Operational Excellence Organisation – Unlocking the potential of operational excellence with dedicated operational excellence support units

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The President:

Prof. Dr. Thomas Bieger

Vorwort

Die vorliegende Arbeit entstand während meiner Tätigkeit als wissenschaftlicher Mitarbeiter am Lehrstuhl für Produktionsmanagement der Universität St.Gallen. In zahlreichen Industrie- und Forschungsprojekten konnte ich Einblicke in verschiedene Aspekte des Managements produzierender Unternehmen erhalten. Für diese Erfahrungen bin ich sehr dankbar.

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Zusammenfassung

Produzierende Unternehmen streben mit Verbesserungsprogrammen seit Jahrzehnten nach exzellenten Unternehmensleistungen. Oft waren Aktivitäten auf Standortebene sowie singuläre Verbesserungsansätze beschränkt – auch bei multi-nationalen Unternehmen. Über verschiedene Industrien hinweg lässt sich aktuell beobachten, dass Verbesserungsinitiativen zunehmend vom Zentralbereich ausgehen und auf eine unternehmensweite Implementierung abzielen. Diese Initiativen im Produktionsumfeld fassen dabei verschiedene Verbesserungsansätze, welche als gemeinsame Basis das Verständnis der kontinuierlichen Verbesserung haben, unter dem Namen Operative Exzellenz zusammen. In der Praxis bleiben die Aktivitäten jedoch oftmals hinter den Erwartungen des Managements zurück und die Mitarbeiter fallen in alte Arbeits- und Verhaltensmuster zurück. Eines der Handlungsfelder, um das Potenzial einer Operative Exzellenz Initiative freizusetzen, und Gegenstand dieser Arbeit, ist die Organisation von dedizierten Operativen Exzellenz Teams auf Zentral- und Standortebene, genannt Operative Exzellenz Unterstützungsgruppe. Die vorliegende Dissertation soll Führungskräften in produzierenden Unternehmen bei der Diskussion, Bildung und Reflektion des jeweiligen Status der Operativen Exzellenz Organisation, bestehend aus mehreren Unterstützungsgruppen, dienen. Darüber hinaus gibt die Arbeit Gestaltungsempfehlungen für die genannte Unterstützungsgruppe.

Die vorliegende Arbeit gibt zunächst einen umfassenden theoretischen Überblick zu den Themengebieten Operative Exzellenz, kontinuierliche Verbesserung und Organisationstheorie. Operative Exzellenz und kontinuierliche Verbesserung sind im Kontext von Kultur, Methode und Performance von verschiedenen Autoren bereits untersucht. Jedoch gibt es wenige Forschungsaktivitäten im organisatorischen Kontext, vor allem zu dedizierten Ressourcen für das Management von Verbesserungsprogrammen. In der vorliegenden Dissertation wird diese Lücke geschlossen und ein Modell entwickelt, um die Organisation von Operativen Exzellenz Unterstützungsgruppen besser zu verstehen, zu gestalten und zu optimieren. Das Modell beinhaltet drei Dimensionen – die Position, die Aufgaben und die Organisationsstruktur einer Operativen Exzellenz Unterstützungsgruppe. Die theoretische Wissensbasis wird mit praktischen Erkenntnissen aus qualitativen Daten angereichert. Das Modell kann darüber hinaus helfen die Entwicklung der Operativen Exzellenz Organisation über die Zeit darzustellen. Drei Fallstudien zeigen die Gestaltung einer Operativen Exzellenz Organisation in der pharmazeutischen Industrie und belegen die Anwendbarkeit sowie die Nützlichkeit des Modells in der Managementpraxis.

Die Forschung hat deskriptiven und konzeptionellen Charakter. Die Ergebnisse dieser Arbeit tragen zur Institutionalisierung der Operativen Exzellenz Unterstützungsgruppe bei. Dadurch wird das aktuelle St.Gallen Verständnis von Operativer Exzellenz um organisatorische Aspekte erweitert sowie ein Praxisbeitrag zur Professionalisierung und nachhaltigeren Umsetzung von Verbesserungsinitiativen in produzierenden Unternehmen geleistet.

Summary

For decades, manufacturing companies have strived to achieve excellent organisational performance with improvement programmes. However, such improvement activities have often been sporadically implemented and limited to a local plant level, even within larger, multi-national companies. Across different industries it is apparent that such improvement initiatives are becoming more frequently driven from a corporate level, with a centralised vision for a standardised, company-wide implementation. The manufacturing environment is comprised of a variety of improvement approaches, all of which are supported by a fundamental concept of 'continuous improvement', being collectively defined as 'operational excellence'. However, in practice improvement activities too often fail to meet the expectations of management, with employees too often regressing to former working and behavioural routines. One field of actions to unlock the potential of an operational excellence initiative and analytical focus of this thesis is the organisation of dedicated operational excellence support units. The thesis at hand is supporting manufacturing leaders in the discussion, design, and reflection of the particular operational excellence organisation, which consists of some operational excellence support units. Additionally, the paper gives design recommendations for such dedicated support units.

The thesis is providing a comprehensive theoretical overview of the topics operational excellence, continuous improvement, and organisational theory. Cultural context, methods and performance within the fields of operational excellence and continuous improvement have been widely studied by numerous authors. However, there has been little research conducted in the organisational context, in particular the dedicated resources for the management of improvement programmes. In the study at hand this gap is closed and a model is developed to better understand, design, and optimise the organisation of operational excellence support units. The model has three dimensions – the position, the tasks of and the organisational structure to picture an operational excellence support unit. The theoretical knowledge base has been enriched with practical insights derived from qualitative data. Additionally, the model can support to visualise the development of an operational excellence organisation over time. Three cases show the design of an operational excellence organisation within the pharmaceutical industry, depicting the application, and the inherent usefulness of the model within general management practice.

The research offers both descriptive and conceptual character. The results of this thesis are supporting the institutionalisation of the term operational excellence support unit. Thus, the actual St.Gallen understanding of operational excellence is expanded with organisational aspects and a practical contribution is made toward the professionalising as well as the sustainable implementation of improvement programmes within manufacturing organisations.

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List of abbreviations

CDR	Corporate design recommendation
CHQ	Corporate headquarters
CIRCA	Continuous Improvement Research for Competitive Advantage
COS	central operational excellence support
EFQM	European Foundation for Quality Management
e.g.	exampli gratia, for example
EMS	Effective Management System
et al.	et alia
FTE	Full-time equivalent
GMP	Good Manufacturing Practice
JIT	Just-in-Time
KPI	Key Performance Indicator
LOS	local operational excellence support
MIT	Massachusetts Institute of Technology
MPS	Mercedes Benz Production System
OMCD	Operations Management Consulting Division
p./pp.	page/pages
RQ	research question
SDR	Site design recommendations
TMC	Toyota Motor Corporation
TPM	Total Productive Maintenance
TPS	Toyota Production System
TSSC	Toyota Production System Support Center
TQM	Total Quality Management
WCM	World Class Manufacturing

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1 Introduction

When the wind of change blows
some build walls
others build windmills
Old Chinese saying

Since the beginning of the 20th century, operations management practitioners and researchers have worked out a multitude of improvement concepts. Initial research results have been kept mostly furtive and have only been made accessible to, and attracted the attention of, a small audience. In the 1990s, a study from the Massachusetts Institute of Technology (MIT) called broad attention to improvement initiatives (Womack, Jones & Roos, 1990). Japanese production management became a dominant influence on operations management (Schonberger, 2007). The Toyota Motor Corporation (TMC) played an exceptional part in this development and was the role model for an ongoing movement (Holweg, 2007). Companies continue to devote enormous effort to implementing, managing, and maintaining company specific improvement activities, mostly expressed in the form of company-specific production systems. The current paradigm behind these improvements is getting excellent. The latest development in the improvement of multinational manufacturing companies is to focus on the transition from plant-specific improvements to corporate improvement initiatives (Netland & Aspelund, 2014). The pursuit of excellence in the manufacturing area and beyond is expressed with corporate operational excellence initiatives. Operational excellence is best described as the improvement of a manufacturing company in terms of effectiveness and efficiency (Friedli, Basu, Bellm, & Werani, 2013). In order to achieve this, improvement mechanisms employ lean manufacturing methods and tools (Bateman & David, 2002). Several companies implemented operational excellence successfully, which called other companies from different industries to join and start their own initiatives. Pharmaceutical companies also do so, but the history of operational excellence in this industry is relatively short. A differentiating factor when considering the initiatives of different manufacturing companies is the organisation of an operational excellence initiative, meaning the organisational structure of the responsible unit for the improvement programmes. This includes attributes such as the specific tasks of improvement teams and the resources applied to an improvement initiative. Netland, Schloetzer, and Ferdows (2015) show that dedicated teams are beneficial for the implementation of corporate improvement initiatives on plant level. But little is known on the organisation of dedicated operational excellence teams. The key topics

of this thesis explore how teams dedicated to operational excellence are organised. The objective of this thesis is thus to provide relevant solutions for an operational excellence organisation within manufacturing companies. Hayes, Wheelwright, and Clark (1988) have previously stated that one of the most critical tasks for management is *"to build and operate through a purposeful organisation"* (p. 96).

The first chapter offers a practical and theoretical perspective into why research in the chosen field is relevant. The research questions (RQs) and objectives are formulated for a target-orientated work. This chapter ends with the overall structure of the thesis.

1.1 Research relevance and motivation

The practical and theoretical relevance for this research project on the organisation of operational excellence initiatives, as well as the research motivation, is outlined in this sub-chapter.

1.1.1 Practical relevance

The evolution of operational excellence into what we understand it to be today took a long time. Several concepts can be found in practice, including, among others, just-in-time (JIT) (Monden, 1983), kaizen (Imai, 1986), total quality management (TQM) (Deming, 1986), world class manufacturing (WCM) (Schonberger, 1986), total productive maintenance (TPM) (Nakajima, 1988), the Toyota Production System (TPS) (Ohno, 1988), lean manufacturing and thinking (Womack et al. 1990; Womack & Jones, 1996), and time-based manufacturing practices (Koufteros & Vonderembse, 1998). All of these have been in strong demand by manufacturing companies since the 1990s and were spread under the label of lean production as defined by Krafcik (1988) and popularised by the findings of Womack et al. (1990). Most approaches originate from Toyota whereby many of them were not invented at Toyota but enhanced over a long period. An early example for JIT outside of Japan can be found at Hewlett Packard's "Stockless Production – Push out the old … Pull in the new" (Hewlett Packard, 1983). Over the last 25 years lean production has spread to a high number of industry sectors and it is hard to find a manufacturing company where lean has not been discussed on management floors, or where its methods and tools were not introduced on the shop floor (Dabhilkar & Åhlström, 2013). Many empirical studies show that most improvement concepts like TQM (Kaynak, 2003), TPM (McKone, Schroeder, & Cua, 2001) or JIT (Sakakibara, Flynn, Schroeder, & Morris, 1997) contribute in a positive way to the performance of a plant. Today's operational excellence initiatives that improve effectiveness and efficiency are based on lean production and continuous im-

provement (Friedl, Basu, Gronauer, & Werani, 2010). An initiative aims at a company-wide implementation and one common factor for operational excellence has received considerable attention over the last decade, namely *"the concept of kaizen has been introduced to the management arena, at times as the "missing link" in explanations for the widely noted operational excellence of Japanese firms"* (Berger, 1997, p. 110). Outside Japan kaizen is known as continuous improvement. Popularised from the Japanese, where kaizen means changing to be better, continuous improvement is understood as a set of ongoing improvements involving everyone from the shop floor to the management level (Imai, 1986). It is, furthermore, characterised by dynamic aspects implying both small, incremental as well as large, radical changes in the existing work organisation (Imai, 2012). In practice we found manifold variants of operational excellence teams working in an operational excellence initative, both on corporate and plant levels.

Manufacturing companies mostly have the knowledge and motivation, often represented by individuals at different hierarchical levels of the organisation, to plan and conduct improvement activities. But improvements performed with a high degree of effort, too often seem unsustainable. Keeping the achieved progress alive and transferring the new routines into the organisation often fails and numerous manufacturing companies have not been able to successfully implement continuous improvement (Anand, Ward, Tatikonda, & Schilling, 2009). In a study on the success of continuous improvement, Mendelbaum (2006) found out that only 11% of companies considered their continuous improvement initiatives to be successful. Experience from various industries shows that the challenge is mobilising employees in order to keep the achieved improvement alive whilst transferring the new routines into the organisation. Due to the holistic characteristic of operational excellence, the organisation of an operational excellence initiative is not a fast-selling item. Someone needs to manage, drive, and design the change resulting from an operational excellence initiative. And these changes require organisational resources to support the sustainable implementation of improvement approaches based on the continuous improvement understanding.

Different industries have applied various single concepts in different specifications – from automotive to pharmaceutical industry. For an industry that is facing tremendous changes such as the pharmaceutical industry, it is even more relevant, as operational excellence brings with it more than merely financial benefits. The pharmaceutical industry faces a sales slump due to expiring patents that has resulted in a loss in sales of 38 billion U.S. dollars in the worldwide pharmaceutical industry: e.g., Pfizer Lipitor sales in 2011 were 9.58 billion U.S. dollars, in 2012 3.36 billion, and Elli Lilly

Zyprexa went from 4.62 billion U.S. dollars to only 1.32 billion U.S. dollars in 2012 (Thomson Reuters, 2014). Pharmaceutical companies reacted to the changing environment among others by implementing operational excellence initiatives (Friedli et al., 2010). Having begun to introduce operational excellence at the beginning of 2000, the pharma industry has had the chance to learn from the experiences that others have made in implementing operational excellence, and thereby has caught up more and more. Interestingly, the main reason for launching operational excellence in the pharmaceutical industry is not to meet requirements of government agency, but to initiate a cultural change for continuous improvement as data from the St.Gallen operational excellence benchmarking show.

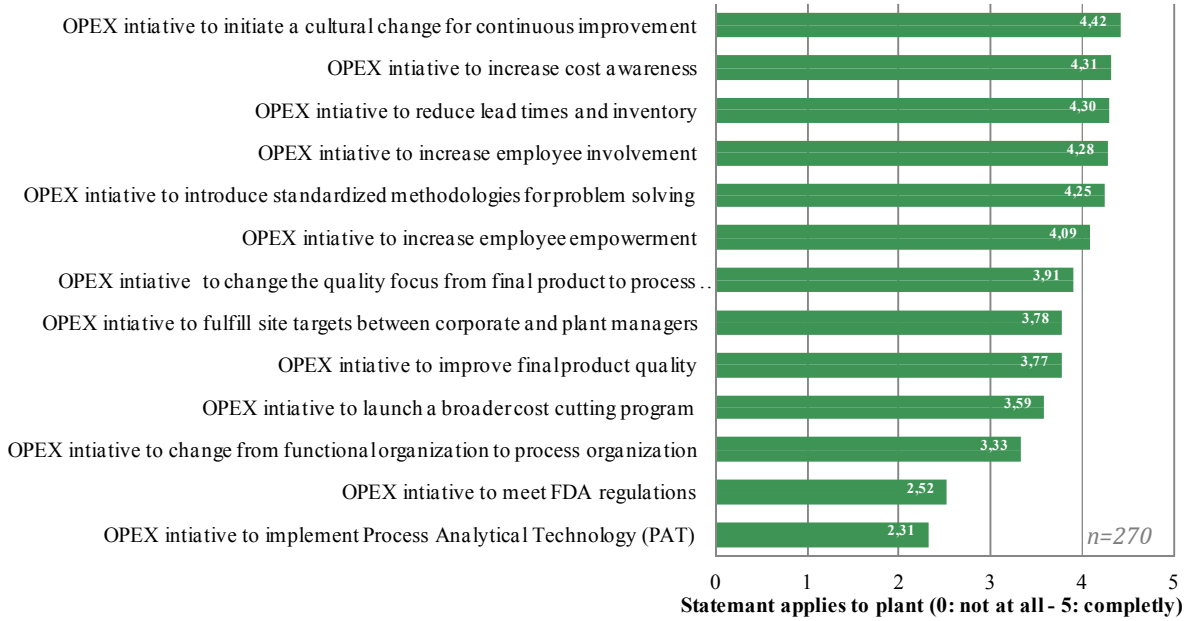


Figure 1. Reasons for launching an operational excellence initiative in the pharmaceutical industry based on the St.Gallen operational excellence benchmarking

A guidance how an operational excellence initiative is organised, e.g. how operational excellence teams are organised or how an operational excellence structure looks like, is missing in the practitioner environment. There seems a lack of knowledge on how to organise operational excellence at the beginning of the journey for excellence and how to adapt it during the journey to assure sustainability. To close this gap the research at hand concentrates on dedicated operational excellence teams and its organisation. The interest of pharmaceutical practitioners in the organisational structure used to embed continuous improvement is also reflected in all participants of the St.Gallen operational excellence research group who identified “operational excellence structure over time” as a key research topic.

An additional motivation of the author is the continuation and enhancement of the conducted operational excellence research at the department of Production Manage-

ment at the University of St.Gallen. The department has been conducting research on operational excellence in the pharmaceutical industry for more than ten years. The high relevance of operational excellence research for the industry represented in the continual collaboration in research and practical projects with leading pharmaceutical companies has shaped the development of operational excellence in the this industry and the understanding of operational excellence in St.Gallen. Since 2004, several dissertations at the department of Production Management have addressed different aspects of the St.Gallen operational excellence research, beginning with the work of Kickuth (2006), followed by that of Volkmer (2011), Gronauer (2012), Ziegler (2013), Guetter (2014), and Bellm (2014).

1.1.2 Theoretical relevance

Before taking a look at the theoretical relevance and underlying literature, the research fields in which this thesis is embedded are presented. The research is grounded in two fields: First and foremost, the thesis at hand is in operations management research with a focus on continuous improvement and operational excellence. Operations management is viewed as a functional field of management and research with a strong practical focus (Buffa, 1980). Operations management *"addresses a multidisciplinary field that investigates the design, management, and improvement of processes aimed at the development, production, delivery, and distribution of products and services*" (Gino & Pisano, 2008, p. 677). Drejer, Blackmon, and Voss (1998) point out that operations management differs from most other areas of management research in addressing both physical and human elements of the organisation. Hayes and Wheelwright's (1984) infrastructural and structural elements of manufacturing reflect this perspective perfectly. With reference to the chosen research field of this thesis, in particular continuous improvement, but also lean manufacturing as a basis for operational excellence, have been among the most influential concepts in operations management since the 1990s (Holweg, 2007).

Second, this study is based in the organisational design track and adopts a dynamic view of the nature of continuous improvement in manufacturing companies. A reason for this is that *"(...) the OM research community has denied or, at best, neglected the problematic nature of organisation"* (Ruffini, Boer, & Riemsdijk, 2000, p. 863). As the unit of analysis includes the central and local dedicated operational excellence teams, the research strives the corporate headquarter (CHQ) research and contributes new insights into how manufacturing companies can organise the central operational excellence unit and the CHQ's relationship with the manufacturing sites and its respec-

tive local operational excellence team. Little is known about CHQ's staff(ing), its functions in particular in operational excellence initiatives as well as the relationship to production plants. The dissertation at hand provides knowledge in this field.

The following briefly summarises the literature review conducted in Chapter 3. In this chapter the research on continuous improvement and operational excellence is discussed in detail in the context of organisational aspects. The knowledge about how to reach operational excellence comes from wide-ranging research on dominant paradigms in operations management, namely lean production, continuous improvement and other improvement concepts, such as TQM, TPM or JIT. In this fields research is available on methods, tools, and cultural aspects as well as leadership. Research on excellence has been conducted since the 1980s (among others Peters & Waterman, 1982; Hayes et al, 1988; Peters & Austin, 1985; Schonberger, 1986; Dahlgaard & Dahlgaard-Park, 1999; Cua, McKone, & Schroeder, 2001; Dahlgaard-Park & Dahlgaard, 2007). Research on operational excellence has been extensively influenced by the findings on the TPS as well as by the introduction of the term lean production by Krafcik (1988) (among others Sugimori, Kusunoki, Cho, & Uchikawa, 1977; Monden, 1983; Ohno, 1988; Imai, 1986; Shingo & Dillon, 1989; Womack et al., 1990; Spears & Bowen, 1999; Liker, 2004; Holweg, 2007; Shah & Ward, 2003; Modig & Ahlström, 2012; Dabhilkar & Ahlström, 2013). From a scientific point of view, continuous improvement is widely studied in different fields from manufacturing to indirect areas of various industries (Imai, 1986; Berger, 1997; Bessant, Caffyn, & Gallagher, 2001; Tennant & Roberts, 2001; Abdolshah & Jahan, 2006; Magnier-Watanabe, 2011; Imai, 2012; Singh & Singh, 2012). But most scholars in operations management have looked at the performance implications of different organisational forms, lean practices or cultural aspects (e.g. Choi, 1995; Flynn, Sakakibara & Schroeder, 1995), and have focused on single plant improvements (Netland, Ferdows, & Sanchez, 2014).

Clearly researching improvement initiatives is nothing new. Already in the 1980s, finding on the *"effective ways of organizing both human and physical centers of activities"* (Amoaka-Gyampah & Meredith, 1989, p. 252) was on the operations management research agenda. The contribution of the study at hand is the understanding it conveys of operational excellence as corporate improvement initiatives and the insights it provides into the organisation of an operational excellence initiative, in particular, the operational excellence support organisation on corporate and site levels. Little is known about how to embed a corporate operational excellence initiative in an organisation, or about the interplay between continuous improvement with its dynamic characteristic and the adaption of the organisational structure over time. Anand et al.

(2009) indicate the importance of infrastructural aspects as follows: *"Infrastructure practices can fulfil the important role of coordination and support of projects and create a culture for continuous improvement to help sustain a continuous improvement initiative beyond its immediate gains. However, existing studies tell us little about the constitute elements of such an infrastructure"* (p. 446). The theoretical gaps noted in the study at hand, confirm the relevance of conducting research in the field of operational excellence from an organisational perspective. The following gaps were identified and have guided the research. The research gaps resulting from the literature review and analysis are presented in Chapter 3. The following five points sum up the theoretical implications in the field of continuous improvement and operational excellence in the context of organisational aspects:

1) In literature and practice there seems to be no common understanding on the barriers to and drivers for the implementation of improvement initiatives.
2) Less information in literature on requirements for a dedicated operational excellence support unit are provided.
3) Recent publications do not investigate tasks of a dedicated operational excellence support unit and the interplay with the organisational structure.
4) Establishing an operational excellence organisation to release operational excellence in its full potential with continuous improvement projects has been neglected in the past.
5) There is no sufficient information on the adaption of an operational excellence organisational support unit over time.

