.

Würden Sie dem zustimmen?

II.10 Welche QM-tools können Sie hierzu als ‚geeignete Tools' abgestimmt auf

die Anforderungen empfehlen? Was sollen diese bezwecken?

II.11 Welche davon würden Sie als ‚best-practice-elements' einstufen?

II.12 Wie können diese in das Unternehmen integriert werden?

II.13 Gibt es hierzu eine geeignete Software?

II.14 Mit der Überarbeitung der ISO 9001 kommt im Herbst eine ISO 9001:2015 Norm raus, die eine Risikoorientierung fordert – was bedeutet das für die Unternehmen?

II.15 Wer sollte die Verantwortung für die Eignung der QM-tools tragen?

Phase III

(Case Study)

III.1 Gibt es in Ihrem Unternehmen ein Frühwarnsystem?

III.2 Welche ‚Tools' werden hierzu eingesetzt?

III.3 Wie zufrieden sind Sie mit den jetzigen Hilfsmitteln?

III.4 Welche Schnittstellen sind besonders kritisch?

III.5 Wie wird eine gesicherte und effiziente Kommunikation und Kooperation unter den Beteiligten geschaffen? Werden dafür Werkzeuge des CO / QM eingesetzt, die für alle verbindlich sind?

III.6 Wie wird die Holschuld einer Information zur Unternehmenssicherung sichergestellt?

III.7 Wie wird die Bringschuld einer Information zur externen Unternehmenssicherung sichergestellt?

An dieser Stelle wird dem Interviewpartner das entwickelte Frühwarnsystem vorgestellt und folgende Fragen diskutiert.

III.8 Welche kritischen Anmerkungen haben Sie zum entwickelten Frühwarnsystem?

III.9 Welche Anforderungen würden Sie an das entwickelte Frühwarnsystem noch stellen, unter Beachtung der Anforderungen der Sanierungsberater (siehe Block I)?

III.10 In welcher Konstellation sehen Sie dieses System am ehesten in die Praxis umsetzbar?

III.11 Was sind messbare Risiko-Kriterien, die in dieses System integriert werden sollten?

III.12 Welchen Mehrwert könnte man mit diesem Frühwarnsystem für das Unternehmen erreichen?

III.13 Welchen zusätzlichen Aufwand müsste für das System durch die Beteiligten betrieben werden?

III.14 Was sind Aspekte, die den Einsatz des Systems in der Praxis erschweren würden?

III.15 Kann Ihrer Meinung nach mit diesem System die Existenzsicherung des Unternehmens erhöht werden?