Based on the indicated research gaps, this research will contribute to the field of operations management. The general contribution consists in providing a better understanding of operational excellence initiatives in manufacturing companies. The research is embedded in the contingency theory, the structural theory, and socio-technical theory (see Section 2.1).

1.1.3 Research motivation

The reasons for writing a doctoral thesis are manifold. Beside the practical and theoretical relevance indicated above, there is a personal motivation of the author. The process intrinsically involved in this work is a task for its own sake due to the author's interest in the research topic. Starting the doctoral thesis with some basic knowledge of and curiousness about the research topic, the author's aims are to provide a useful con-

tribution for practitioners who are working in the field of operational excellence and at the same time expanding his personal knowledge. The design and further development of operational excellence, shown by the example of the pharmaceutical industry, should provide a sense-making contribution in terms of a structured summary of operational excellence knowledge based on an insightful analysis of the operations management literature and a compendium of knowledge on setting up an operational excellence support organisation on corporate and plant level. The underlying model seeks to make a complex entity like an operational excellence organisation discussable. The research is done with high conscientiousness by the author to provide a model that should have a level of novelty on the operational excellence support unit and is beneficial for practitioners. In addition, the model should confirm a level of abstraction of the current practical reality.

1.2 Research questions and objectives

The following sub-chapter introduces the RQs and research objectives.

1.2.1 Research questions

The role of the RQ is important in every scientific work as they organise the project. They also delimit the research scope and help the researcher to stay focused during the whole research process (Punch, 1998). Based on the practical and theoretical relevance the guiding RQ for this thesis are as follows:

RQ ***How should an operational excellence support unit in the pharmaceutical industry be designed to support continuous improvement?***

RQ a) What are the drivers for and barriers to continuous improvement?

RQ b) What functions should an intra-organisational operational excellence support unit have to fulfil?

RQ c) How are intra-organisational structural mechanisms shaped to support continuous improvement?

RQ d) How should an operational excellence support unit need to be adapted over time?

As the RQs show, the main focus of the thesis is on continuous improvement and operational excellence. Combining these two field allows to capture the dynamic aspects of the development of an operational excellence initiative in manufacturing companies. The empirical focus is set on the pharmaceutical industry. The present re-

search targets the design of the organisational structure of an operational excellence support unit and its development over time on the basis of the continuous improvement approach.

1.2.2 Research objectives

The objective is to find a lever to unlock the potential of operational excellence through the systematic and effective design of an operational excellence support unit. Better understanding the functioning and staffing of the operational excellence support unit on corporate and plant level are crucial components of achieving this goal. As a consequence, the level of analysis is not the basic organisational form like the matrix organisation, but the operational excellence support unit. As stated in Section 1.1, there are several challenges to implementing operational excellence in practice and theoretical gaps that need to be overcome in order to unlock the potential of operational excellence. Based on the relevance, underlying motivation, and chosen research setting, the dissertation proposes the following four research objectives.

1) Understanding the drivers for and barriers to continuous improvement.

Introducing operational excellence faces numerous challenges, but the initiative can contribute to the superior performance of a manufacturing organisation. The information on barriers in implementing and sustaining improvement programmes leads to a better understanding of how to shape the operational excellence support unit in order to establish a structure which supports the continuous improvement of processes.

2) Deriving organisational structure elements for managing the design of an operational excellence support unit.

The sustainable implementation of operational excellence requires a suitable organisational infrastructure. Understanding the design requirements (set of conditions that a manager aiming at an operational excellence support unit) and design dimensions (set of different organisational design variables) for an operational excellence support unit is crucial (Lillrank, Shani, & Lindberg, 2001). Therefore, the relationship between the functions of an operational excellence support unit and the different organisational dimensions needs to be considered.

3) Developing a generic management model.

The alignment of practical requirements with relevant theoretical knowledge provides the basis for developing a generic management model. The developed model should support managers to take the relationships between different functions of an operational excellence support unit and the operationalised organisational structures into consideration. Furthermore, the model should be applicable at different stages of an

operational excellence initiative right from the beginning, following the stability, and improvement phase of the continuous improvement approach. Overall, the model needs to visualise and map the organisational structure with a focus on the different operational excellence support functions.

4) *Drawing conclusions for an operational excellence support unit which are summarised in design recommendations for an operational excellence support organisation.*

Qualitative data from interviews enriches the theoretical knowledge with practical insights. The consolidation of practical cases, the theoretical knowledge obtained, and the generic management model developed allow for final conclusions on how to direct a manufacturing company towards an operational excellence organisation. Design recommendations are derived, which enable practitioners to more readily understand, coordinate, and adapt the operational excellence support unit over time. The objective of the thesis is to foster the consistent work of the operational excellence support unit to create an operational excellence organisation.

It is important to be aware that due to the amount of research which has been conducted on improvement initiatives and organisational design this research is not new. But as this study views operational excellence as a corporate initiative and takes up a dynamic view on the operational excellence development based on the continuous improvement perspective, it can nevertheless be seen as a promising contribution. At the present moment the author is not aware of research that takes on this practical challenge under the described conditions. For the thesis the following objectives are central: Research results add to better understanding and explanation of the relationships between the organisational design and operations managers, as well as other employees at different levels in an organisation who are involved in the design and change of existing production systems. Scientific operations management research from the viewpoint of contingency theory is not new, but the combination of contingency theory, structuration theory, complemented with the socio-technical theory considering human and technical aspects, is matching the research topic with its dynamic over time.

1.3 Structure of the thesis

The thesis at hand is structured in seven chapters. The first provides a general overview of the motives for the research, its theoretical and practical relevance, the research question with its sub-questions and the structure of the dissertation. The second chapter presents the research design alongside its theoretical and conceptual back-

ground, as well as the research framework and methodology. Further, definitions of the terminology used are provided. Chapter 3 provides basic information about the field of research, as well as a literature review on operational excellence, continuous improvement, and organisational design with a focus on organisational structures which are useful to conceptualise the structure of an operational excellence support unit. At the end of Chapter 3, the theoretical implications for the research project are derived. Chapter 4 presents the model for thinking about an operational excellence organisation over time as it was derived from results of the theoretical research and its analysis as well as complemented by the qualitative data. In Chapter 5, three case studies provide practical insight and the application of the model in practice is shown. Chapter 6 presents the revised St.Gallen operational excellence model, introduces new definitions and recommendations for organising a corporate and plant operational excellence support unit. Finally, Chapter 7 concludes the dissertation by summarising and discussing the results, as well as its contributions to theory and practice. The limitations of the thesis and the prospects for future research are provided. Figure 2 below provides an overview of the structure with its sub-chapters.

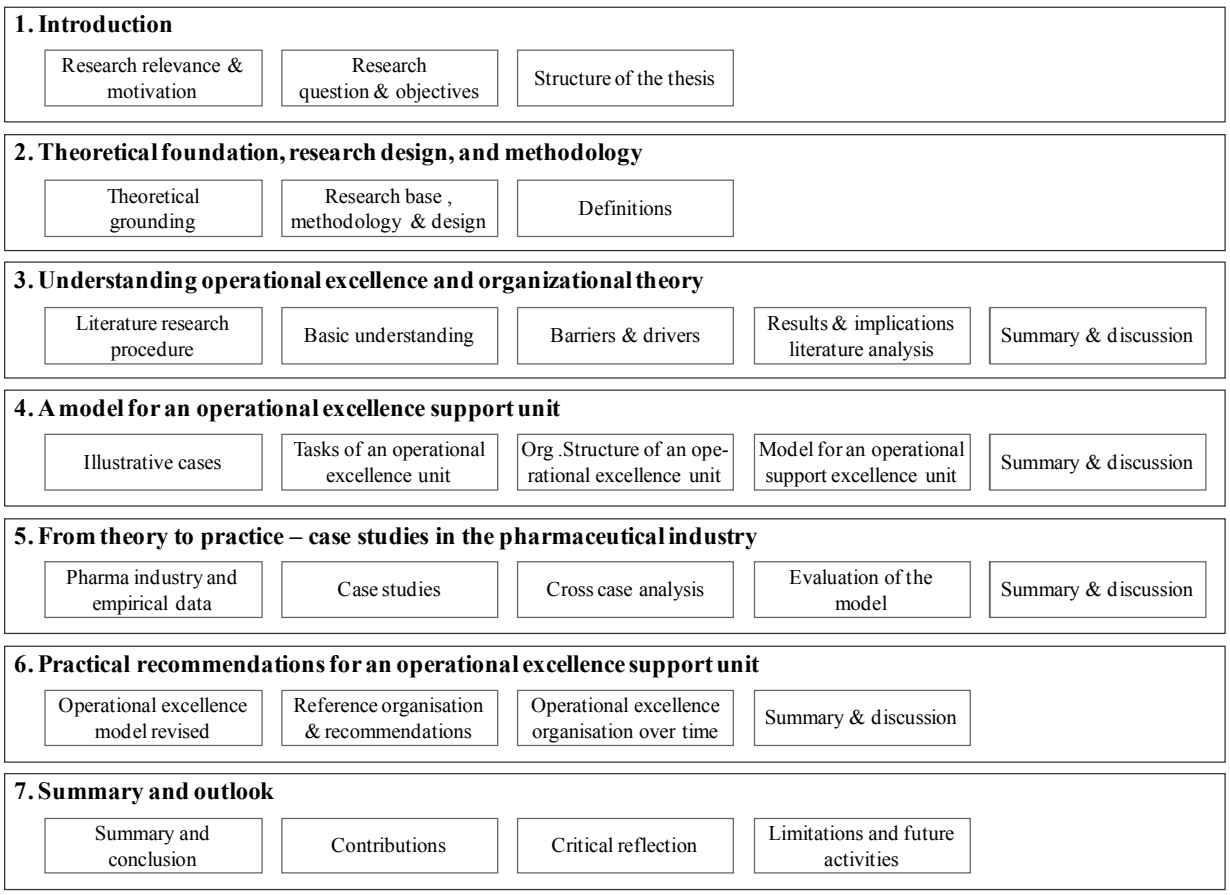


Figure 2. Structure of the dissertation with seven chapters

2 Theoretical foundation, research design, and methodology

Success depends upon
previous preparation,
and without such preparation
there is sure to be failure.
Confucius

Chapter 2 provides the theoretical foundation in which the research topic is embedded and explains the author's perspective on the research topic. Furthermore, the research design and the chosen methodology are explained. In order to establish a common understanding of the terminology used, the basic terms are defined in this chapter.

2.1 Theoretical grounding

Because of the fact that operations management suffers from the lack of a recognised theory (Schmenner & Swink, 1998) the research at hand is based on selected organisational theories and complemented by insights from social theory. The dissertation compliments its use of contingency theory with structuration theory, while the overall research perspective is based on socio-technical system theory. Contingency theory helps to view organisational design as an outcome of management work, while structuration theory supports the perspective of organisational development over time. A shift from organisational design to organisational development fits to the desired nature of continuous improvement – which moves from a proactive design pushed by the top management to a more and more bottom up approach with the involvement of shop floor employees. Why these theories have been chosen out of the many other existing possibilities is explained in the following section.

2.1.1 Contingency theory

Contingency theory focuses on organisational structures and is based on the assumption that a formal organisational structure has a strong influence on the efficiency of an organisation (Kieser, 1995; Vahs, 2009). However, there is no general efficient organisational structure. In order to be effective, organisations must adapt the structures to their specific situation (Kieser, 1995). Thereby the objective of the contingency theory is to ascertain the fit between the situation of the structure, the behaviour of the organisational members, and organisational effectiveness (Vahs, 2009). Vahs (2009) stated, *"The key question is (...) not which factor determines the structure, but how strong is*

the relative influence of each individual factor compared to other situational variables" (p. 43).

Contingency theory was primarily developed as a critique of the existing organisational research in the late 1950s. After research on contingency theory began in a way that was limited to individual aspects (mono-causal), approaches emerged that use several influencing factors to explain the situation (multi-causal) (Kieser & Ebers, 2006; Staehle, 1999). Several enhancements were made to contingency theory based on the research conducted in the 1960s and 1970s. Miller & Friesen (1992) distinguish in contingency theory between external and internal fit. The internal fit relates to the alignment of internal processes and structures (Miller & Friesen, 1992). Pfeffer (1982) named the contingency theory of organisational structures structural contingency theory. Due to the scope of the present research, the wording structural contingency theory is used in this thesis. This meaning is chosen for the research area of organisations. Van de Ven and Drazin (1985) indicated the fit of different approaches in the structural contingency theory views. They show that in the development of contingency theory at least three different conceptual approaches have emerged: the selection, the interaction, and the system approach. Figure 3 shows the interpretation of fit in these three approaches based on Drazin and Van de Ven (1985).

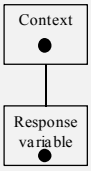
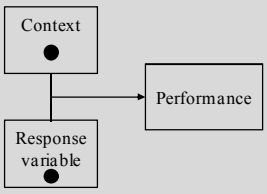
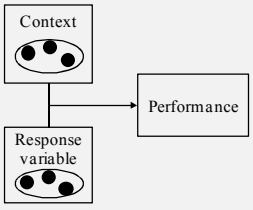
Approach	Definition	Visualization
Selection	Previous view: Fit is assumed premises underlying a congruence between context and structure. Current-future view: Fit at micro-level is by natural or managerial selection of organizations.	
Interaction	Previous view: Fit is the interaction of pairs of organizational context structure factors; it affects the performance. Current-future view: Fit is conformance to a linear relationship of context and design. Low performance is the result of deviations from this relationship.	
Systems	Previous view: Fit is the internal consistency of multiple contingencies and multiple structural characteristics; it affects performance and characteristics. Current-future view: Fit is a feasible set of equally effective, internally consistent patterns of organizational context and structure.	

Figure 3. Interpretation of fit in the selection, interaction, and systems approaches to structural contingency theory views (based on Drazin & Van de Ven, 1985)

For the present research project the system approach was chosen. The concept of a system is based on the perception of a set of elements dynamically related in time and each element is able to affect the performance of the whole (Beer, 1995). The system perspective fits best with the present research insofar as operational excellence involves a holistic understanding of an organisation. Lawrence and Lorsch (1967) indicate that a specific environment leads to specific organisational requirements for the respective organisational unit. This understanding is important for the present research's focus on the operational excellence support unit as part of the whole organisation. Aside from the system approach, the research project is grounded in the pragmatic version of structural contingency theory. Kieser and Walgenbach (2010) indicate that contingency theory is divided into two basic models, the analytic and the pragmatic view. The analytic variation of contingency theory is directed towards answering why-questions, such as "Why do the organisational structures of different companies differ from each other?" (Vahs, 2009). In the analytic model, the relevant situation is described by independent variables, which are referred to as situational variables. The formal organisational structure, the behaviour of the members of an organisation, and the efficiency of the organisation are dependent variables (structural variables) (Vahs, 2009). The pragmatic version of contingency theory aims to answer how-questions. Therefore, it pursues a pragmatic objective of knowledge through the formulation of practical design options and recommendations (see Figure 4). An organisational structure is an instrument to achieve the desired objective by choosing the optimal structure alternative (Kieser & Kubicek, 1992; Vahs, 2009). The structure is designed by those who pursue the objectives and choose the suitable design alternatives (Schulte-Zurhausen, 2010).

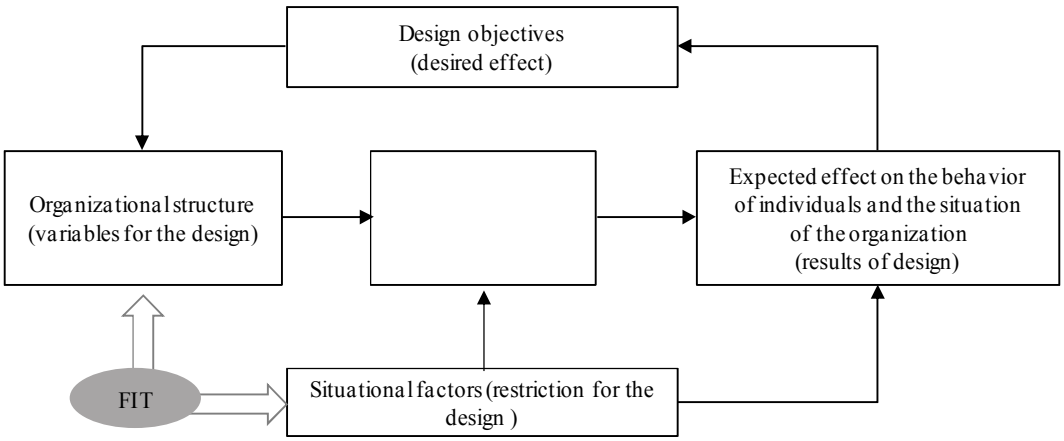


Figure 4. The pragmatic model of the contingency theory approach (based on Schulte-Zurhausen, 2010)

In the context of contingency theory, it's important to note that not all relevant structural and situational characteristics can be covered adequately. A further critical aspect is that the responsible people for the design of an organisational structure are not considered even though having the power to influence the individual variables (internal and external) and are thus able to change the situation (Vahs, 2009). *"Nevertheless, the contingency theory is useful for the explanation of structural differences and for the systematic development of organisational alternatives because it allows to take into account the relevant influencing factors and their impact on the organisational structure"* (Vahs, 2009, p. 46).

This dissertation follows the system approach of Drazin and van de Ven (1985) and the pragmatic perspective of Kieser and Kubicek (1992) and Vahs (2009). The focus is on the internal situation of an organisation from the perspective of an operational excellence support unit.

2.1.2 Complementary theoretical foundation

The research is complemented in social theories, in particular the structuration theory. The reason for this choice is that structuration theory provides an alternative theoretical frame for explaining and interpreting human behaviour as well as the structure of social phenomena in organisations (Broger, 2011). Also Broger (2011) states that, *"structuration theory to explore organisational phenomena from a new, more integrative perspective holds much promise"* (Broger, 2011, p. 213).

Theory of structuration. The social theorist A. Giddens (1984) proposes in *The Constitution of Society* a theoretical model with the objective, *"to overcome the distinction of structure (formal and informal) from people and their actions"* (Scott, 2013, p. 25). The following quote from Marx (1852) reflects tellingly the basic understanding behind Giddens' desire to develop a new theoretical framework: *"Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past."* (as cited in Giddens, 1984: xxi). This framework *"allows [...] to understand both how actors are at the same time creators of social systems yet created by them"* (Giddens, 1991, p. 204). Thus, the use of structuration theory in this dissertation seems beneficial, as it matches the perspective of the current study concerning the establishment of an intra-organisational structure as an outcome of human actions (over time). The social sciences' basic field is to explore social practices ordered across space and time (Giddens, 1984). In structuration theory, structure generally refers to the *"structuring properties allowing the binding of time-space in social systems, i.e. the proper-*

ties which make it possible for discernibly similar social practices to exist across varying spans of time and space […]" (Giddens, 1984, p. 17). Giddens rephrased the view of structure and agency, pointing out that, *"action, which has strongly routinized aspects, is both conditioned by existing cultural structures and also creates and recreates those structures through the enactment process"* (Walsham, 1993, p. 34). People's activities take place within, and are related to a given structure, and these structures are the medium of, and provide the context for action. People produce as well as reproduce this structure; in consequence, structures are the outcome of actions they recursively organise (Giddens, 1984). Giddens calls this the duality of structure. According to him the dualism between structure and agency exists only in and through activities (Pozzebon & Pinsonneault, 2005). Thereby, rules not only govern human behaviour, but also imply 'methodical procedures' of social interaction (Broger, 2011). Giddens's claim of recursion states that human activities are to a large extent routinised in terms of a basic feature of day-to-day social activity (Giddens, 1984: xxiii). *"This […] is vital to maintaining a basic sense of trust how to 'go on' or, in Giddens's terms, 'ontological security'"* (Broger, 2011, p. 6). In a nutshell, the most fundamental tenet of Giddens' structuration theory is that humans are knowledgeable, reflexive, and purposive agents (Giddens, 1984).

Giddens (1984) has suggested that structuration theory, and theories in general, should be seen more as *"sensitizing devices than as providing detailed guidelines for research procedure"* (Giddens, 1984, p. 294). *"By 'sensitizing devices', Giddens refers to some of the basic elements of structuration theory, such as the notion of duality of structure"* (Pozzebon & Pinsonneault, 2005, p. 1356). As actions take place within existing structures, which they both reproduce as well as alter, *"Giddens's formulation also reinforces the need to make a more dynamic view of social structures and behavior"* (Scott, 2013, p. 25). The shift of the focus of analysis over space and time fits the way the research at hand deals with continuous improvement and the adaptation of structures over time. Giddens has also been criticized for his work. McLennan (1984) criticizes him for producing an incoherent mixture of realist, positivist, and idealist arguments. At the theoretical level, Archer (1982) criticizes Giddens for not resolving the dualism between structure and agency, but in fact conflating the two. Nevertheless, Giddens' work and understanding are beneficial for the overall understanding of this dissertation, as argued above.

Socio-technical system theory. In addition to structural contingency theory and structuration theory, the dissertation is grounded in the understanding of socio-technical system theory. Socio-technical system theory originates from the work done at the Ta-

vistock Institute (Trist & Bamforth, 1951). The core idea is that the performance and the design of an organisation can only be understood and improved if social and technical aspects are both considered as interdependent parts (Clegg, 2000). This understanding can also be seen in the following statement by Hayes et al. (1988): *"Superior performance is ultimately based on the people in an organisation. The right management principles, systems, and procedures play an essential role, but the capabilities that create a competitive advantage come from people – their skill, discipline, motivation, ability to solve problems, and their capacity for learning"* (p. 242). The importance of socio-technical aspects for changing the work organisation for the sustainable implementation of lean is supported by Paez, Dewees, Genaidy, Tuncel, Karwowski and Zurada (2004) as well as Shah and Ward (2007), who define lean as an integrated socio-technical approach (ref. 2.3.1). Dabhilkar and Ahlström (2013) conclude in their research that there is no inherent conflict between socio-technical system theory and lean production. The key principles of socio-technical system theory can also be found in lean production. Some of the characteristics that contribute to effective work design are, among others, multi-skills and information flow (Cherns, 1976). As socio-technical system theory is an approach with the underlying concept of employee involvement, it fits with continuous improvement.

Operational excellence implies aspects of the socio-technical system theory. The characteristics of the research objects (operational excellence and continuous improvement) as well as the unit of analysis (operational excellence support unit in manufacturing companies and in particular the pharmaceutical industry) reflect the importance of the consideration of both social and technical aspects. This allows the conclusion of this thesis to be grounded on the foundations of socio-technical system theory. *"The sociotechnical systems approach is likely the – most extensive body of scientific and applied work underlying Employee Involvement and innovative work designs"* (Cummings & Worley, 2001, p. 354).

2.2 Research base, methodology, and design

In order to answer the defined RQ and achieve the desired research objectives the research methodology and design is described. This section starts with the research base which shows the author's view on the research procedure.

2.2.1 Research base

The research is grounded in the understanding of Ulrich (1984) that management is about *"[...] designing, controlling and further developing (of) purpose-oriented socio-technical organisations"* (Rüegg-Stürm, 2005, p. 11). The author is aware of the fact

that the research object is not fully controllable insofar as the topic has dynamic aspects and deals with human actions. But the intention is nevertheless to develop a model for the design and change of organisational and social reality in practice. The dissertation addresses a practical problem and the developed artefact is tested in the context of the respective practical background. Consequently, the research starts and ends in practice whereat theory is used to provide information on the research topic (Ulrich, 1984). The dissertation follows an iterative research process based on Kubicek (1977). This includes ongoing practical work with different manufacturing companies in addition to conceptual and theoretical work (see Figure 5).

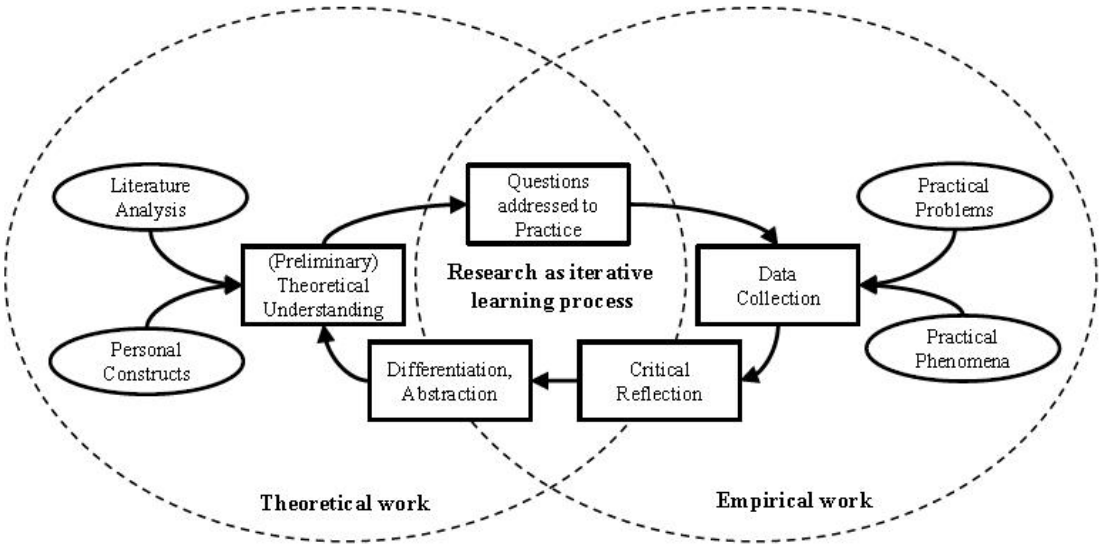


Figure 5. Iterative research process based on Kubicek (1977)

The research process and field of research are seen from an ontological perspective which is understood as a part of philosphy looking at assumptions about the defintion and the existence of reality and how things fit together; additionally it helps to encompass problems about general relations of the things that do exist (Stanford Encyclopaedia of Philosophy, 2011). In addition, the understanding is complemented by an epistemology which is looking at the theory and nature of knowledge, what is knowledge and how it establish (empirical, theoretical abstract); this depends on the school of thought. Ontology is important for this thesis because different perspectives bring phenomena of interest into the research focus (Hatch & Cunliffe, 2006).

2.2.2 Research methodology and design

The chosen research methodology follows the mixed method approach combining quantitative and qualitative research methods. Research with mixed method is grounded in Campbell and Fiske's (1959) assumption that a research topic is best un-

derstood if it is viewed from diverse perspectives. The mixed methods approach for this research is understood as the collection of both quantitative and qualitative data (Creswell, 2002; DeCuir-Gunby, 2008). The decision to use this approach is based on the following criteria: implementation, priority, integration, and theoretical perspective (Creswell, 2002). The implementation follows the sequential procedures, meaning that the researcher seeks to elaborate on, or expand the findings of one method with the ones of another method (DeCuir-Gunby, 2008). The overall priority is placed on qualitative data and the integration of data will occur at different stages in the research process. The empirical research design follows a multiple case study format and a single unit of analysis, complemented by a focus group input. The research methodology is described in the following.

Understanding practical relevance, desk research & explorative interviews. As the research is based in the understanding of Ulrich (1984) and starts and ends in practice. In the desk research, a comprehensive literature review is conducted on organisational structure and operational excellence. The focus is on the different organisational dimensions in the context of operational excellence and the possibilities for embedding operational excellence in different hierarchical levels of a manufacturing company. The conducted analysis is based on an accurate description of the research object (Mayring, 2002). Additionally, complementary interviews with operational excellence managers are used to discuss operational excellence related challenges in organisations, as well as to describe the functions of an operational excellence support unit in practice. Semi-standardised interviews on site or per telephone are used for this research project.

Qualitative research. Based on the definition of the Bureau of Applied Social Research, the term qualitative refers to the individual quality of every answer in contrast to the number of responses of a formal questionnaire (König, 1972). Qualitative research is especially suitable in the early stages of a research project due to insufficient knowledge. With direct contact, e.g., with interviews, a more holistic understanding of the research object is achieved, while the research process itself is flexible and circular (Flick, 2006). Focus groups and interviews are used as a data collection method for the research project at hand. The use of group interactions allows producing data and insights that would be less accessible without the interaction in a group (Morgan, 1988). The focus group discussions are conducted at regular meetings of the St.Gallen operational excellence research group. Results of these discussions are additionally useful for developing interview schedules and questionnaires (Morgan, 1988). According to Flick (2006), focus groups are used as a method in conjunction with other methods.

The research is supported by the St.Gallen operational excellence research group. All four multinational pharma companies meet three times in Europe and the U.S.. Operational excellence support structure and its development over time was chosen as one topic by the participants. The meetings were set-up in 1.5 day meetings with presentations and workshops complemented by plant-tours at both the administration and shop floor level to see the application and status-quo of operational excellence on the spot. These plant-level activities helped the researcher gain a detailed understanding of the respective operational excellence organisation.

Table 1 *Overview of the empirical data – Focus group*

Company	Industry	Involved functions	Data gathering via	Data used for
Pharma Company I	Pharmaceutical industry	Global Head of Operational Excellence, Site Head	3 workshops, site tour	General understanding Model development & testing
Pharma Company II	Pharmaceutical industry	Vice President Strategy, Site Head of v	3 workshops, site tour	General understanding Model development & testing
Pharma Company III	Pharmaceutical industry	Head of Operational Excellence	3 workshops, site tour	General understanding Model development & testing
Pharma Company IV	Pharmaceutical industry	Head of Operational Excellence	3 workshops	General understanding Model development & testing

For this research project semi-standardized interviews are used. Meuser and Nagel (2002) indicate that expert interviews are a specific form of applying semi-standardized interviews. Expert interviews are used for the present research project to analyse and compare the content of the experts' knowledge (Flick, 2006). The interviews were conducted to get a better understanding of the research field, to support the model development, and enrich it with practical relevance as well as to discuss the developed model and adjust it. Table 2 provides an overview of the companies the researcher personally conducted interviews with.

Table 2 *Overview of the empirical data – Interviews*

Company	Industry	Involved functions	Data gathering via	Data used for
Automotive Assembly	Automotive Industry	Head of Industrial Engieering, Head of Operational Excellence	3 Interviews, meeting	General understanding, model development
Automotive Supplier I	Automotive Industry	Head of Quality, Site Head	Meeting, site tour	General understanding
Automotive Supplier II	Automotive Industry	Global Head of Production System	Interview	General understanding, model development
Automotive Supplier III	Automotive Industry	Global Head of Industrial Engineering	2 Interviews	General understanding, model development & testing
Automotive Supplier IV	Automotive Industry	Corporate/ divisional Operational Excellence consultant	Interview	General understanding, model testing
Automotive Supplier V	Automotive Industry	Corporate lean employee, Lean trainer	2 Interviews	General understanding, model development & testing
Truck Company	Truck Industry	Senior Consultant Production System	2 Interviews	General understanding, model development & testing
Mechanical Engineering	Mechanical Engineering	Head of Operational Excellence site level, Site head, General Manager Switzerland	3 Interviews, site tour	General understanding, model development & testing
Medical Care	Healthcare	Global Head of Operational Excellence	Interview	General understanding, model development
Global pharma company Asia	Pharmaceutical industry	Corporate Head of Operational Excellence	Interview	General understanding, model development
CxO Pharma	Pharmaceutical industry	Corporate Head of Operational Excellence	Interview	General understanding, model development
Global pharma company EU I	Pharmaceutical industry	Director Operational Excellence site level	Interview	General understanding, model development
Global pharma company EU II	Pharmaceutical industry	Head of Operational Excellence site level	Interview	General understanding, model development
Aquired Pharma Company	Pharmaceutical industry	Director Head of Operational Excellence	Interview	General understanding, model testing
Machine Tool Inc. I	Machine tools industry	Corporate & Site Head of Operational Excellence	Interview	General understanding, model development & testing
Machine Tool Inc. II	Machine tools industry	Corporate & Site Head of Operational Excellence	Interview	General understanding, model development & testing
Agricultural Company I	Agricultural industry	Corporate Head of Operational Excellence	Interview, Site tour	General understanding, model testing
Agricultural Company II	Agricultural industry	Corporate Head of Operational Excellence	Interview	General understanding, model development

Case study research. The general goal of the case study research is to study a small number of cases in detail and thereby develop an in-depth understanding of the natural setting, complexity, and context (Punch, 1998). In particular, case studies seek to study phenomena in their contexts, rather than independent of context (Pettigrew, 1973). The chosen approach for this thesis is a multiple case study. The cases are further used for a cross-case analysis. According to Eisenhardt (1989), cross case analysis can be conducted by looking at data in different ways: This can be to select categories and look at within-group similarities as well as with intergroup differences. Another tactic is to select pairs of cases and list the similarities and differences between each pair (Eisenhardt, 1989). In the dissertation at hand, the quantitative data are used to complete the case study with insights. Quantitative research explains phenomena by collecting numerical data that are analysed using mathematically based methods (Aliaga & Gunderson, 2005).

Table 3 *Overview of the empirical data – Case study*

Company	Industry	Involved functions	Data gathering via	Data used for
Gx Pharma Inc.	Pharmaceutical industry	Global Head of Operational Excellence, six Site Heads	Interviews, workshops, trainings, meetings, site tours, St.Gallen operational excellence benchmarking	General understanding Case study
Speciality Pharma Inc.	Pharmaceutical industry	Head of Operational Excellence, Site Head	Interviews, workshops, trainings, meetings, site tours, St.Gallen operational excellence benchmarking	General understanding Case study
R & D Asia Inc.	Pharmaceutical industry	Head of Operational Excellence, Site Head, Head of Industrial Engineering	Interviews, workshops, trainings, meetings, site tours, St.Gallen operational excellence benchmarking	General understanding Case study

Alignment of research results & desk research. In the last step, the research results are aligned and the feedback from the case study will lead to guidelines, which will be provided to practitioners. At this stage the research process ends according to Ulrich (1984). The descriptive and generic artefact is embedded (instantiation by embedding) in the St.Gallen operational excellence model.

Table 1 to 3 summarises the empirical database, which consists of 25 companies the author exchanged information and could study organisation of the improvement initiative. This work helped to gain a general understanding on the research field, as well as to provide the basis for the case studies and the model testing. The focus of the

chosen companies is on the pharmaceutical industry. It comprises several site visits and discussions with site heads, as well as operational excellence leaders, to get more information on their operational excellence organisation in practice. Companies provided different sources of information, such as internal documents and site tours, which allowed for the triangulation of the data. Quantitative data are only used for the completion of the case studies. The data stem from an ongoing survey that has been conducted regularly since 2004 at the department of Production Management, namely, the St.Gallen operational excellence benchmarking. Overall, the empirical database consists of manufacturing companies from diverse industries. In addition several other projects, the researcher worked in during his time at the University of St.Gallen enlarged his knowledge and general understanding on operational excellence in practice.

2.3 Definitions

The existing research on excellence and continuous improvement in the field of operations management is wide and the research in organisational design in general is even more extensive as well as has a long history. To ensure a common understanding, important terms are defined in advance. The definition further shapes how the author views the research field in the scientific track and what he sees as essential to analyse.

2.3.1 Definitions related to operational excellence

Excellence. The Oxford dictionary (2014) defines excellence "*as the quality of being outstanding or extremely good"*, and traces its origins from the Latin word *excellentia*. A definition of excellence itself cannot be found in the operations management literature. The European Foundation for Quality Management (EFQM) defines excellence as "*Excellent Organisations achieve and sustain outstanding levels of performance that meet or exceed the expectations of all their stakeholders."*(EFQM, 2014). Dahlgaard and Daahlgard-Park (2007) define the term only indirectly by saying that, *"excellence models and frameworks are inspired by the Japanese practices and they recognize the importance of the soft dimension of organisational realities"* (p. 371). They further state that, *"excellence is not a stage, but a way of doing, way of living, a process of becoming"* (Daahlgard-Park, 2009, p. 26).

Operational Excellence. "*Operational Excellence constitutes the continuous pursuit of improvement of a production plant in all dimensions. Improvement is measured by balanced performance metrics comprising efficiency and effectiveness, thus providing a mutual basis for an improvement evaluation*." (Friedli et al., 2013, p. 24). Based on the St.Gallen understanding, operational excellence consists of a technical and social

subsystem, wherein TPM, TQM, and JIT are assigned to the technical subsystem, and Effective Management System (EMS) to the social subsystem (Friedli et al., 2013).

Operational excellence support unit and operational excellence organisation. An operational excellence support unit is understood as independent organisational unit which conducts operational excellence activities and has different functions and responsibilities. No definition of an operational excellence support unit and operational excellence organisation could be found in the operations management literature. In practice, the wording Kaizen Promotion Office, Lean Promotion Office or Production System Office can be found (Lean Enterprise Institue, 2015). As a result of this research new definitions for both terms are provided in Chapter 6.1.

Continuous improvement. Low risk and low expense improvements performed by shop-floor workers and managers in order to reduce waste and provide a better working environment (Imai, 2012). The term kaizen is also often used, and refers to the Japanese word for continuous improvement. Imai further refers in the preface of his book *Gemba Kaizen,* to kaizen as "*a strategy to win by developing people into problem solvers"* (Imai, 2012, p. XV)

Continuous improvement initiative. Continuous improvement initiative consists of two broad areas of action required for sustained improvements, namely, the execution and the coordination of process improvement projects (Anand et al., 2009, p. 3). Following Imai (2012), a further distinction can be made between the stability/standardisation (maintenance) phase and the improvement phase.

Lean production. Several definitions can be found in literature. For this research Shah and Ward's (2007) definition is used as the socio-technical perspective on lean is in line with the St.Gallen understanding of lean. *"Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability"* (Shah & Ward, 2007, p. 791). Netland (2013) states that corporate lean programmes consist of five principles: TQM, TPM, JIT, human resource management, and continuous improvement.

2.3.2 Definitions related to organisational theory

Organisation. In the organisational literature on the subject different views and definitions of organisations can be found. The understanding of organisation in this thesis is based on the perspective of German scholars, who use different terminologies than their United States counterparts. For the research at hand, the institutional (goal-oriented, open social system with a formal structure), instrumental organisation (or-

ganisational structures as a tool to achieve objectives) and functional (organisational design as the creation of organisational structures) perspectives are taken into account (Schulte-Zurhausen, 2010). An organisation is seen as part of the infrastructure of a company. Organisation is seen in the sense of 'organising', which follows the functional understanding of an organisation. This includes all activities associated with the planning, implementation, and enforcement of organisational rules (Schulte-Zurhausen, 2010). Furthermore, it is important to distinguish between primary organisation ('Primaer Organisation') and secondary organisation ('Sekundaer Organisation'). The primary organisation includes all permanent organisational units that are connected to each other by hierarchical relationships. It also provides the basic hierarchical structure, which is represented by different organisational forms, such as the functional, geographical or matrix structure (Scott, 2013). The basic organisational forms are supplemented and superimposed by a parallel structure, the secondary organisation (Schulte-Zurhausen, 2010). The secondary organisational hierarchy includes all complementary and cross-hierarchical organisational structures and expands the primary organisational structure with additional structures that are central to the company's competitiveness considerations. The primary organisation is superimposed, e.g., by staff line organisation (Schulte-Zurhausen, 2010). These views on organisation are very simplified, but allow discussing a complex setting such as a manufacturing organisation.

Organisational structure. According to Mintzberg (1979) the structure of an organisation can be defined as the sum of the ways in which it divides its labour into tasks and then achieves coordination among these tasks.

Dimension of organisational structure. An organisational structure has multiple dimensions and different dimensions can be found in the literature: e.g., centralisation, standardisation, formalization (Damanpour, 1991; Koufteros & Vonderembse, 1998; Nahm, Vonderembse & Koufteros, 2003; Daft, 2012).

Organisational design. The concept of organisational design involves the systematic planning, implementation, and control of explicit organisational rules, and is therefore considered a structural approach. The focus is on the functionality and efficiency of the structures deliberately designed, constantly monitored and, if necessary, reorganised. The objective of the organisational design is to solve problems resulted from expected or existing events as efficiently as possible (Vahs, 2009). Organisational design is seen as one of several functions of management (Schulte-Zurhausen, 2010).

Organisation development. *"(...) is an effort (1) planned (2) organisation wide, and (3) managed from the top, to (4) increase organisation effectiveness and health through (5) planned interventions in the organisation's process, using behavioural-science knowledge"* (Beckhard, 1969, p. 9). Organisational development aims primarily at changing the attitudes and behaviour of organisation members, and rather less at designing a formal organisational structure (Schulte-Zurhausen, 2010). The main objective is a positive organisational climate and the focus is on the corporate culture (Vahs, 2009).

In this chapter the theoretical grounding of the thesis is presented. The research is based in organisational theories and complemented by a social theory. This choice shows the authors view on the research topic and stipulates the limitations of the research itself. Further, the research design to answer the research questions is presented. The author chose a research approach focusing on qualitative data to achieve the research objectives. In order to ensure a common understanding of the wording and meaning of technical terms, definitions are stated at the end of this chapter. These definitions are primarily based on the literature review, although the new term operational excellence support unit is introduced by the author.

3 Understanding operational excellence and organisational theory

There is nothing
so practicable
as a good theory
Kurt Lewin

Accurate research can only be conducted by taking existing knowledge into consideration. Thus, a literature review is an essential step and the foundation for a research project (Brewerton & Millward, 2001). A literature review can be defined as *"a summary of a subject field that supports the identification of specific research questions"* (Rowley & Slack, 2004, p. 31). Chapter 3 starts with an overview of the methodological procedure in the literature research. In a next step, the basic knowledge of the two research tracks is provided. Based upon this fundamental knowledge, the results of the literature research and its analysis are presented. This chapter ends with the implications and summary from the conducted literature analysis.

3.1 Literature research procedure

The literature research in this dissertation is conducted according to vom Brocke, Simons, Niehaves, Riemer, Plattfaut, and Cleven (2009), who propose a literature review to ensure quality, reliability, and traceability. The literature review comprises the following five steps:

1. Definition of review scope
2. Conceptualisation of topic
3. Literature search
4. Literature analysis and synthesis
5. Research agenda

These five steps are described in further detail in the following section and conducted activities for the research process at hand are indicated.

1. Definition of review scope. Based upon vom Brocke et al. (2009), the taxonomy according to Cooper (1988) is chosen to clearly define the scope of the conducted literature review. The taxonomy consists of the six basic categories of focus, goal, organisation, perspective, audience, and coverage. Figure 6 provides an overview based on Cooper (1988) and shows the chosen characteristics in bold face in the introduced categories.

The focus of the research is on research outcomes and the application of the research results. The goal is an integration of the research whereby the organisation of the research is on conceptual aspects. Conceptual is understood as the development of a new concept or the reinterpretation of existing ones, explaining or describing the phenomenon being studied. The perspective is neutral and the target audience is specialized scholars from the field of operations management and practitioners, namely operations managers in the field of excellence. The coverage of the research is exhaustive and selective.

Categories	Characteristics			
1) Focus	**Research outcome**	**Research methods**	Theories	Application
2) Goal	**Integration**	Criticism		**Central issue**
3) Organization	Historical	**Conceptual**		**Methodological**
4) Perspective	**Neutral representation**		Espousal of position	
5) Audience	Specialized scholars	**General scholars**	**Practitioners**	General public
6) Coverage	Exhaustive	**Exhaustive and selective**	Responsible	Central/pitvoal

Figure 6. Definition of the research scope based on Cooper (1988)

2. Conceptualisation of topic. The literature review should start with existing knowledge and potential areas where knowledge is needed. The working definition of the key terms should be provided in the conceptualisation phase (Torraco, 2005; Zorn & Campbell, 2006). The definitions of the key terms have already been provided in Chapter 1.3. These terms are further used for the literature search, aiming to cover the research field and preventing an overly-narrow search. The research terms are as follows: operational excellence organization, operational excellence structure, operational excellence infrastructure, operational excellence support organization, operational excellence organizational structure, operational excellence organizational design. In addition, operational excellence was replaced by continuous improvement in the same combination as with the term operational excellence as shown above.

3. Literature search. The literature search process can be conducted in various ways. According to vom Brocke et al. (2009), an approach comprising a database and keyword search, journal search, and forward/backward search is suitable. All of these are applied in the research at hand and described more detailed in the following.

Database selection and key word search. EBSCOhost, Emerald Insight, Wiley Online Library, and Science Direct were used for the database research. The search was con-

ducted in all four databases as at least “abstract” and if possible in combination with “title” and “keywords search”. Table 4 summarises the search results in the database with the respective research word combinations. The period was chosen from 1960 to 2014. Depending on the research word combination the timeframe was shorter.

Table 4 *Overview of database selection and key word research results*

	"Operational Excellence"	*"Continuous Improvement"*	**Emerald**	**EBSCO Host**	**Science Direct**	**Wiley Online Library**
Target			Only abstract	Abstract, limited to academic journals, dissertation/thesis	Title, abstract, keywords	Only abstract
Time*			1960 - 2014	1960 - 2014	1960 - 2014	1960 - 2014
organization	and		10	101	11	20
		and	210	1629	187	267
structure	and		9	19	2	7
		and	98	567	81	307
infrastructure	and		3	5	0	2
		and	15	79	17	22
"support organization"	and		0	0	0	4
		and	0	0	0	70
"support infrastructure"	and		0	0	0	1
		and	19	2	0	13
"organizational structure"	and		0	1	1	2
		and	4	24	1	14
"organizational design"	and		0	2	1	2
		and	1	12	0	24
		Overall	**369**	**2441**	**301**	**755**

*** dependent on availability of journals**

Note: The research was conducted in Dec. 2013 and complemented in Dec. 2014

The screening of the database resulted in different outcomes. The key word search in terms of infrastructure, support organisation support infrastructure, organisational structure and organisational design resulted - in the combination with operational excellence and continuous improvement - in a low number of findings. In a comparison with the keyword combinations with operational excellence and continuous improvement, continuous improvement resulted in more finings.

The combination of the keyword operational excellence and continuous improvement and organization as well as structure results in a high number of findings. Consequently, a detailed journal search was conducted using these key words, yielding a high number of search results.

Journal research. Based upon the conducted database review an in-depth journal review was conducted for the search terms with a high number of search results. The review of the relevant literature is based upon the journal ranking of Petersen, Aase, and Heiser (2011).

The top twenty journals from Petersen et al. (2011) were complemented with relevant organisational design literature. In the journal research, non-relevant journals like mathematical contents have been excluded from the beginning. In the search, empirical and conceptual papers were considered. Table 5 provides a list of the journals with the used key words and criteria (ISI category ranking).

Table 5 *Journal research overview*

Key words	Continuous improvement, Continuous improvement & structure, Continuous improvement & organization, Kaizen, Operational Excellence, Operational Excellence & structure, Operational Excellence & organization	
Criteria	All text, 1960 - 2014	
Journals	Academy of Management Journal	Journal of Optimization in Industrial Engineering
	Decision Sciences	Journal of Organization Design
	European Journal of Operational Research	Journal of the Operational Research Society
	Harvard Business Review	Management Science
	IIE Transactions	Naval Research Logistics
	Interfaces	Omega
	International Journal of Operations & Production Management	Operations Research
	International Journal of Production Economics	Operations Research Letters
	International Journal of Production Research	Organization Science
	International Organization	Organizational Dynamics
	Journal of Economic Behavior and Organization	Production and Inventory Management Journal
	Journal of Management Studies	Production and Operations Management
	Journal of Manufacturing Systems	Research in Organizational Behavior
	Journal of Operations Management	Strategic Management Journal

Backward and forward search. The backward search describes the process of reviewing the sources that were cited in the articles found in the keyword search. By contrast, the forward search is characterised by reviewing these articles that have cited the articles derived from the keyword search (vom Brocke et al., 2009). Both are used for the research process.

The conducted literature search was complemented with a review of operations management and organisation books. Especially early literature on continuous improvement and lean - which introduced the concept to the English-speaking audience - was reviewed, including Imai (1986), Ohno (1988), Womack et al. (1990), Liker (2004), and Takeda (2006). In the organisational design research track, literature from German scholars is used, among others are Vahs (2009), Kieser and Walgenbach (2010), and Schreyögg (2010). This knowledge is mostly used for the basic understanding chapter (Chapter 3.2).

4. Literature analysis and synthesis. The results of the so far conducted research (literature research) are presented in Chapter 3.6 in detail.

The fifth step according to vom Brocke et al. (2009) - the research agenda - has already been provided in Chapters 1 and 2. Before showing the results of this step, sub-chapter 3.2 provides a basic understanding in both research tracks, namely operational excellence and organisational theory and design.

3.2 Basic understanding of continuous improvement and operational excellence

The following sub-chapter describes the evolution of operational excellence. A focus is placed on the continuous improvement approach with its historical background, which the author considers essential for a useful understanding of improvement programmes. So this chapter addresses the existing confusion and the inconsistency associated with management approaches like operational excellence and lean production (Shah & Ward, 2007). At this stage, an in-depth analysis is renounced, as the section aims to provide brief summaries of the research field and basic knowledge that should help readers who are unfamiliar with the TPS, kaizen, and operational excellence to better understand the conducted research and thereby show the authors view on the research topic.

3.2.1 Influencing operations management concepts

Several concepts contributed to the today's view on lean, excellence, and continuous improvement. For a better understanding on corporate initiatives the authors first looks at influencing concepts that contribute to the development of operational excellence over the last 75 years.

3.2.1.1 The Toyota Production System

The history of continuous improvement is closely connected to Toyota, in particular due to the success of Toyota with its TPS. Moreover, kaizen - the Japanese terminology of continuous improvement - comes into the focus of practitioners and researchers. Toyota itself communicates the TPS as follows: *"This production control system has been established based on many years of continuous improvements, with the objective of "making the vehicles ordered by customers in the quickest and most efficient way, in order to deliver the vehicles as quickly as possible"* (Toyota, 2015a). The TPS has its roots in S. Toyoda's automatic loom in the early 1900s (Ohno, 1988). The TPS philosophy is based upon the absolute elimination of all waste using different methods and tools (Ohno, 1988). The reason for the focus on waste elimination is due to re-

source scarcity after the Second World War, whereby Toyota had to find their own system to fit their environment. They reacted by only providing a product that the customer wants (focus on doing the right things) and eliminating all forms of inefficiency or waste that do not add any value (focus on doing things right) (Modig & Ahlström, 2012).

The TPS was mainly influenced by K. Toyoda - the founder of the TMC - who developed the JIT concept, and T. Ohno,[1] who helped to establish the TPS at Toyota. The two pillars supporting the TPS are autonomation, also named jidoka, and JIT (Ohno, 1988). Jidoka enables the production to stop immediately when a problem occurs to avoid passing defective products to the next process step and thus it helps to solve the root cause of the problem. Accordingly, quality is built in the manufacturing process (Toyota, 2015; Imai, 1986). JIT addresses productivity improvement with the slogan making only 'what is needed, in the amount needed and exactly when it is needed'. This means that on the shop floor only the products that are needed by the next process are produced. The TPS includes standardisation of work, continuous work flows, direct links between suppliers and customers, and continuous improvement based upon scientific methods (Spear & Bowen, 1999). Waste reduction is a key objective in the TPS. Ohno (1988) structured waste according to seven types: overproduction, transport, motion, defects, over-engineering, inventory and waiting. Figure 7 shows the TPS as used today at Toyota Material Handling and the Toyota Production System Support Centre[2] (TSSC). The TSSC define the TPS as an organisational culture that comprises three key elements: Toyota's philosophy (continuous improvement, shop floor focus, people are the most valuable resource, customer first), TPS practices and tools (JIT and jidoka) and the managerial role (leaders inspire and develop people as well as solve problems for performance improvements) (Toyota, 2015d). The fundamental concept behind this is 'Good Thinking, Good Products', the slogan for Toyota factories all over the world (Toyota, 2015a). *"The real value of the system was that it provided motivation to employees by focusing on their skills and creativity"* (Toyota, 2015a). Toyota has the understanding of continuous improvement

[1] In Japanese documents or at Toyota sometimes written without 'h' as 'Ono'

[2] The Toyota Production System Support Center is a not-for-profit corporation affiliated with Toyota Motor Engineering & Manufacturing North America, Inc. located in Erlanger, Kentucky.

that no process can ever be declared perfect and thus there is always room for improvement (Toyota, 2015a).

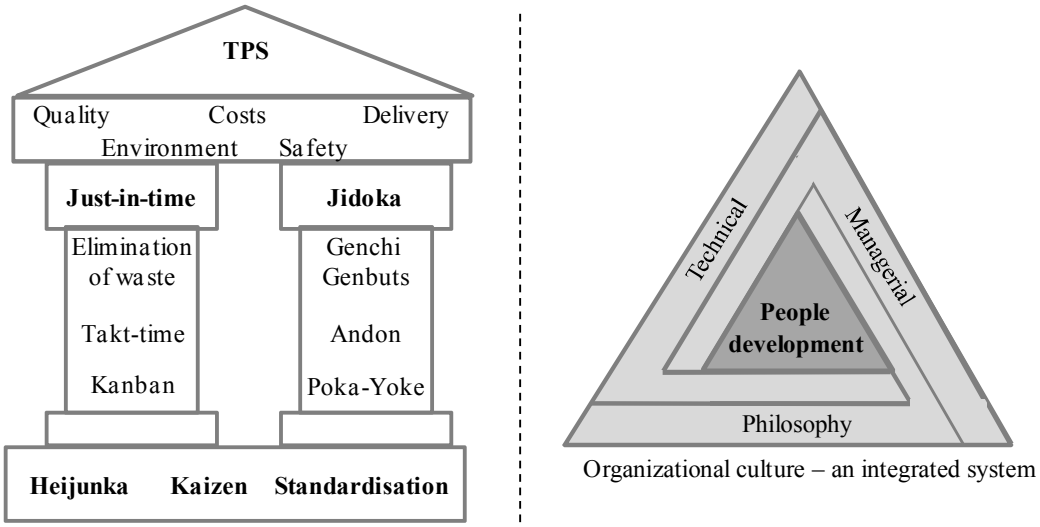


Figure 7. The Toyota Production System (Toyota 2015c, Toyota 2015d)

The TPS has evolved within Toyota and in collaboration with its suppliers in the 1950s and 1960s through many years of trial-and-error to improve efficiency. Astonishingly, it was not formally documented until 1965, when the kanban systems were rolled out to the suppliers. So, the TPS was largely unknown in the outside of Japan until the late-1970s (Schonberger, 2007). R. Hall commented: *"Toyota instructs implicitly. They cannot tell you in words what they are doing, not even in Japanese"* (Holweg, 2007, p. 423). The TPS started attracting attention in the oil crisis in the 1970s. The first publications on the TPS were by Sugimori et al. (1977), a Toyota employee, followed Ashburn (1977) and then Ohno (1978). Ashburn (1977) and Ohno (1978) describe the TPS in a holistic view, while Sugimori et al. (1977) limits his research to the kanban system. Moreover, Japanese management was also interested, e.g. marked by Vogel (1979) in his book ‚Japan as Number 1: Lessons for America'. Further articles followed by Monden (1981), while studies on the TPS and especially on JIT were published by Schonberger (1982), Hall (1983), and Monden (1983) in the 1980s. Monden (1983) focuses on single aspects of the TPS and Schonberger (1982) presents how JIT affects plant configurations, along with personal observations concerning how one Japanese subsidiary from Kawasaki in Nebraska reconfigured its plant in the process of adopting a JIT production system. Shah and Ward (2003) observed that the early Japanese books are generally more precise in defining the TPS and identifying its underlying components because the authors focused on the whole system.

There are manifold aspects to research Toyota and its TPS, but in the following section the focus is set on continuous improvement at Toyota and the organisational aspects of embedding the TPS.

Continuous improvement at Toyota. Continuous improvement plays a crucial role in the TPS which becomes obvious through positioning of kaizen in the fundament of the TPS house (ref. Figure 7). In 2001, Toyota released an internal publication called 'The Toyota Way', outlining Toyota's core values which contribute to the long-term success. The Toyota Way is supported by five basic values that are categorised within two key areas, namely continuous improvement and respect for people (Liker, 2004; Moldig & Ahlstöm, 2012).

The Toyota Creative Idea and Suggestion System was the company's first step towards encouraging employees to suggest improvements at work. Interestingly, Toyota's Creative Idea and Suggestion System was established in 1951, introduced by E. Toyoda, who took the idea from a Ford Motor Company plant, which he had visited a year before. The 1960s were a milestone for continuous improvement development at Toyota, whereby S. Shingo introduced the concept of zero quality control, T. Asaka and K. Ishikawa developed the concept of quality circles. Today, these are perceived as the first real kaizen events. "*Quality circles focused on solving quality problems that interrupted production throughout the plant. The quality circle was a cross- functional team charged with analyzing and finding the root cause of a problem, formulating a solution, and then implementing it"* (Mika, 2006, p. 6). Statistical quality control was introduced in 1949 at Toyota, and TQC introduced in 1961. In 1962, quality control meetings were started which are perceived as predecessor of the quality circle.

There are rare insights of the organisation of the TPS inside Toyota. As indicated, the TPS was not formally documented until the mid 1960s. However, the following aspects briefly provide some insight into organisational aspects and how the embedding of the TPS was organisationally supported.

TPS and organisational aspects. In particular information on the organisation of the Toyota Creative Idea and Suggestion System and quality circles can be found. The Toyota Creative Idea and Suggestion System is structured in form of a suggestion committee, followed by department committees, and sectional committees (Monden, 2012). Also the quality circles are very well structured. Figure 8 shows the structure of the quality circle structure and the Creative Idea and Suggestion System structure.

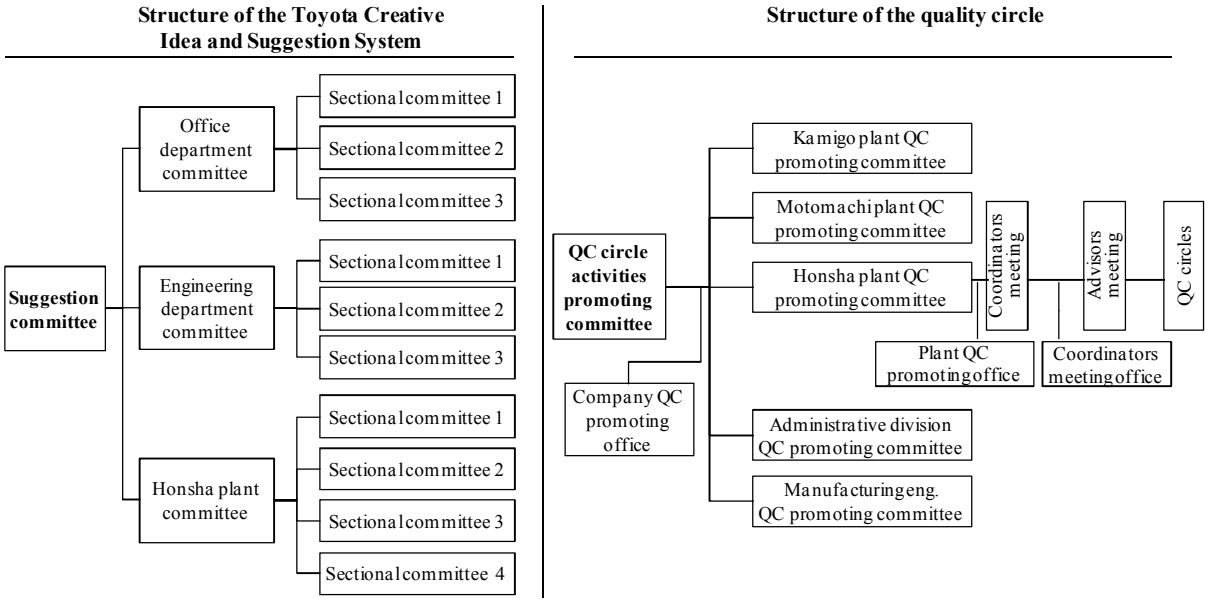


Figure 8. Structure of the creative idea and suggestion system and the quality circle (Monden, 2012)

A ‘quality circle activities promoting committee’ is supported by a ‘quality circle promoting office’ which collects all activities reported from the ‘quality circle promoting offices’ in the different plants. Taking plant A as example: Plant A has a ‘quality promoting committee’ and a ‘plant quality circle promoting office’. Conducted quality circle activities and improvement are discussed in the advisor meeting and their advisor meeting office. The next higher level is the coordinators meeting; they are reporting to the ‘plant quality circle promoting office’. This structure can be found in every plant (Monden, 2012).

Another organisational relevant factor in the TPS implementation is the Toyota’s Operations Management Consulting Division (OMCD). This unit was established in 1969 by T. Ohno (originally Production Survey Office) as the keeper of the TPS and to implement TPS at Toyota plants and its suppliers. The Toyota’s OMCD helped to solve operational problems and trained employees to transfer knowledge within the network (Spear & Bowen, 1999; Marksberry, 2012). Figure 9 shows the structure of the OMCD on corporate-global, corporate-regional and plant level.

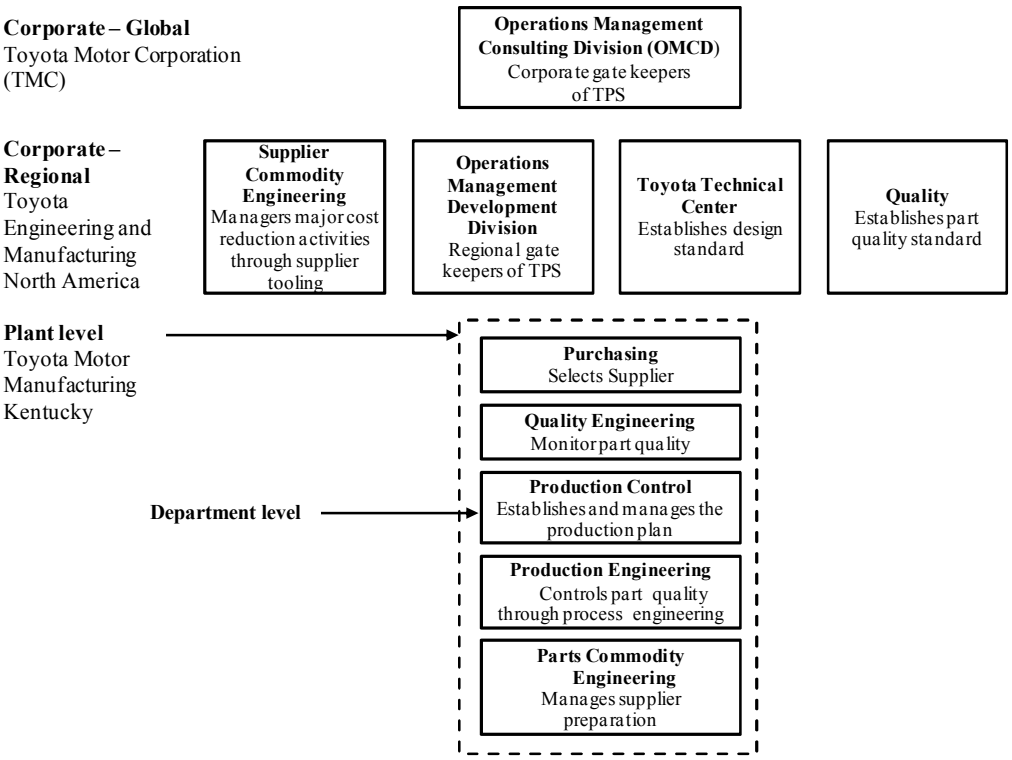


Figure 9. Structure of the Toyota's Operations Management Consulting Division (Marksberry, 2012, p. 341)

In 1976, Toyota started to systematically propagate TPS knowledge in the supplier network with the creation of the society for autonomous research on the TPS. The activities of this group started with autonomous study groups, the so called jishuken. Today, jishuken activities are conducted on team leader and group level (once a month), second-level manager (workshops once a month and participants rotate between sites), and upper management (as part of business leadership development high-level managers work on innovation focused projects) (Baudin, 2005). Until the 2010s, Toyota had responsibilities for the Operation Planning & Support Group on senior managing director level (board member) and for the Operations Management Consulting Division on managing officer level (Toyota, 2010).

3.2.1.2 The world class manufacturing concept

The term WCM was introduced by Hayes and Wheelwright (1984), who used it to describe organisations that achieved superior performance in their global industry through their manufacturing capabilities (Flynn, Schroeder, & Flynn 1999). *"Hayes and Wheelwright described world class manufacturing as a set of six world class manufacturing practices, implying that the use of best practices would lead to superior performance"* (Flynn et al., 1999, p. 250). These are: 1) workforce skills and capabilities; 2) competing through quality; 3) management technical competence; 4) rebuilding manufacturing engineering; 5) workforce participation; and 6) incremental im-

provement approaches. Especially for the research at hand, the sixth dimension is important. *"Hayes and Wheelright suggest that world class competitors pursue continuous improvement in small increments, winning the race by creating a constantly escalating standard"* (Flynn et al., 1999, p. 252). Hayes and Wheelright's (1984) six dimensions - also named practices - have been expanded by others (e.g. Schonberger, 1986; Hall, 1987; Giffi, Roth, & Seal, 1990). Schonberger (1986) enriched the discussion with his book 'World Class Manufacturing – The lessons of simplicity applied' by adding practices and considering sixteen manufacturing principles to play a major role in WCM. In his enhancement on WCM, Schonberger focuses on continuous improvement (Schonberger, 2007; Flynn et al., 1999). Thereby, Schonberger (1986) focuses on the continuous improvement of performance improvements, information, and quality. He also stresses the importance of simplification as a form of improvement. Both, Schonberger (1986) and Giffi et al. (1990) included the incremental improvement approach in their understanding of WCM (Flynn et al., 1999).

3.2.1.3 The lean production approach

In the early 1990s, the improvement of operations - particularly in the automotive industry - was strongly influenced by lean production. The oil crises end of the 1970s results in the interest in researching the automotive industry which led to the International Motor Vehicle Program at the MIT (Holweg, 2007). The results of this research contributed to the lean paradigm and the publication of the book 'The Machine That Changed the World' by Womack et al. (1990) which attracted strong interest. The term lean first appeared in 1988, when it was used by Krafcik in his article 'Triumph of the Lean Production System' (Krafcik, 1988). Initially, Krafcik used the term fragile in his master thesis, but in his MIT publication Krafcik (1988) used lean rather than fragile to overcome the negative association with fragile. Womack et al. (1990) describe the concept of lean production as comprising of four core principles: 1) teamwork; 2) communication; 3) the efficient use of resources and elimination of waste; and 4) continuous improvement. In their book, Womack et al. (1990) regularly refer to the TPS in their book on lean production, which led to confusions in theory and practice. "*Lean production directly descended from and is frequently used as a proxy for Toyota Production System (TPS), which itself evolved from Taiichi Ohno's experiments and initiatives over three decades at Toyota Motor Company"* (Shah & Wards, 2007, p. 786). A common perception seems to be that the TPS movement began in the 1990s with the publication of the five-year research International Motor Vehicle Program results. However, as shown in Section 3.2.1.1, early publications on JIT and TPS can be dated to the end of the 1970s and the early 1980s. Others refer to the strong MIT brand name

as well as the good 'marketing skills' and the use in university lessons to explain the success of Womack et al.'s (1990) book. It can be concluded that lean production became one of the most significant paradigms in manufacturing companies.

Due to the success of improvement initiatives under the name lean, there are many definitions combined with lean, e.g. lean production, lean manufacturing, lean management and lean development. For this thesis, the concept of lean production is used, based on the definition based of Shah and Ward (2007): "*Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability"* (p. 791).

Various research on lean production is available today. Stone (2012) divided these into four phases: From the early mention of 'Japanese management' practices (Drucker, 1971) to the discovery phase (1970-1990) and dissemination (1991-1996) of the TPS into the lean paradigm, followed by the implementation phase (1997-2000) and over the last years from the enterprise phase (2001-2005) to the performance phase (2006-2009) (Stone, 2012). Different scholars generally agree that TPM, TQM, JIT and human and strategic-oriented practices constitute lean (Cua et al., 2001). Netland, Ferdows, and Sanchez (2014) enlarge the lean research on corporate improvement programmes. Due to competitiveness on a global scale, multi-national companies develop a company-specific production system for their worldwide operations (Netland & Aspelund, 2013). These corporate improvement programmes often find their expressions in company-specific production systems, like the Synchro Production System at Trumpf or the Mercedes Benz Production System.

Organisational aspects of lean. Despite the high amount of lean research, only several scholars have addressed organisational aspects. What different scholars indicated that during the development of lean and consequently operational excellence the working environment in which it is introduced becomes affected (de Toni & Tochina, 1996; Hasle, Bojesen, Jensen, Bramming, 2012). Work organisation objectives for lean production are: standardisation, discipline and control, continuing training and learning, a team-based organisation, participation and empowerment, multiskilling and adaptability, common values and compensation and rewards (Monden, 1983; Ohno, 1988; Shingo & Dillon, 1989; Womack & Jones, 1996; Liker, 2004; Olivella, Cuatrescasas, & Gavilan, 2008).

Lean is about breaking routines and the current way of working. This even is counterintuitive to the human nature sometimes – actively seek for problems, changing standards, slow down to balance in order to speed up or stop the production line in or-

der to solve the root cause so that the production will never stop. Beside the technical aspects and from a socio-technical perspective, lean is about developing people. Looking at the TMC, some Japanese TPS gurus mention that the essence of TPS and lean is developing a 'kaizen consciousness' in every employee (Ballé, Beauvallet, Smally, & Sobek, 2006). This means changing the mental way of thinking and processes of every employee towards a mindset of seeing problems, not hiding them but rather solving the root cause. In practice, lean is sometimes used similarly to continuous improvement or kaizen, although lean is not continuous improvement; rather, both supplement each other and enable the full use of the potential of each approach. Due to its similarity and former usage of Toyota as a prime example, lean is referred to as Toyotism. What kaizen truly involves is shown in the next sub-chapter.

3.2.2 What is continuous improvement?

In this chapter, continuous improvement and its Japanese synonym kaizen are described in more detail. Defining continuous improvement first requires an examination of its historical background and evolution. This seems essential for a useful understanding in today's business environment, with its loss of understanding due to manifold views on continuous improvement.

3.2.2.1 History of continuous improvement

In general, researchers and practitioners realised that continuous improvement in an industrial context does not originate from Japan and is not part of the Japanese culture to the degree as it is often claimed (Ma, 2013). A kind of suggestion system could be traced back to the 18th century in Japan, where a shogun had a small box called the *meyasubako* to motivate people making ideas (Schonberger & Robinson, 1991). De facto, many Western organisations were the precursor of today's operation improvements and Holweg (2007) indicates that these can be traced back to the 1800s. An early example in USA is the National Cash Register in 1894 or the suggestions system at Volkswagen (Schroeder & Robinson, 1991). In 1949, Volkswagen started their so-called 'Betriebliche Vorschlagswesen', where the workforce was involved in the development of products and workflow as a part of quality assurance (Volkswagen 2015a).

However, continuous improvement as it is known today in operations management has a strong connection to Toyota and its ascendency after World War II. The probably best-known advocate of continuous improvement is M. Imai, who wrote the first English-published book on continuous improvement with the title 'Kaizen – The Key to Japan's Competitive Success' in 1986. The origin of continuous improvement is

strongly connected to the absorption of foreign technique in Japanese post-war industry, particularly the quality control movement imported from the United States. The absorption of foreign techniques in Japan was extensively influenced by the Training within Industries initiated by United States. These programmes comprised three ten-hour courses known as the "J" modules: job instruction training, job methods training and job relations training. The most influential persons were W. Deming and J. Juran, two quality gurus of the 1950s. Deming - who was invited by the Union of Japanese Scientists and Engineers - highlighted the importance of data collection and the Plan-Do-Check-Act cycle (Zangwill & Kantor, 1998). In the 1950s he returned to Japan regularly as a lecturer and consultant (Japanese Scientists and Engineers, 2015). The exposure of Japanese management to Training within Industries and the experiences that Japanese executives brought home from America - e.g. T. Ohno and T. Toyoda from Ford - helped them to generate some great concepts, like the supermarket principle (Schroeder & Robinson, 1991). Poe (1991) argued that the development of continuous improvement programmes was based upon Japanese managers' interpretations of the Western manufacturing philosophies. Companies that adopted such programmes early included Toshiba in 1946 and Toyota in 1951 (Schroeder & Robinson, 1991). Moreover, Toyota was trained in the Training within Industries programmes in the form of an internal training for supervisors (Toyota, 2015b). As already shown in Chapter 3.2.1, Toyota started the Toyota Creative Idea and Suggestion System in the early 1950s.

A contributing factor to popularising continuous improvement outside of Japan and the United States was an NBC (1980) broadcast ''If Japan can...Why can't we?''. According to this documentary, Deming's quality concepts were the major contributors to Japan's industrial rise. He became popular overnight to a brought audience (Maurer, 2012). In Europe, the idea of continuous improvement became famous in particular through the application at Porsche and Opel in the early 1990s.

3.2.2.2 Definition of continuous improvement

Today, different perspectives on continuous improvement exist, including Japanese-oriented and Western views. Starting with the 'Japanese original', Imai defines continuous improvement as *"a strategy to win by developing people into problem solver"* (Imai, 2012, p. XV). A further definition is: *"Kaizen is a Japanese word that has become part of the language in many Western companies; it means continuous incremental improvements of the standard way of work*" (Japan Human Relations Association, 1997). For the Japanese the word kaizen stands for the way in which the staff

handles daily problems (Suârez-Barraza, Ramis-Pujol, & Kerbache, 2011). Continuous improvement signifies small improvements with a process-oriented thinking based upon a problem-solving process with decisions made based upon data (Imai, 2012). From a Western view, kaizen designates a range of improvement approaches, ranging from staff-dominated projects with limited involvement from people working the process to initiatives that emphaszie participation through suggestions or team improvement projects (Laraia, Moody, & Hall, 1999). Continuous is understood as the notion that "*improvement activity is explicitly designed and organised for continuity"* (Lillrank et al., 2001, p. 43). Improvements are seen as a planned change and can be classified as either continuous improvement or innovation (Imai, 2012). Results are based upon ongoing effort with a low-risk approach (Imai, 2012). Thereby the results should accumulate and conducted around the same performance indicators (Lillrank et al., 2001; Choi, 1995).

Continuous improvement can be considered from different perspectives - similar to lean - whereby Shah and Ward (2007) and Scherrer-Rathje, Boyle, and Deflorin (2009) distinguish lean as a philosophy and lean from a practical perspective as a set of management practices, tools or techniques. Suârez-Barraza et al. (2011) conducted an analysis of the literature on Kaizen and proposed three perspectives: 1) Kaizen as a 'management philosophy'; 2) Kaizen as a component of TQM; and 3) Kaizen as a theoretical principle for improvement methodologies and techniques. The separation into these two distinctive streams can be found in the continuous improvement literature, too. *"The kaizen philosophy assumes that our way of life – be it our working life, our social life or our home life – should focus on constant improvement."* (Imai, 2012, pp. 1-2). The tool perspective is represented by the house of gemba management, e.g. with 5S (Imai, 2012).

Especially in practice, additional wording in connection with continuous improvement exists, such as continual improvement processes and continuous improvement processes. The Oxford dictionary states that continual and continuous are often used as synonyms, whereby continuous is used more frequently than continual. Continuous can be used to refer to space as well as time. Continual typically means "*happening frequently, with intervals between*" (Oxford dictionaries, 2015a). In this thesis, the term continuous is used. A process can be understood as a "*series of actions or steps taken in order to achieve a particular end"* (Oxford dictionaries, 2015b). These terms refer more to the tools and technique perspective of continuous improvement.

For this thesis, the continuous improvement understanding of Anand et al. (2009) is used, defining continuous improvement as *"a systematic effort to seek out and apply*

new ways of doing work i.e. actively and repeatedly making process improvements" (p. 444). The pursuit of ongoing improvements can be understood as a philosophy which focuses on sustainability and requires ongoing attention and learning. In this thesis, initiative is rather used, understood *as "an act or strategy intended to resolve a difficulty or improve a situation; a fresh approach to something"* (*Oxford dictionaries, 2015c)*. Anand et al. (2009) define a continuous improvement initiative as *"... a planned and organised system for the continual discovery and implementation of such process changes. Continuous improvement initiatives consist of two broad areas of action required for sustained improvements, namely the execution and the coordination of process improvements projects"* (p. 446). Ultimately, the potential of continuous improvement is obvious as it contributes positively to the achievement of organisation's target (Lillrank et al., 2001).

3.2.2.3 Types of continuous improvement

Several scholars indicate that different types of continuous improvement exist, which are addressing continuous improvement at different hierarchical levels or strategic, process, and workplace levels. From a hierarchical perspective the three types of kaizen are management-, group- and individual-oriented kaizen (Imai, 2010; Bodek & Tozawa, 2007; Laraia et al., 1999). Management-oriented kaizen is considered the most important type as it focuses on the company strategy and involves everyone in the company (Bhuiyan & Baghel, 2005). A similar approach dates back to hoshin kanri kaizen, starting at the strategic level (Gorecki & Pautsch, 2014). Group-oriented kaizen is represented by quality circles, in which employees form a team with the goal to find a problem that they are faced during the daily work and solve its root causes without interference from management (Bhuiyan & Baghel, 2005). An expert task force is based upon the reliance on a temporary expert task force comprising professionals from maintenance, engineering, and quality thus the span of improvement tasks requires considerable time and investment. Individual continuous improvements are set off by individuals and are generally organised with a suggestion system (Berger, 1997). Individual-oriented kaizen is understood as a bottom-up approach (Bhuiyan & Baghel, 2005). By contrast, flow kaizen addresses the process and focuses on the value stream of a production or service process, which is considered in a holistic way. Point kaizen is subject of improvements that are without a holistic reference to higher organisational objectives and address a workplace improvement.

Another type - mainly influenced by the Japanese understanding - is kaizen teinan. *"Teinan means proposal or suggestion and consequently Kaizen teinan is a company-*

wide system for employees' continuous improvement proposals, to bring ideas of each employee" (Japan Human Relation Association 1997, p. X). Bodek and Tozawa (2007) define it as follows: *"Quick and easy Kaizen is a simple but powerful system designed to inspire all employees to generate or offer new improvements ideas on a continuous basis. It enables them to make their own jobs easier, and to take the initiative to make small changes that will help satisfy customers, reduce costs, improve quality and safety, and also to reduce the time it takes to deliver products and services to your customers"* (p. 7). Kobetsu kaizen stands for focused improvements and is used in connection with TPM and an element of the TPM house. The objective is the maximisation of the machine efficiency.

Kaizen requires strong support as well as direction from top management to be successful (Laraia et al., 1999). This is a key aspect and often neglected as kaizen is perceived as a bottom-up approach. Figure 10 indicates the important role of the middle and top management in the area of innovation and kaizen. The maintenance of achieved improvements is positioned rather at the supervisor and shop floor level (Imai, 2012).

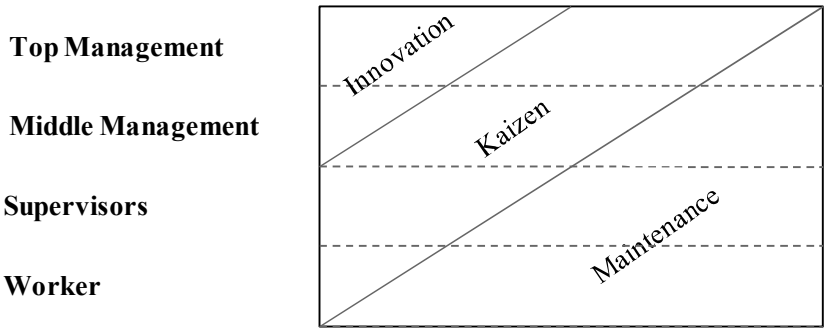


Figure 10. Innovation, kaizen, and maintenance at different organisational levels (Imai, 2012)

3.2.2.4 Principles of continuous improvement

In literature, six major guiding principles of continuous improvement exist as outlined by Imai (2012): continuous improvement and management, process orientation, following the PDCA and SDCA cycles, speak with data, putting quality first, and the next process is the customer. In the following, these essential elements are described in further detail. Laraia et al. (1999) add 'reject excuses and seek solutions', as well as the slogan 'just do it'.

Continuous improvement and management. In the context of continuous improvement management has two functions that are maintenance and improvement. Maintenance deals with activities of keeping standards (technological, managerial, and oper-

ating), training the employees, and discipline (Imai, 2012). Improvement refers to elevating and improving current standards (Imai, 2012). According to Kaynak (2003), management is one of several elements that affects operating performance. Imai (2012) suggests that "*management exists to help gemba (meaning real place) do a better job by reducing constraints as much as possible"* (Imai, 2012, p. 15). Ownership, responsibility, and authority to change a process are crucial for the success of any continuous improvement activity (Laraia et al., 1999).

Process orientation. According to Imai (2012), improvements are based upon process improvements before improvements in the product. According to Kaynak (2003), process management has one of the strongest effects on operating performance (inventory management and quality performance). Kaizen is such a difficult undertaking because the main idea is to change one single parameter in the process and see what happens by comparing data before and after the change. When changing many parameters, it is hard not know which changed data led to an improvement. That is why kaizen activities are small and take a long time. This is also a reason why Toyota is very open to share their concept of continuous improvement. It is impossible to copy the achieved improvements as outsiders do not know which single change led to the improvement.

Speak with data. Collecting data on the status-quo helps to recognise and understand problems. Data serves as a starting point for improvements and helps to focus on the right area of future improvements (Imai, 2012). The Key Performance Indicators (KPI) need to be aligned to the overall initiative. Setting KPIs at different organisational levels has been seen as a success factor for a sustainable lean implementation (Brunet & New, 2003). As continuous improvement strongly relies on employee involvement, the workers need to have visual access to information, and understand these to evaluate and improve the underlying processes (Fullerton, Kennedy, & Widener, 2014). But, working with data is only useful when the employees can influence the KPIs with their improvement activities; this encourages empowerment and participation.

The next process is the customer. Customer focus comes into place in the form that all work is a series of processes, each of which has its supplier and customer. There are internal (within the company) and external (out in the market) customers. The idea behind is that no defective parts or inaccurate pieces of information is passed to the next process (Imai, 2012).

Putting quality first. According to several scholars, quality should always have the highest priority among the company's goals (Aguayo 1991; Imai, 2012). Practising a

quality-first credo requires management commitment. Quality refers to process and product quality (Imai, 2012). However, Ferdows and De Meyer's (1990) founding logic - which postulates the quality-delivery-flexibility-cost sequence of manufacturing competitive performance - is not a universal procedure.[3]

Improving and maintaining standards. Combining innovations with ongoing effort of improving and maintaining standards leads to real improvements (Imai, 1986; Berger 1997). The Plan-Do-Check-Act cycle goes back to Shewart (1939) and Deming (1986). Before one starts working on Plan-Do-Check-Act [4], any current process must be stabilised in a process which is referred to as the standardise-do-check-act cycle (Imai, 2012).

People orientation. Being people-oriented and having the involvement of every employee over all hierarchical levels is a key element of continuous improvement (Imai, 1986). In Anglophone literature, total people involvement, employee empowerment and total employee involvement is often used. Hall (1987) indicates that total employee involvement is believed to be a key driver in the success and long-term sustainability of continuous improvement. The essence of employee involvement is moving decision-making power downwards within the organisation (Lawler, Mohrmann, & Ledford, 1998). Cotton (1988) defines employee empowerment as *"... participation process to use the entire capacity of workers, designed to encourage employee commitment to organisational success"* (Cotton, 1993, p. 3). McLachlin (1997) indicates that employee involvement includes process improvement suggestions by each employee.

3.2.2.5 Elements of continuous improvement initiative

A continuous improvement initiative, also named continuous improvement system, consists according to Imai (2012) of TPM, total quality control / TQM, a JIT production system, policy deployment, a suggestion system, and small group activities. Implementing these elements implies moving away from the traditional way of working.

[3] Schroeder et al. (2010) clearly suggest that the sand cone model is not a universal phenomenon. Rather, there may be contingencies guiding the sequence that different plants follow (p. 20).

[4] In 1986, Dr. W. Edwards Deming reintroduces the Shewhart Cycle. He used the Plan-Do-Study-Act, often called PDSA, cycle. Today most people talk about the Plan-Do-Check-Act, often called PDCA. Deming continues by encouraging his audience to use the Plan-Do-Study-Act cycle (Deming, 2016).

There is a strong focus on team organisation, multi-functional teams, spontaneous problem-solving at low organisational levels, utilising employee ideas with a suggestion scheme, employee involvement and active participation (Pettersen, 2009). These elements can also be found under different branding of corporate improvement initiatives, e.g. lean (Cua et al. 2001). In this chapter, these elements are briefly described.

According to Imai (2012) and other authors, one element of kaizen is hoshin kanri. The top management should establish clear targets to guide every employee. The process of setting objectives, controlling the results and involving employees is called policy deployment or hoshin kanri in Japanese (Kondo, 1998). It can be translated as 'management by a compass needle', which implies clear orientation of future objectives at a strategic level as well as a vertical and horizontal planning process to ensure that everybody in the organisation knows what to do (Gorecki & Pautsch, 2014). A continuous improvement system also has a formal suggestion system. According to Netland et al. (2015) show that financial rewards are not always beneficial for an improvement programme, especially when financial incentives get removed after sometime it becomes hard to motivate employee to submit suggestion without previous rewards. Another element is small group activities which refer to quality circles with multi-functional teams (Karlsson & Ahlström, 1996). The core idea of TPM is to achieve maximum effectiveness of the equipment used in production (Nakajima, 1988). TQM as a holistic quality philosophy is a manufacturing programme aimed at continuously improving and sustaining the quality of products and processes by using the involvement of all employees, suppliers, and customers (Cua et al., 2001). JIT is a manufacturing approach with the objective of continuously reducing and finally eliminating all forms of waste (Sugimori et al., 1977; Ohno, 1988). Some authors argue that continuous improvement should be considered as just another element in TQM (Crosby, 1979; Ishikawa, 1986; Deming, 1986; Garvin, 1987; Juran, 1989; Oakland, 1989; Feigenbaum, 1991; Dean & Bowen, 1994). These authors are based in the school of quality management. Other researchers argue that TPM, TQM, and JIT are the basis for lean, which often leads to confusion. Imai's (2012) understanding shows that lean and kaizen mutually reinforce each other. Continuous improvement is rather an inner attitude and mindset to improve and not so much about waiting for external reasons to improve. But, in general organisation aim to reach a stable status and the call for continuous improvement is rather contradictory. Consequently continuous improvement as process requires continuous commitment and effort in order to implement the single elements of the approach continuous improvement. An investment in resources and time seems crucial for a successful initiative.

3.2.3 What is operational excellence?

"Today, many organisations are "searching" for excellence but not many organizations have been able to achieve this goal, seemingly because management does not have a profound understanding what it really means to be excellent" (Dahlgaard & Dahlgaard-Park, 2007, p. 371). Excellence in operations, based upon the St.Gallen understanding, is described and clarified in this chapter.

3.2.3.1 Development of excellence research

Several researches have contributed to the excellence research in recent decades. In the following, the works of Peters and Waterman (1982), Hall (1986), and the EFQM model (2015) are outlined. While there are several other relevant scholars, the purpose of this sub-chapter is not to provide a complete overview but rather an orientation and the historical evolvement.

The excellence research was influenced by the findings of Peters and Waterman's 7S model (1982), a framework introduced by the two former McKinsey consultants in the late-1970s. Peters and Waterman (1982) identified eight attributes that characterised the excellent companies. Especially interesting for the research at hand are: 1) the simple form meaning that the underlying structural forms and systems in the excellent companies are simple, and top-level management is organised lean; 2) simultaneous loose-tight properties, meaning that an excellent company is both centralised and decentralised are interesting. Featured in the book 'In Search of Excellence', by T. Peters and R. Waterman, the framework visualises a constellation of eight factors that influence an organisation and its ability to change. T. Peters and N. Austin published the second book on excellence, called 'A Passion for Excellence' in 1985. The findings from the first book are simplified into the simple model or scheme: 1) people, who practice; 2) care of customers; 3) constant innovation; and 4) leadership, which binds together the first three factors by using management by wandering around at all organisational levels (Peters & Austin, 1985).

Another interesting, in the past neglected system, despite the success of the company, is the Danaher Business System from Danaher. The company´s history goes back to the end of the 1960s as a real estate investment trust. Already in the early 1980, Danaher was one of the first North American companies using the concept of continuous improvement at Jacobs Vehicle Systems business (Danaher, 2016). Four "P", namely plan, people, process, and performance are the foundation of the Danaher Business System. What made Danaher so successful was the link of a relatively new way of operating to the company´s business strategy. With each new acquisition

Danaher sends a team who is implementing the Danaher Business System fast and company-wide from top-down. Doing this Danaher is implementing its Business Excellence system inorganically within a relatively short timeline (Anand, Collis, & Hood, 2008).

In Europe, one of the most commonly used models for self-assessment and strategic change is the EFQM excellence model, based upon the following eight fundamental concepts: 1) result orientation; 2) customer focus; 3) leadership and constancy of purpose; 4) management by processes and facts; 5) people development and involvement; 6) continuous learning; 7) innovation and improvement; and 8) partnership development and public responsibility. The EFQM Excellence Model provides a holistic tool for assessing how effective an organisation is in developing and delivering a stakeholder focused strategy. The eight fundamental concepts can be used as the basis to describe the attributes of an excellent organisational culture. The model should be used more like a management control model involving the main aim of improvements rather than an award application (EFQM, 2015).

Liker (2004) describes the fourteen management principles behind Toyota. He divides these into four categories, all starting with "P": philosophy, process, people/ partners and problem-solving.

Category	Management principles
Philosophy (long term thinking)	Base manaement decision on a long –term philosophy, even at the expense of short-term fiancial goals
Process (eliminate waste)	Create a process "flo" to surface problems Use pull system to avoid overproduction leve the workload Stop when tehere is a quality problem Standardize tasks for continuous improvmement Use visual controls so no problems are hidden Use only reliable thourughly tested technology
People and partners (respect, challenge, and grow them)	Grow leaders who live the philosophy
Problem solving (continuous improvement and learning	Continual organization learning through Kaizen Go see for yourself to thoroughly understand the situation Make decision slowly by consensus, thoroughly considering all options, implement rapidly

Figure 11. The 4P model and Liker's fourteen management principles (Liker 2004)

The fourteen principles have been important principles in establishing excellence into the Toyota Corporation. Dahlgaard and Dahlgaard-Park (2007) recognise these fourteen principles as being important to understand how to guide an organisation towards excellence.

3.2.3.2 The St.Gallen understanding of operational excellence

Operational excellence has evolved from the understanding of lean production (Friedli & Schuh, 2012) and is generally regarded as part of continuous, corporate improvement concepts. In the following, the St.Gallen operational excellence understanding is discussed following the visualised St.Gallen operational excellence model (see Figure 12). Based upon the introduced concepts of TPS, WCM, lean production and excellence research as well as conducted work at the Institute of Technology Management at the University of St.Gallen, the operational excellence reference model can be divided into two larger sub-systems. First, there is a 'technical' sub-system that can be regarded as comprising TPM, TQM, and JIT. The sub-elements are structured in a succeed sequence, as data and practical work show that stable equipment are a prerequisite for a sustainable operational excellence implementation, followed by stable processes, which are among others ensured by stable equipment. Having stable machines and stable processes, low inventories can be obtained without risking running out of stock. Second, there is a 'social' sub-system with the ambition of an operational characterisation of work organisation and in particular management quality. This second system focuses on supporting and encouraging people to continuously improve processes (Friedli et al., 2013). Figure 12 shows the St.Gallen operational excellence model.

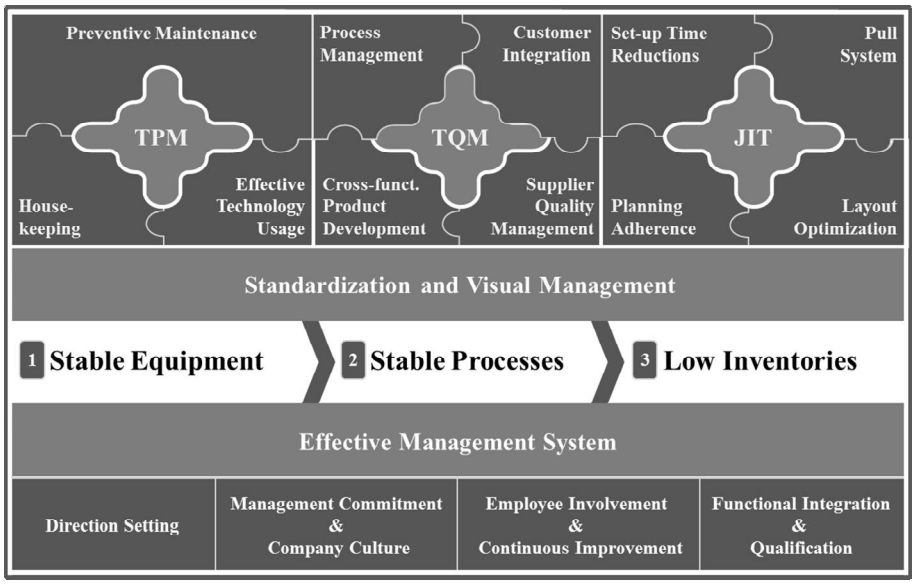


Figure 12. The St.Gallen operational excellence model (Friedli et al., 2013)

Total Productive Maintenance. TPM has its roots in Japan and its basic form was developed at Toyota in the 1960s, more precisely at Nippondenso. This time at the company was characterised by an increasing level of automation as well as productivity and quality problems. Frequent machine breakdowns overburdened the employees in a

maintenance department and in order to achieve the companies´ objectives the responsibility for the maintenance activities was extended to the machine operators. This is referred to as so-called autonomous maintenance, which forms a basis of the TPM philosophy. S. Nakajima - vice-chairman of the Japanese Institute of Plant Engineers - promoted TPM throughout Japan and has become known as the father of TPM.

TPM is a comprehensive company-wide approach designed primarily to improve equipment stability and effectiveness to achieve a higher level of equipment availability and maximise its efficiency through a structured system of preventive maintenance (Nakajima, 1988; Cua et al. 2001; Shah and Ward, 2007; Imai, 2012). This is achieved throughout the involvement and participation of everybody at the plant, not only the maintenance team (Nakajima, 1988; Imai, 2012). The preventive character sometimes leads to the use of preventive rather than productive in TPM. A TPM programme provides long- and short-term elements. The long-term consists of new equipment design, elimination of sources of lost equipment time, involvement of many areas of the organisation. The short-term maintenance efforts, normally performed at the plant level, are planned maintenance programme for the maintenance department and autonomous maintenance programme for the production department (McKone et al. 2001).

Based upon the St.Gallen understanding, TPM comprises three elements: housekeeping, technology usage, and preventive maintenance. McKone et al. (2001) name seven elements of TPM, namely four elements of autonomous maintenance: cross-training of operators to perform maintenance tasks, housekeeping on the production line, teams of production and maintenance employees, and operator involvement in a maintenance delivery system; And three elements of planned maintenance: disciplined planning of maintenance tasks, information tracking of the equipment and process condition and plans, and schedule compliance to the maintenance plan. Based upon the St.Gallen understanding, TPM exists of the three elements preventive maintenance, housekeeping, and effective technology usage. Preventive maintenance follows the slogan that preventing is better than repairing. Each of the elements comprises different methods and tools, e.g. 5S as a tool in the method housekeeping. Achieving this, the schedule compliance is an important indicator of the planned maintenance system (Nakajima, 1988). Housekeeping comprises the tasks of cleaning, lubrication, inspecting, precision checks, and other light maintenance tasks that are broken down into 5S's tasks. These tasks are shifted to operators which allow maintenance employees to focus on developing and implementing proactive maintenance plans (Nakajima, 1988; Suzuki, 1992). All activities lead to an effective technology usage.

TPM is one of the ten distinct dimensions of a lean system and a critical component of WCM (Shah & Ward, 2007; Schonberger, 1986). McKone et al. (2001) showed that TPM has a strong positive impact on multiple dimensions (cost, quality, delivery, and flexibility) of manufacturing performance.

Total Quality Management. TQM is labelled as a manufacturing programme (Dean & Bowen, 1994; Hackman & Wageman, 1995; Powell, 1995; Cua et al., 2001) as well as integrated management philosophy (Shah & Ward, 2007). According to Flynn et al. (1995) *"Total quality management (TQM) is an approach to improving quality of goods and services. At its foundation are the goals of continuous improvement of all processes, customer driven quality, production without defects, focus on improvement of processes rather than criticism of people and data driven decision making"* (p. 1327). From a rather management and philosophy perspective, TQM can be defined as a holistic management philosophy striving for continuous improvement in the whole organisation (Kaynak, 2003). A common understanding is that an organisation is treated as a total system from top management through to middle managers, supervisors, and shop-floor workers (Sitkin, Sutcliffe, & Schroeder, 1994). A critical fact is that the strong focus on quality sometimes leads to a separation between manufacturing and quality in its different departments. This dates back to Taylor (1911) and his understanding of specialisation.

According to Flynn et al. (1995), TQM is a multi-dimensional construct operationalised with the practices process flow management, product design process, statistical control/feedback and the quality management infrastructure practices customer relationship, supplier relationship, work attitudes, workforce management and, top management support. Cua et al. (2001) names nine practices that are often-quoted in operations management research literature as part of TQM: cross-functional product design, process management, supplier quality management, customer involvement, information and feedback, committed leadership, strategic planning, cross-functional training, and employee involvement. Dean and Bowen (1994) name the three principles customer focus, continuous improvement, and teamwork.

The St.Gallen understanding of TMQ comprises process management, customer integration, cross-functional product development, and supplier quality management (Friedli et al., 2013). Process management is understood as reducing process variation by identifying and correcting problems which should result in increased output and reduced rework as well as the elimination of waste (Anderson, Rungtusanatham, & Schroeder, 1994; Forza & Flippini, 1998). This increased process quality leads to improved product quality. An effective supplier quality management is facilitated by

long-term and cooperative relationships with as few suppliers as possible to obtain high quality materials as well as strong services (Kaynak, 2003). Cross-functional product development has two objectives: designing manufactural products and developing quality into the products (Flynn et al., 1995). This results in a higher efficiency in the processes by reducing the process variance and complexity (Ahire & Dreyfus, 2000; Flynn et al., 1995). Customer integration is a key aspect in a TQM system as its enables the manufacturer to have a close contact with customers and receive feedback on the products, the quality, and delivery (Cua et al., 2001). In a nutshell, all quality management efforts must be focused on the satisfaction of the customer needs (Dean & Bowen, 1994).

According to Kaynak (2003) infrastructural TQM practices such as training and employee relations or top management leadership affect the performance (inventory management and quality performance) through core TQM practices: process management, quality data and reporting, supplier quality management, and product (service) design (Kaynak, 2003).

Just-in-time. As already briefly indicated in Chapter 3.2.1, JIT is one of the two key pillars of the TPS. The major goal of JIT is continuously reducing and ultimately eliminating of waste (Sugimori et al., 1977; Ohno, 1988). In particular, delays in flow time and inventory aspects like work-in-process material are addressed through the implementation of JIT (Brown & Mitchell, 1991).

According to Hall (1987), JIT is linked to the three constructs total quality, JIT manufacturing techniques, and people involvement. Monden (1981) adds to this constructs a kanban system, production smoothing, and setup time reduction as critical components of a JIT system. According to Cua et al. (2001) nine practices are frequently cited as JIT practices, namely set-up time reduction, pull system production, JIT delivery by supplier, functional equipment layout, daily schedule adherence, committed leadership, strategic planning, employee involvement, and cross-functional training. Shah and Ward (2007) mention four factors that constitute the philosophy of lean production and facilitate JIT production. These are kanban cards (serves as a signal to start or stop production), continuous flow (establish mechanisms that enable and ease the continuous flow of products), set-up time reduction (reduce process downtime between product changeovers) and JIT delivery by suppliers. Mackelprang and Nairten (2010) consider ten JIT practices: small lot sizes, setup time reduction, JIT delivery from suppliers, daily schedule adherence, preventive maintenance, equipment layout, Kanban, JIT link with customers, pull system, and the repetitive nature of a master schedule. Comparing the provided attributes show recurring practices.

In the St.Gallen operational excellence model, the four sub-elements of set-up time reduction, pull system, planning adherence, and layout optimisation contribute to JIT (Friedli et al. 2013). Set-up time reduction is the extent to which the plant reduces set-up times in production. Daily schedule adherence deals with the extent to which a production site is producing to schedule as well as utilises time buffers to be prepared against unexpected stops in production. The pull system is a key element of any JIT initiative and follows the concept that a product is pulled by a customer through the production process and not pushed from process step to process step and put the warehouse as semi-manufactured or final product (Ohno, 1988). A layout optimisation refers to the close proximity of machinery and the arrangement of machines according the production flow to reduce waste in terms of transportation and motion (Mackelprang & Nairten, 2010).

Different scholars and in consequence also practitioners often use the terminology JIT production system (Imai, 2012). A production system can be defined as a regulation framework and guidance in the application of methods within a company (Westkämper, 1999). In literature, time-based manufacturing is used similarly to JIT. The focus of time-based manufacturing is placed upon reducing throughput time. Koufteros and Vonderembse (1998) highlight that JIT and time-based manufacturing address the same phenomena, albeit with different emphases. Time-based manufacturing is often described as an evolution of JIT with its internal focus on inventory and cost reduction and time-based manufacturing with an external focus on customers and time (Koufteros & Vonderembse, 1998).

JIT has a strong influence on several performance aspects. In particular, research shows that daily schedule adherence, JIT link with customers, pull system, and small lot sizes have a high impact on quality, cost, delivery, cycle time, inventory, and flexibility (Mackelprang & Nairten, 2010). Equipment layout, pull system, supplier quality level, and kanban are identified as major contriving factors to JIT performance (Skababira et al., 1993). Moreover, JIT is naturally associated with higher profitability and improved inventory performance (Callen, Fader, & Krinsky, 2000). However, JIT is only complemented by the use of organisational and human resource practices (Challis, Samson, & Lawson, 2005).

Standardisation and visual management. As Imai (1986) explained in his book on continuous improvement, it is impossible to improve a process before it has been standardised and by this stabilised. Standardisation not only refers to processes; moreover, it also includes the standardisation of technology and equipment. Standardisation is a common supportive element for TPM, TQM, and JIT. A further basic element is visual

management, a system that provides the employees with data on the processes and different aspects of performance (e.g. cycle and takt-time). One effect of visual management is transparency.

Effective Management System. In the EMS system are the social aspects of operational excellence placed. These include, beside human aspects, strategic-oriented practices. Based on Cua et al. (2001) there are common practices in all technical subsystem. These are committed leadership, employee involvement, strategic planning, cross-functional training, and feedback and information (Cua et al., 2001). The four bundles comprise different lean practices - including continuous improvement - and have influenced the St.Gallen operational excellence understanding (Friedli et al., 2013). In the St.Gallen operational excellence model, the EMS system comprises the elements of direction setting, management commitment and company culture, employee involvement and continuous improvement, functional integration and qualification (Friedli et al., 2013). Direction setting is a key aspect to make an operational excellence initiative sustainable as it defines what and how to achieve the desired business performance. Supporting the corporate objectives, the manufacturing objectives and concrete action plans are derived with the purpose of achieving a high business performance. It needs to be clear for every employee that manufacturing can support corporate objectives (Skinner, 1969). So the communication of objectives is essential. Jenner (1988) indicates that lean manufacturing organisation must have communication pathways that are broad and efficient. Top management commitment is crucial to any improvement initiatives and change programme. For instance, Powell (1995) found that top management commitment to quality was significantly related to the quality performance of an organisation. It is often desirable and associated with continuous improvement that changes are driven from the shop floor. But it is important that the transition to lean manufacturing needs to be driven by an executive management team (Scherrer-Rathje et al., 2009). Qualification enables an organisation to achieve its objectives more efficiently. Dreyfus and Vineyard (1996) found that training and qualification are significantly related to quality performance, whereby a higher level of qualification enables the application of multi-functional teams which are higher in operational excellence organisations than in traditional work organisations. A multi-functional team is understood as a group of personnel who are able to perform different tasks (Karlsson & Åhlström, 1996). For the organisation, this means that tasks that were previously performed by indirect departments (e.g. maintenance) are now the responsibility of a team. A high level of integration in the organisation is desired as integration allows transferring process and exploiting information across func-

tional sub-units without barriers and workers are more engaged in the overall organisational objectives (Turkulainen & Ketokivi, 2012).

The introduced operational excellence elements shape the understanding of operational excellence as a holistic, corporate-wide initiative with socio-technical aspects. Operational excellence concerns the way in which an organisation achieves superior performance, as well as how it continuously improves itself and comprises structural and behavioural changes to support the necessary activities in the best way. Operational excellence is defined as: *"Operational Excellence constitutes the continuous pursuit of improvement of a production plant in all dimensions. Improvement is measured by balanced performance metrics comprising efficiency and effectiveness, thus providing a mutual basis for an improvement evaluation"* (Friedli et al., 2013, p. 24).

3.2.4 Infrastructural levers in improvement initiatives

Infrastructural aspects are researched by several scholars and get an increasing importance in the management of improvement initiatives. *"Infrastructure practices can fulfil the important role of coordination and support of projects and create a culture for continuous improvement to help sustain a continuous improvement initiative beyond its immediate gains. However, existing studies tell us little about the constitute elements of such an infrastructure"* (Anand et al., 2009, p. 446). In their book 'Restoring Our Competitive Edge: Competing Through Manufacturing', Hayes and Wheelwright (1984) discuss a framework for structure and infrastructure aspects. But according to Flynn et al. (1999), the introduced infrastructure practice lacks practices related to JIT core practices (Flynn et al., 1999).

Miltenburg (2008) divided production systems into structural and infrastructural sub-systems, which he calls manufacturing levers. The three infrastructural sub-systems are human resources, organisation structure and controls, and production planning and control; the three structural sub-systems are sourcing, process technology, and facilities (see Figure 13). The phrase manufacturing levers is used by Miltenburg (2008) rather than production sub-systems. *"Each of the infrastructural and structural sub-systems is the subject of its own rich literature"* (Miltenburg, 2008, p. 312). The six levers determine the kind of productions system, whether a job shop, batch flow, operator –paced line flow, equipment-paced flow, continuous flow or a flexible manufacturing system (Miltenburg, 2008). Figure 13 shows a description of the six introduced levers. In this thesis, research in the area of the lever organisational structure is conducted.

Levers	Description
Humans resources	Skill level, ages, training, promotion policies, employment, security, and so on, of each group of employees
Organization structure and controls	Relationship between groups of employees in the production systems. How are decision made? What is the underlying culture? What system are used to measure performance and provide incentives?
Production planning and control	Rules and systems that plan and control flow of material, production activities, and support activities such as maintenance and introduction of new products
Sourcing	Amount of vertical integration. What is the relationship with suppliers? How does the production system manage other parts of the supply chain?
Process technology	Nature of production process, type of equipment, amount of automation, and linkage between parts of the production process
Facilities	Location, size, focus, and types and timing of changes

Figure 13. Levers comprising a production system (Miltenburg, 2008, p. 312)

According to Porter (1985), support activities facilitate the primary functions (logistics, operations, services, and marketing and sales), which are value creators. Such support activities include infrastructure which is - according to Porter (1985) - understood as the company's support systems (functions or departments), serving the organisation's needs, sticking its various parts together and making it work. Porter (1985) names this as infrastructure, while Miltenburg (2008) uses the term organisation structure and controls, although both deal with the relationship between groups of employees in the productions system (decision-making, system to measure performance, system to provide incentives). In literature, the following support functions can be found: human resource management, technological development, and procurement. In the field of infrastructure, these are finance, planning or quality management. The professional handling of operational excellence is not specified at all; this aspect is addressed in this thesis.

3.3 Basic understanding of organisational theory

Research of organisations has been conducted for decades and there are extensive publications in the different fields of organisational research. In this chapter, the history of classical organisation theories is described, followed by the basic elements of an organisation that are necessary for a deeper discussion of an operational excellence support organisation. Furthermore, the basic question of how and by whom tasks are fulfilled is tackled with the basic understanding of differentiation and integration. The sub-chapter includes the introduction of organisation structure and its elements. As the

research deals with a development over time, organisational design, development and change are explained. Thus, the foundations of organisation theories are covered, creating the basis for the understanding and design of an operational excellence support unit. Similar to Chapter 3.2, this section aims to provide an overview of the research field and in particular on selected topics which are relevant for the research at hand.

3.3.1 History of organisational theories

The best understanding of a discipline can be obtained from its pioneer's idea in the context in which it occurred and the historical development in response to changes in society, namely in the organisational theories of the late 19th and early 20th centuries (Schreyögg, 2010; Daft, 2012). Above all, these are the early approaches that Shafritz, Ott, and Jang (2011) refer to as classical approaches. They are important for the understanding of this work. For this thesis, relevant classical approaches are Scientific Management, Weber's Bureaucracy model, and Fayol's Administrative principles which are explained in the following. In addition, one organisational behaviour perspective, the Human Relation Approach, is included.

Scientific Management. F.W. Taylor (1911) provides the basis for a new view of humans as a production factor and a new mind-set in management in the 20th century. Thereby, he breaks down tasks at the plant level into single parts and retains workers to get the most from each motion and the time at work. He labelled his results under the term 'Scientific Management'. Forerunners of Taylor were the political economist A. Smith (1723 - 1790) - who described the advantages of the division of labour in the book 'The wealth of nations' (1776) - and C. Babbage (1791 - 1871) - who stated that the division of a work process in different sub-processes reduces labour costs in production (Babbage principle) (Vahs, 2009).

The focus in Taylor's work lies in the division of labour and the optimisation of work. The core principle is the resolution of planning and execution, and thus the separation of intellectual and manual work. The work content is analysed with scientific methods. This is another prerequisite and core of any optimisation of the work organisation. Therefore, Taylor used time and motion studies. The selection of a suitable worker for the task (systematic personnel selection) points to the increasing importance of specialisation (Taylor, 1911; Schreyögg, 2010). According to Taylor, the role of management is to maintain stability and do the thinking while workers should do what they are told by management (Daft, 2012). As successful as 'Taylorism' was, the approach was very controversial due to the negative consequences of scientific management on the worker, such as the loss of sense of work, a high level of controlling

and missing self-determination. The combination of Taylor's thoughts with the former methods and technologies of mass production had a strong influence on the modern industrial society. Taylor's conception of scientific management was the catalyst for a global rationalisation movement (Thommen & Achleitner, 2003). Their work was also the starting point for the establishment of the 'Reichsausschuss für Arbeitszeitermittlung' in Germany in the early-1920s, publishing the principles of 'Taylorism' in German (REFA, 2015).

Weber's Bureaucracy Model. A further important contributor to the structural ideas stem was the German economist and sociologist M. Weber. His main work 'Wirtschaft und Gesellschaft: Grundriss der verstehenden Soziologie' (1922) is the starting point for the development of the bureaucracy approach. The reason for his work was the emergence of large organisations in the industrial society at the beginning of the 20th century. These companies were led in a patriarchy way and dominated by an executive with almost unlimited power. Weber's interest particularly concerned the question of how power (he called it authority) is exercised in such an organisation. His bureaucracy model outlined the following six central elements: 1) a fixed division of labour and authority (in particular, the tasks of competence are accrued formally, whereby it does not matter who, whereby people can be exchanged without changing the organisational structure); 2) a hierarchy of offices; 3) a set of written rules governing performance; 4) the separation of personal from official property and rights; 5) technical qualifications (not family ties or friendships) for selecting personnel; and 6) employment as a primary occupation and long-term career (Weber, 1947). After World War II, Weber's work was rediscovered and spawned a substantial body of theory and research. His intention was not to generate an exact image of reality; rather, he understood the bureaucratic approach as an ideal type, whose special value is to develop a better understanding of the reality. Weber's ideas were the basis for extensive research on organisations with its different aspects, e.g. the relationships among the different elements of an organisation structure, as well as the effects of the structure on productivity and effectiveness (Blau & Scott, 1962; Thompson, 1967; Hall, 1977).

E. Litwak (1961) contrasts Weber's bureaucracy model with his human relation approach of the bureaucracy model, based upon a bottom-up system. A central element was the relocation of major decision-making functions to the lower level. Consequently, a higher horizontal communication and cooperation is necessary (Litwak, 1961). These insights are important for an operational excellence support unit.

Fayol's Administrative Principles. H. Fayol was a French mining engineer who published the 'Administration industrielle et générale' (Fayol, 1916). The book received

widespread publicity after it was translated into English. Until today, Fayol is perceived as a major authority on management and his fourteen principles of management are considered the early foundation of management theory as it exists nowadays (Fayol, 1949; Wren, Bedeian, & Breeze, 2002). These principles of management are (Fayol, 1949):

- division of labour
- authority and responsibility
- discipline
- subordination of individual interests to the general interests
- unity of direction
- unity of command
- proper remuneration
- centralisation of authority
- scalar chain of ranks or layers
- order
- equity and fairness in treatment of employees
- stability of tenure of personnel
- initiative
- esprit de corps or organisational spirit

Fayol (1949) noted that all activities and essential functions in an industrial organisation can be classified into six groups:

- technical activities (production, manufacture, adaption);
- commercial activities (buying, selling, exchange);
- financial activities (search for and optimum use of capital);
- security activities (protection of property and persons);
- accounting activities (stocktaking, balance sheet, costs, and statistics); and
- managerial activities (planning, organisation, command, coordination, control).

This classification is the foundation of organisational design and management science until today (Fayol, 1949; Daft, 2012). Fayol viewed formal organisation as a rationally designed instrument to achieve goals and maximum efficiency (Fayol, 1949; Shafritz et al. 2011). Archer (1990) argued that much of the Japanese success can be traced back to Fayol's management principles. Japanese techniques that embody the principles of Fayol are the quality circles - which relate to Fayol's esprit de corps - and lower-level decision-making (empowerment and process ownership), which are similar to Fayol's principle of initiative (Archer, 1990; Pyror & Taneja, 2010). Fayol is further well known for his 'Fayol's Bridge'. Given that vertical and horizontal communication barriers arise through establishment of hierarchies, the 'Fayol's Bridge' conquer these hierarchical obstacles with direct horizontal communication (also known as 'Passarelle') (Vahs, 2009).

All classical approaches have in common that deviations are perceived as interference and should be minimised by control (Vahs, 2009).

Human Relation Approach. H. Mayo and W. Roethlisberger are considered as founders of the human relation approach movement. They gained their knowledge in particular with their experiments in the Hawthorne Works of the Western Electric Company (1927-1932) (Roethlisberger & Dickson 1939). The lighting experiments in which the effects of different light intensities were investigated on the productivity of workers gained particular attention. As a result, no single causal relationships lead to changes in physical working conditions or improvements in performance. Beneficial for performance were rather aspects influencing the employee satisfaction and informal organisational attributes like interpersonal contacts, good working relationships, and routines. Key assumptions are that employees in industrial organisation are social beings. Consequently, a key role is occupied by a cooperative management style (Roethlisberger & Dickson 1939; Thommen & Achleitner, 2003).

However, due to the coexistence of German and English terms, the terminology in organisations research has become rather difficult. Organisational research and its publications are dominated by English-speaking authors and researchers, despite the fact that German researchers on organisations achieved great contributions, e.g. Weber. One reason may be that in the early times non-English research remained within its country of origin and an English-reading audience was not reached (Wren et al., 2002). The concept of 'Aufbau und Ablauforganisation' is difficult to find in English-speaking literature and the increasing application of English literature terminology of 'structure' (elements of organisation) and 'process' (relationship between elements) has replaced it (Zell, 2011).

3.3.2 Modern organisational approaches

Doing business in the 21st century and being confronted with challenges and megatrends of this time, many organisations utilise systems based on principles from the 20th century. It is hard to change those principles as many organisations have been successful with these ways of working over the last 60 years.

An old theory, but worth mentioning in this sub-chapter is McGregor (1961) with his theory X and theory Y. Theory X encompassed the old view of workers established in Taylor´s time and assumes that employees take no responsibility, preferred to be directed, wanted to avoid responsibility, are incapable of self-discipline, and want financial security above all. In this view only an autocratic leadership style seems to works. In contrast, according to theory Y employees like their work, do seek responsibility, are intrinsically motivated, and work more independently (McGregor, 1961). Managers working in a theory Y environment will find higher participation due to

workers who want to be empowered. They seek and solve problems and their root causes (Miller, 2014). This is more in line with the underpinning principles of continuous improvement (see Section 3.2.2).

In recent years a shift from self-contained organisation designs towards organisations with opened up boundaries took place (Anand & Daft, 2007). Clear boundaries between suppliers, the organisation itself, and customers have begun to break down; and within companies there has been a reduction or even elimination of organisational boundaries between departments. This evolution changes the traditional idea of management with planning, coordination, organisation, command, and control as well as removes classical grouping of people into functions or departments. These new organisational forms are more process-, team- and project-based; in these forms employees act in a network or virtual organisation (Thommen & Achleitner, 2003).

The network structure´s form is worth discussing in the context of operational excellence initiatives. This form is not new as first forms are represented in quality circles (see Sections 3.2.1.1 & 3.2.2) and parallel organisation structures, but set in today´s fast changing environment it receives net attention and an advanced set-up compared to previous dimensions. In times of global production networks and new ways of collaboration due to digitalization a networked organisation is understood as an organisation connected together by informal networks and the collaboration in communities based on the demands of the task. The formal organisation structure and reporting lines still exist in the primary system. Miles and Snow (1986) were the first to distinguish in a systematic way the network and did this between three kinds of network - the internal, the stable, and the dynamic network. For this thesis only internal networks are viewed in a more detailed way because of the relevance for an operational excellence organisation; Stable and dynamic networks deal with a network of companies. Internal networks are loose associations within a single company. Focusing on internal networks, Kotter (2016) believes that organisation of the future will have two organisational structures: a hierarchy, and a network (teaming, egalitarian, and adaptive), whereby both are purposefully designed. The hierarchy remains for conducting and optimising the work while the in and due to the network big changes happen. The network is a system of communities of interest and purpose with teams members from different business units, functions, and hierarchical levels, working in an anti-hierarchical form (Kotter, 2011; Kotter 2016). The teams rather have volunteer and expert character that are likely more empowered and feel more engaged, challenged, and valued in the expectation to deliver more value (Kotter 2016). This means the communities work in a network organised as a parallel structure; thus a network struc-

tures complement the formal primary organisation structure. The parallel structures allow employees to move back and forth between the two structures, depending on the tasks: the formal, primary structures are for routine tasks and in order to ensure efficient operations; the parallel network to support innovative activities in processes, managerial activities or technology. Similar structural arrangements are known as 'ambidextrous organisations' which are understood as exploring (improve existing capabilities) and exploiting organisational capabilities in order to developing the capabilities necessary to face of changing markets (O'Reilly & Tushman, 2004; Raisch & Birkinshaw, 2008).

A model describing different evolving organisational forms is F. Laloux (2014) who describes new organisational paradigms by different colours. The oldest paradigm is red as people were organised in tribes with powerful leaders acting in a command authority which allows to work towards a common goal. The green form is about delighting customer, making decision on shared values with high engagement. In this form agile and lean aspects are addressed, where a hierarchical structure still exists but is in conflict with other structures. The latest form is the teal organisation in which people are working effectively without hierarchical structures. These are characterised by flat or interlocking circles from holocracy with a focus on roles aiming a higher purpose with distributed decision making. Holocracy, a new form of organisation, is existing and performing in so called holons (a whole thing as part of a larger system), which focuses on the roles which are defined around the work and employees can fill several roles. They are not characterised by delegated authority but rather with distributed authority to teams and roles that are working in rapid iteration cycles and self-organised teams (Robertson, 2015). Different organisational models have been established over the last years. For example Gore & Associates Inc. In a first view the organisation looks similar to others for example with a CEO and four business units and support functions. But looking closer differences can be observed: there is no management level and no organigram. Indepedendent and self organised teams with two main objectives: making money and having fun. Bill Gore, the founder of Gore, had the idea of a hierarchy not in form of a ladder but rather a net. An interesting aspect at Gore is that every employee has free available time every week (half a day) to do experiments. Employees can join a project that establishes out of an idea created in the free time. Management innovation leads to a reallocation of power and authority (Hamel & Breen, 2007). In general, manufacturing companies do rather not follow these new organisational models.

3.3.3 Components of an organisation and organisational units

Almost all of today's companies organise employees in a hierarchy, which is represented in an organisational chart as a pyramid with connected boxes and long cascaded organisational name abbreviations. Operations in the organisation run in well known managerial processes like introduced by Fayol (1949) with planning, staffing, budgeting, measuring and some others (Kotter, 2011). According to Nadler and Tushman (1988), an organisation comprises four major components: l) the task; 2) the individuals; 3) the formal organisational arrangements; and 4) the informal organisation. In this thesis, the focus is only on the task and the formal organisational arrangements, given that these elements are important for the better understanding of the operational excellence support unit. For the thesis, the tasks are complemented by activities and formal organisation aspects by authority and responsibilities, position and grouping of positions and lines connecting the positions (Hill, Fehlbaum, & Ulrich, 1994).

Tasks and activities. From a static perspective, a task is a to-be performance, whereby several to-be performances sum up to the total task of a position. With a dynamic perspective, a task includes different activities that need to be fulfilled, including physical transformation processes, communication, and information processes (Hill et al., 1994). Basic forms of division of labour are carried out by the division by quantity (the same kind of working range) and division by type (transfer of work on different types of specialists) (Schulte-Zurhausen, 2010). Forms of specialisation can be divided into horizontal (the range of to be performed is characterised by generalist and specialist as two extremes) and vertical specialisation (qualitative separation between execution of the task its planning and control). Critical in specialisation is monotony and job dissatisfaction. This can lead to a decline in quality of work and defects as well as a high turnover. To reduce over-specialisation, there are counter-measures for more generalisations. These are extending the job scope, as well as an extension of decision-making and area of control (Schulte-Zurhausen, 2010; Azizi, Zolfaghari, & Liang, 2010):

- Job rotation: lateral and scheduled transfer of workers in a predetermined rhythm among different workstations each with different skills and responsibilities e.g. by training-on-the-job.
- Job enlargement: increasing the work volume by merging structurally similar tasks.
- Job enrichment: increasing the volume of work by adding structurally diverse tasks.
- 'Semi-autonomous' groups: a related task area is assigned to a working group.

The term task is to be distinguished from function, whereby the latter has a share in the overall task fulfilment (Koisol, 1976).

Competencies and responsibilities. In order to fulfil the tasks, a person needs certain skills subsumed under competences. Combining a task with the assigned competence is called responsibility (Hill et al., 1994). The allocation of responsibility is called delegation, but the person who delegated the task is formally still accountable for the outcome; in particular in rather traditional organisations. Accountability is a result of the assigned responsibility which is understood as the obligation to perform the assigned tasks. When a person in a managerial position has certain, formal rights he or she has authority; shortly said it refers to the rights to tell people what to do. Authority includes the access to resources to complete the job and has a decision-making structure to organise the authority of different levels. Competencies are part of a job description and influence the performance of an employee. Assessment of competencies can help to identify the necessary skill to perform a new job. This is in particular important when talking about operational excellence as necessary new skill to perform new tasks; these are being able to execute and implement as well as being able to give people direction and guidance (Schulte-Zurhausen, 2010).

Authority and the distribution of authority are centralised under the term governance (Robertson, 2015). Having the power to execute or direct people is linked to different power spheres in an organisation. French and Raven (1959) name five bases of power, namely reward, legitimate, coercion, referent, and expert. Expert power is linked to expertise which consists of knowledge, special skills and experience. In traditional organisation authority and power are often linked to high hierarchical positions, whereby in discussion in modern organisation these power and authority are not linked to positions but knowledge is getting in the foreground.

Position and grouping of positions. From a formal perspective, the smallest unit in an organisation is referred to a position ("Stelle")[5], which has some distinctive features: a task area is permanently assigned, any position has at least one position holder, a jobholder has certain competencies with formal rights and authority as well as a certain responsibility to follow-up decisions and actions (Schulte-Zurhausen, 2010; Vahs,

[5] While in the Anglo-Saxon literature is only spoken of department, in the German organisation theory "Stelle" is a central term (Hill et al., 1994).

2009). Position can be grouped according to different organisational set-ups, namely the so-called line functions with execution and leadership functions as well as supporting function, with staff position or assistance position. In a nutshell, an organisation comprises of executing position, leading positions, staff teams and central units. Similar tasks are combined to position and the grouping of people or different positions establish to a departments with reporting relationships among people and between departments. *"The structures of this era, including functional, division, and matrix designs, rely largely on the vertical hierarchy and chain of command to define departmental groupings and reporting relationships."* (Anand & Daft, 2007, p. 330).

The term organisational is understood as all formal element of an organisation caused to individuals by assigning tasks, including all sub-systems formed within an organisation, such as divisions, departments, working groups and positions with their tasks and the underlying activities (Schulte-Zurhausen, 2010). Another type of organisational units is a committee; this comprises a multitude of persons who are in direct interaction over a longer period (Vahs, 2009). Vahs (2009) distinguishes between full-time committees (e.g. a steering committee and working group), non-executive committees (committee and group for problem-solving), and project groups. Committees can be part of the 'Primärorganisation' as well as the parallel structure (Vahs. 2009). A full-time body in the form of the working group holds strong importance for kaizen. An important aspect is the self-organisation and the problems and qualification functions, focusing on the ongoing expansion and improvement of individual skills. Decisions are taken by the equal group members and the group spokesperson has coordination tasks.

Raisch and Birkinshaw (2008) cited Goldstein (1985) and Adler, Goldoftas, and Levine (1999) regarding the idea of a parallel structure: *„(...) secondary structures (such as project teams or networks) balance the primary structure's shortcomings and support nonroutine tasks and innovation (Goldstein, 1985). The supplementary structure coexists with the primary task structure to ensure efficiency and flexibility (Adler et al., 1999). These formal primary structures is rather used for routine tasks and the maintenance of stability as well as efficiency*" (Raisch & Birkinshaw, 2008, p. 390). Additionally parallel structures seem to be useful in terms of isolation between structurally or globally separated units (Devins & Kähr, 2010).

3.3.4 Integration and differentiation

The central question in organising is how and by whom tasks are performed. The general problem in an organisation is the duality of dividing and combing tasks. Two de-

sign issues are at the heart of organisational structure: how to allocate work (differentiation) and how to coordinate roles and units once responsibilities (integration) (Bolman & Deal, 2003). In other words, differentiation refers how the organisational units are designed to carry out transactions (Gummings & Huse, 1985); and integration refers to the coordination among organisational units (Gummings & Huse, 1985). Grochla (1981) sees the three basic approaches for the design of an organisation in the division of labour (tasks are divided among players involved), coordination (processes for fulfilment of tasks are coordinated), and configuration (design of the organisational structure by hierarchical levels and span of control). Horizontal differentiation refers to the way in which tasks are organised and distributed in an organisation (Koufteros & Vonderembse, 1998). Vertical differentiation refers to the number of hierarchical levels in organisations and separates work performance from its administration (Mintzberg, 1979). The level of horizontal integration is the degree to which employees or teams are functionally specialised versus integrated in the work, skills, and training (Davenport & Nohria 1994; Nahm et al., 2002).

Integration. Integration describes the way in which the divisions and functions are subsequently combined (Mueller-Stevens, 2005). In literature, integration is often referred to coordination. Organisations employ a variety of methods to coordinate individual and group effort and link local initiatives with corporate-wide goals. The objective is to reduce the need for coordination by flexible resources, reserve resources, buffers, standards, autonomous bodies, and departments. However, the greater the distance to be overcome in terms of space and time as well as human terms, the greater the need for coordination (Schulte-Zurhausen, 2010). Formal instruments of coordination are distinguished between vertical, horizontal, and lateral forms. Schulte-Zierhausen (2010) adds to this view the following aspects of formal coordination tools. From a high centralisation of decision with personal instruction to a decentralisation of decision with standardisation of roles and self-determination and -organisation (see Figure 14). In literature, coordination based upon temporal aspects such as the advance coordination and the feedback coordination can also be found. In advance coordination decisions are made longer in advance through standardisation and planning. The feedback coordination (ad-hoc coordination) is in response to disturbances (Vahs, 2009).

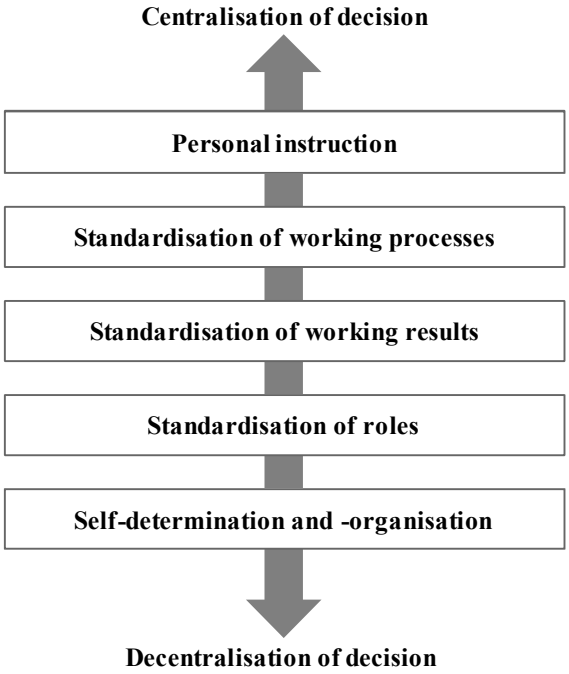


Figure 14. Instruments of direct coordination (Schulte-Zurhausen, 2010)

Vertical (hierarchical) coordination is based upon a direct superiority and subordination between two or more organisational units. Coordination takes place through the formal chain of command, based upon:

- Authority: Authorities like executives, managers, supervisors are officially in charge with keeping activities aligned with set goals. They control by solving problems, making decisions, resolving conflicts, etc. A chain of command is a hierarchy of managerial and supervisory levels, each with a legitimate power to direct the activities and behaviour of those at lower levels (Bolman & Deal, 2003).
- Rules and policies: Rules, polices, standards, and standard operating procedures limit discretion and help to ensure predictability as well as uniformity. Rules govern the conditions of work and specify standard processes for carrying out tasks, handling personnel issues, and relating to the external environment. This helps to ensure that similar situations are handled uniformly (Bolman & Deal, 2003).

Lateral forms of coordination are typically less formalised and more flexible than authority-bound system and rules. These formats are, e.g. meetings, committees, coordinating roles or network structures (Bolman & Deal, 2003). Moreover, they can also be simpler and quicker (Bolman & Deal, 2003). Meetings and taskforces are described as:

- Meetings: formal meetings are a key element of lateral coordination. In an organisation, regular meetings and executive committees take place in which decision can be make (Bolman & Deal, 2003).
- Task forces: These are teams, assigned when important problems require the collaboration of a number of specialists or different functions (Bolman & Deal, 2003).

As organisations become more complex, technologies grow, and environments become more turbulent the demand for lateral communication rises.

Differentiation. Differentiation is to the way in which an organisation is divided into divisions and functions. These activities proceed in a structured and consciously way. The resulting outer shape of the structure is referred to as configuration which forms a framework for all business activities (Vahs, 2009). The organisation chart is the visual representation of a whole set of underlying activities and processes in an organisation. The organisation chart can be quite useful in understanding an organisation but it is not possible to see the real internal structure (Daft, 2012).

In organisations new positions, departments or divisions are defined to accomplish new tasks that are perceived as being valuable for the organisation (Daft, 2012). In an optimal set-up, departments are created to perform tasks considered strategically important to a company. In general, departmentalisation is conducted according the principle of homogeneity. This means that such tasks are summarised that are interdependent to a high degree and the organisational form is controllability. The content of a position and the scope of a task must correspond to the capacity (Vahs, 2009).

The basic forms of organisational structures are the result of horizontal differentiation, which takes place according to different criteria. These are separated by execution via functions or objects e.g. products (Vahs, 2009). A function-oriented structure leads to a functional organisation and an object-oriented structure to a divisional organisation. Classical organisational forms are as follows (see Figure 15):

- Functional form: in the functional structure activities are grouped together by common function from the bottom to the top of the organisation.
- Divisional form: the divisional structure occurs when departments are grouped together based upon organisational outputs. The divisional structure is sometimes called a product structure or profit centre (Anand & Daft, 2007). Divisions may themselves be product-, region-, project- or process-oriented (Osterloh & Frost, 2006).
- Matrix structure: this form comprises functional departments on one axis, while the vertical counterpart is based upon differentiation by a product group or a

geographic setup (Avdelidou-Fischer, 2006). In this structure, some employees report to two bosses rather than a single boss. This leads to no single chain of command but rather is dual responsibilities of command assigned to functional departments (Davis & Lawrence, 1978); and consequently to higher coordination efforts leads to power struggles, excessive overhead, uncontrolled layering and decision strangulation (Davis & Lawrence, 1978).

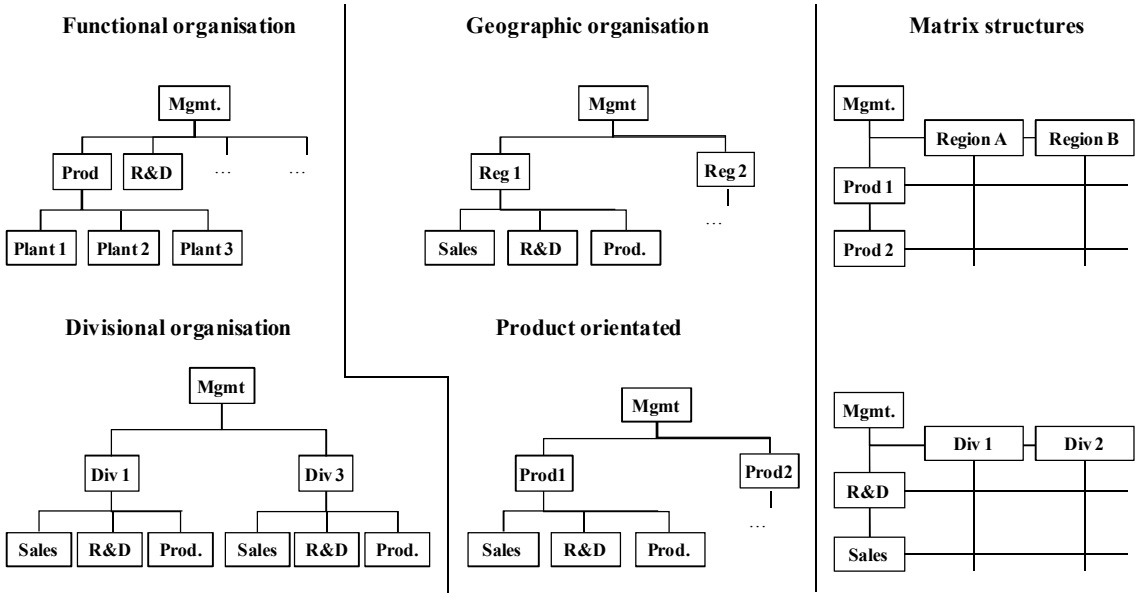


Figure 15. Different basic organisational forms (based on Harris & Raviv, 2002)

As introduced in Chapter 3.1 there are modern approaches of organisational forms. Looking in manufacturing companies most are rather organised traditional and the organisational charts pictures a matrix structure. For the organisation of an operational excellence support unit, several other differentiation aspects need to be discussed. These are organisational divisions that orient on the decision-making process and are divided into decision preparation and decision (Schreyögg, 2010). The underlying idea is to outsource the decision preparatory activities which are called staff positions. A historical analysis shows that the department is closely related to the specialisation; indeed, this origin can be found in the military (Schreyögg, 2010). An organisational unit in general has a consulting function and specialists are dealing with general challenges which are relevant for the complete organisation. In this function they do not have the authority for other departments. From a historical perspective staff functions were established in the preußische army as Gerhard von Scharnhorst did not want to give the army into some view person. Rather talented officer gave the commander independently conseils.

The staff organisation can be found in Mintzberg (1980) work, too. He describes an organisation consisting of five basic parts, namely, strategic apex, operating core, middle line, techno-structure, and support staff.

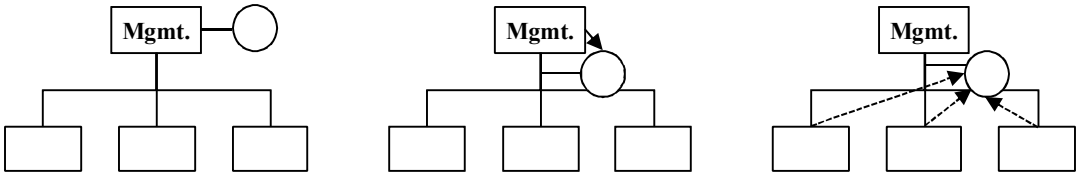


Figure 16. Different kinds of staff organisations

Figure 16 shows different possibilities to integrate a staff function. In many manufacturing companies central roles like industrial engineering, strategy department, human resources, or finance have the purpose to support the functional departments like manufacturing, logistics or sales. This allows exploiting economies of scale. In particular in multi-national companies with different divisions centralised, corporate staff functions exist in the headquarter and in the underlying division or business units (named group or corporate functions), which their self also have staff functions. The role of corporate staff functions is typically to set guidance with standards, rules and processes for others to follow. By this corporate teams can exploit synergy effects by providing expertise for the entire organisation. These activities concentrate power and decision-making often too far away from the operational line and their requirements. In consequence shop floor employees often feel disempowered as they have to follow corporate designed standards or processes which do not fit their requirements and do not fit to the challenges they are faced in daily practice. An operational excellence organisation faces the tension between a need for central experts, but also a team perfoming more operational work away from the corporate 'center of power'. Over time local plant teams build up a high expertise, too, which questions the relevance of corporate teams and their size

3.3.5 Organisational structure

The organisation establishes when an initial group comes together to pursue a mission with common goals (Mintzberg, 1980). The way in which individuals relate to work towards these goals is determined by the structure of the organisation (Duncan, 1981). However, even more importantly, structuring means to create rules in the broadest sense. Structures always represent a mandatory selection from a variety of options and include the retention of these choices over a certain period (Luhmann, 1984). Limitations of the variety of options - meaning the generation of a structure - can be described as setting up expectations. In other words, expectations arise from restrictions (Luhmann, 1984). Chandler (1969) defines structure as the design of an organisation through which the enterprise is administered. This is in line with Avdelidou-Fischer (2006) saying that *"each function needs a structure designed to allow it to develop its skills and become more specialized and productive"* (Avdelidou-Fischer, 2006, p.

172). Structure refers to an organisation's internal pattern of relationships, authority, and communication (Aiken & Hage, 1968). Thus, the structure of an organisation can be defined as the sum of the ways in which it divides its labour into tasks and subsequently achieves coordination among these tasks (Mintzberg, 1979). According to Daft (2012), there are three key components in the definition of organisation structure:
"1. Organisation structure designates formal reporting relationships, including the number of level in the hierarchy and the span of control of managers and supervisors.

2. Organisation structure identifies the grouping together of individuals into departments and of departments into the total organisation.

3. Organisation structure includes the design of systems to ensure effective communication, coordination, and integration of efforts across departments" (Daft, 2012, p. 90).

What is clear through the range of provided definitions is that structures do not emerge out of nothing, but rather require a goal-oriented configuration influenced among other factors by the external environment (Lawrence & Lorsch, 1967; Rüegg-Stürm 2005). Based on the instrumental understanding of an organisation, organisational structures are a tool to achieve objectives (Hill et al., 1994). Daft (1998) mentioned eight dimensions of organisational structure: formalization, specialization, standardisation, centralisation, professionalism, complexity, hierarchy of authority, and personnel ratios. The extant literature suggests that organisational structure has multiple sub-dimensions. Damanpour (1991) provides an extensive list of such sub-dimensions, including structural variables such as specialization, functional differentiation, professionalism, formalization, centralisation, vertical differentiation, and other culture-, process-, and resource-related variables. Aiken and Hage (1971) employ complexity, professionalism, decentralisation, scheduled and unscheduled communication, and formalization to represent the domain of organisational structure. Germain (1996) uses specialization, decentralisation, and integration to evaluate the role of organisational structure in logistics innovation adoption. Vickery et al. (1999) focus on formal control, operations decentralisation, layers, and spans of control in their investigation of the relationships between product customization and organisational structure. In discussing the impact of organisational structure on time-based manufacturing and plant performance, Nahm et al. (2003) hypothesise five structural dimensions: the number of layers in the hierarchy, the level of horizontal integration, the locus of decision making, the nature of formalization, and the level of communication. Thus far, the literature on sub-dimensions of organisational structure varies widely flatness, centralisation, and employee multi-functionality (i.e., the flip side of specialization).

There is no universal agreement on the dimensions of an organisational structure and also on the dimensions of an operational excellence support unit only very little information is available. Mintzberg (1980) used nine design parameters to describe and design and organisation. These are job specialization, behaviour formalization, unit grouping, unit size, training and indoctrination, action planning and performance control systems, horizontal decentralisation (power sharing by nonmanagers), vertical decentralisation (delegation to line managers), and liaison devices (such as integrating managers) (Mintzberg, 1980).

Knowledge on this different structure dimension helps to better understand how an operational excellence support unit is designed and how this unit can establish an operational excellence structure by the target-oriented design of an operational excellence structure over time, which facilitates embedding operational excellence in the organisation in a sustainable way.

3.3.6 Organisational change, design, and development

Most organisations, also manufacturing companies, have gone through different changes in their organisation; from mergers, change programmes, centralisations, and decentralisations or relocations (Laloux, 2014). And an operational excellence initiative is always associated with changes in the organisations. These changes may be purposeful planed and result in a change of the organisational structure, but also effect changes in the behaviour of employees. For the success of change processes, one aspect is critical: the coordination of organisation design and organisation development, which need to be harmonised in terms of time and content (Vahs, 2009). To better understand organisational changes, the different types of changes as well as organisational design and development are explained in this sub-chapter.

Organisational change. In the 1960s organisational changes started to shift from evolutionary changes to revolutionary changes (Greiner, 1967). In the following years different historical stages had a different view on the way of working, team building, and organisational changes. Thereby change activities are intended to support an organisation to become more effective in problems solving and achieving its goals (Cummings & Huse, 1989). Laloux (2014) indicates in his publication that the latest stage is the so called teal organisation where teams are driven by a common purpose, a high level of awareness, and a connectedness among the teams. Actually, discussion on competitive advantages of today´s organisation speed becomes the new credo (Whitehurst & Hamel, 2015). This affects traditional, and too often slow, ways of communication and making decisions in a hierarchical structure. The typical chain of command seems too

slow to react to changes and old strategies no longer seems to apply. In particular in large companies with many hierarchical levels and globally distributed units new ways of organisation seem to be necessary.

Organisational changes are often related to the company's growth. Models for organisational development stem for example from Greiner (1967). His growth model follows six growth phases which describe the assumption of a constant growth rate. A distinction of organisational models is often carried to different development levels (Gomez & Zimmermann, 1999). In this thesis, only the internal development of an organisational operational excellence support unit is investigated and no changes due to growth are researched. Hamel (2007) developed eight steps for successful change. These start with having a strong plan, writing policies, creating a support team, implementing change, finally integrating the change and institutionalizing it in the organisation. These seem also relevant for the changes coming with an operational excellence initiative. In particular as establishing an operational excellence support team first is a change and second this teams itself works on changes through the implementation of operational excellence.

Changes can be viewed from different perspectives. They can be systematic and establish out of different disciplines. These are for example operational excellence initiatives and their resulting changes. Another perspective of change is on the psychological aspects. Besides these, changes are associated with new processes and structures which allow performing activities in a new environment (Al Haddad & Kotnour, 2015). Once can distinguish between different kinds of change, namely planned and unplanned change. With unplanned changes, organisational structures do not behave statically and changes arise from internal causes. Unplanned change takes place unintentionally and accidentally. Planned organisational change is consciously organised with controlled measures and specific goals. Important approaches for managing planned change are organisational design and organisational development (Schulte-Zurhausen, 2010). In this thesis planned changes are researched as an operational excellence initiative is a corporate initiated and purposefully planed initiative.

Further, an organisational change can be characterised by a different scale of change and duration of the change *"Change scale can be defined as the degree of change required to reach the desired outcome"* (Al Haddad & Kotnour, 2015, p. 242). Large scale or major changes cause a holistic change in processes and behaviours leading to a larger step change. Small scale change can be defined as a minor or less significant change. A small scale change is easier to initiate and manage, and does not require as much leadership as needed in big scale change (Al Haddad & Kotnour,

2015). Regarding the intensity of the permanently running processes of organisational change, fundamental (major) and incremental (minor) changes can be distinguished, whereby the latter (evolutionary change or gradual change) includes continuous change and improvement. It comes with a number of small adjustments to improve the organisation continuously within a period. Fundamental or also often named revolutionary change and radical change can be the result of too late or incorrect decision to changing conditions in crisis. Figure 17 summarises these facts.

	Major changes	**Minor changes**
Triggering conditions	Presence or anticipation of environmental shifts	Disrupted internal dynamics Change in a segment of environment
Nature of organizational change	Top management domain High level of emotions	Sensemaking
	Dramatic and discontinuous change High associated risks	Purposively logical or disjointed incremental changes
Performance outcome	High performance gain when done right	Localized performance gain

Figure 17. Change characteristics in organisation literature (Choi, 1995, p. 608)

The duration of a change can be short or long. Thereby long-term changes can be challenging for an organisation. In particular a strong leadership throughout the change is required which enables active involvement of employees in the change process. The opposite are short term changes which take place in rather small, incremental, and ongoing ways. This kind of changes offers the opportunities to implement the different elements of an improvement initiative (Al Haddad & Kotnour, 2015). There are different perspectives on organisational change in the field of strategic change and organisation development (Choi, 1995). Along with the understanding that organisational change is exceptional and process-oriented, organisational researchers see it as natural (Weick, 1998; Orlikowski, 1996; Feldman, 2000; Tsoukas & Chia, 2002). The majority of research on organisational change focusing on strategic aspects viewed from the perspective of a management team of an organisation.

Besides the terminus change management the word transformation is used in context of improvement initiatives and both are often used interchangeably (Ashkenas, 2015). But, a transformation can be more seen as element on a portfolio of initiatives and executes a defined change rather than reinventing the organisation (Ashkenas, 2015). Transformation is an internal, significant change, whereby change is the consequence of a transformation. Transformation addresses more the mindset and results of many changes (Ballé et al., 2006). The objectives of an tranformation are to improve

performance and a majority of employees in the organisation must change their behavior (Blumenthal & Haspeslagh, 1994).

Organisational design and development. Organisation design is arranging how work and people are organised to carry out an organisation´s strategy and achieve the aims set in the strategy (Stanford, 2015). Organisation structure is one aspect of organisational design. And it is much more than changing boxes, lines, names of a formal organisation chart and rather about enabling employees in line with a set vision and strategy; it is about keeping the integrity of an organisation (Stanford, 2015). The context in which organisation design happens is not static. It is resource intensive even in good times when the organisation is doing well. It is a fundamental ongoing process and has rather preventive character than afterwards activities. Burton, Obel, De Sanctis (2011) adopt a multicontingency view to address the challenges of designing the organisation. Consequently an organisation's design should be chosen based on the particular context, including both structural (goals, strategy, and structure) and human aspects (work processes, people, incentive mechanisms, coordination, and control) (Burton et al., 2011). This is achieved by planned interventions in the processes by using behavioural-science knowledge. Organisation design enables organisation to executed a strategy predictably (Beeson, 2014). Organisation design includes grouping of jobs into units, the internal structure of these units as well as control and coordination mechanism to link the units (Nadler & Tushman, 1988). Organisational design requires work activities, reporting relationships, departmental grouping options and can be seen as both art and science (Daft, 2010; Journal of Organisation Design, 2015). The purposeful design is based upon company internal causes like low levels of customer satisfaction, quality problems, changes in the company management, and a new corporate strategy. The dual search for stability and change pervades all forms of organising (Weick, 1979; Farjoun, 2010). A prime example is a trade-off in organisations between exploitation and exploration (March, 1991). March's (1991) arguments regarding the need for every organisation to pursue different status. Several authors indicate that the answer lies in ambidexterity (Benner & Tushman, 2003). *"Ambidexterity refers to the synchronous pursuit of both exploration and exploitation via loosely coupled and differentiated subunits or individuals, each of which specialises in either exploration or exploitation"* (Gupta, Smith, & Shalley, 2006, p. 693).

Beckhard (1969) defined organisational development as planned effort, which addresses a complete organisation and is managed from the top. Objective is to increase organisation effectiveness and health. Organisational development deals with keeping the designed conditions in a status to achieve the purposeful designed organisation

(Stanford, 2015). Organisational development is much more about people, while organisational design is more about strategy, structure, and processes. The changes than happen on different levels, like the individual, group or the whole organisation (Al Haddad & Kotnour, 2015).

Dynamic change and organisational development over time. A classical model for a change process is the three-phase approach of K. Lewin (1947). This is based upon the assumption that organisations aspire towards a social equilibrium. The approach involves three phases, namely unfreezing - moving - refreezing (Lewin, 1947). According to the instrumental organisational concept, organisational structures are an instrument to achieve objectives of the company (Schulte-Zurhausen, 2010). It is critical to mention that through the rational-analytic approach, safety is suggested, which is not usually given in practice. It seems to be an appropriate approach to combine organisational design with organisational development. The organisational change is achieved through organisational design. The best chance of implementation is linked to approaches which are carried out taking into account the desires/hopes of the involved and affected people (Schulte-Zurhausen, 2010). Schulte-Zurhausen (2010) names this combination as organisation management, comprising the task necessary for the planned design of organisational structures and the associated behaviours. Similar to the organisational change literature, the continuous improvement literature addresses the topic of change over time. Theorists from both fields of literature believe that organisations are not static entities but rather dynamic entities that alter their own shapes to enhance their chances for survival and prosperity. However, the continuous improvement literature generally promotes the changes that differ characteristically. When examining the development of continuous improvement capabilities that evolve over time implementation strategies can be identified with broader longitudinal designs, a longer time frame, and a more thorough investigation of the context in which developmental 'episodes' occur (Beer & Walton, 1987; Choi, 1995).

Stability and maintenance of standards over time. A multitude of research is available on this topic (e.g. Feldman & Pentland, 2003). Considering Giddens 'duality of structure', in which structures can only be reproduced through the actions of agents, who only come into existence within a structured environment. Duality as interpreted by Giddens pulls the structure and the agency closer together but does not merge both (Jackson, 1999). Farjoun (2010) argues that *"under different assumptions that preserve its essence, stability can be both an outcome and a medium of change*" (p. 203). It also requires stability, regularity, and predictability so that actors can understand and trust the settings (Farjoun, 2010). In most organisational theories, scholars have main-

tained that stability and change, and the practices, processes and forms that support them are largely incompatible and mutually exclusive. Nissen (2014) develop a concept of dynamic fit, dividing the reviewed organisational literature into two broad orientations towards design: *equilibrating* and *fluxing*. "*An equilibrating orientation seeks to achieve and maintain fit through episodic sequences of static organisation (re)designs, whereas a fluxing orientation allows designs to change continuously with changing contingencies"* (Nissen, 2014). However, it is *"...more of an imprecise heuristic than a rigid classification system"* (p. 37). Gupta et al. (2006) say that *"Punctuated equilibrium, or temporal cycling between long periods of exploitation and short bursts of exploration, have been identified as an alternative balancing mechanism that may be both logical and practical"* (p. 698). Reviewing this perspective it becomes obvious that stability and change jointly contribute to organisational effectiveness; see also in Figure 18 showing continuous improvement cycles over time.

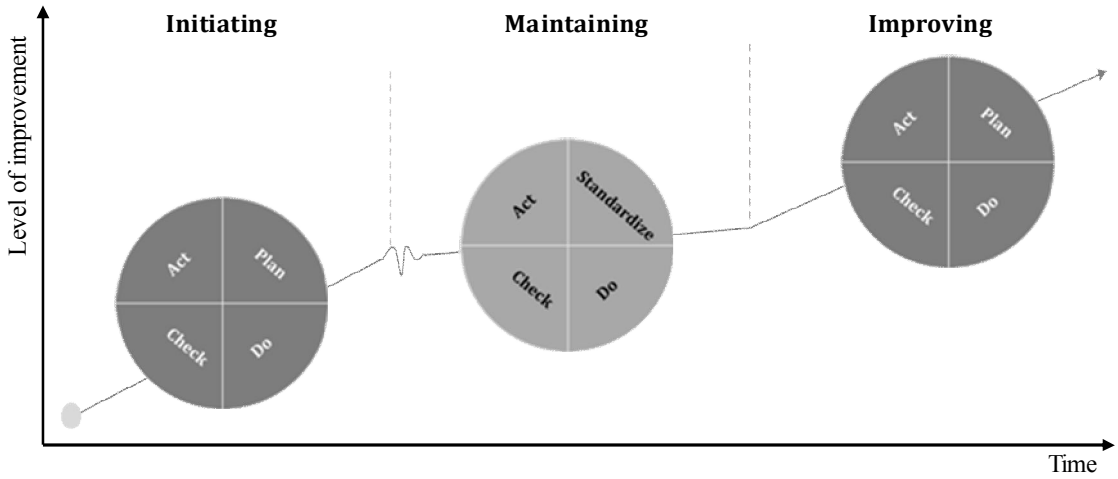


Figure 18. Continuous improvement cycles in different phases of an operational excellence implementation (based on Imai, 2012)

3.4 Barriers for corporate improvement initiatives

Despite the benefits associated with an operational excellence initiative like stable equipment, improved quality and lower inventory, many companies struggle and find themselves confronted with barriers during the implementation of the diverse operational excellence principles. An operational excellence initiative leads to structural and behaviour changes based upon the processes and a new way of working, thinking, and leading (Werani et al., 2013). Changes cause uncertainty and people can react with rejection or resistance and hinder achieving the full potentials of an operational excellence initiative. Darragh and Campbell (2001) analysed 28 corporate initiatives and why many of these initiatives stuck and are not successful. The following root causes for implementation difficulties, based on Darragh and Campell (2001), apply for this

research too: managers in business units do not follow the topics that an initiative is trying to address or see it the same way but do not give it the same priority as corporate level does.

Organisational changes can be classified in different types in term of scale (small/minor and big/major) as well as duration (short and long). Additionally, these changes can happen on different levels, namely the individual, the group or on the organisation (Al Haddad & Kotnour, 2015). Watson (1975) differs the resistance to change at different levels, namely the resistance of a person and from an organisation. From a personal perspective, changes in the existing working environment and area of responsibility can bring along imbalance. If employees get used to a way of working, feel comfortable and are unwilling to change, leaving their existing comfort zone can lead to uncertainty about the future and even fear. Once-formed, behavioural habits become routines and their execution contributes to a certain level of satisfaction. Changes in these routines can lead to resistance as a loss of satisfaction in the work takes place (Schreyögg, 1999). Because resistance is not initially legitimate in today's social environment, it leads to a certain masking, whereby the resistance is often not obvious and thus it is difficult to find and solve (Schreyögg, 1999). Resistance in the organisation can root in personal resistances and cumulate to a higher dimension. In an operational excellence initiative the existing organisational standards and routines are questioned. It is obvious that knowledge on barriers to change helps to react and better implement operational excellence.

A number of success and failure factors have been identified (Hall, Rosenthal & Wade, 1993; Kotter, 1995; Tushman, Newman, & Romanelli, 1986). These success factors are a clear vision, communication of concrete objectives, participation and involvement in change, resulting in an integrative approach of change and top management's commitment to improvement initiative. Failure factors are a blurred vision, a lack of understanding of the problem, inadequate communication, a fragmented optimisation experiments, a lack of courage, and too short time horizons. A study by Picot, Freudenberg and Gassner (1999) empirically shows factors that are important for the success of change projects. These seven 'screws of reorganisation' are:

1) Allocation of decision and action rights
2) Granting of incentives
3) Controlling
4) Communication
5) Implementation of standards
6) Training
7) Timing

Klassen and Whybark (1994) rank barriers to the effective management of international manufacturing operations. Based upon a delphi process four management barriers are identified, namely a general lack of a global view by management as highest rank, the manufacturing strategy, the existing organisational structure, and the missing transfer of management skills (Klassen & Whybark, 1994). Sim and Rogers (2009) indicate that management fails in the area of coaching, communication, and supporting employees. Similar barriers could be found in literature on the TPM, the TQM, and the JIT implementation. Several authors (Chan, Lau, Ip, Chan, & Kong, 2005; Co, Patuwo, Hu, 1998) have attributed missing top management support and understanding as the reason for the failure of a TPM implementation. The lack of support is attributed to management in not entirely understanding the true goal of TPM. This comes along and reinforces each other as a lack of training and education has also been considered for the failure of TPM. Chan et al. (2005) stated that a specific training for the achievement of the TPM benefits in the production and maintenance department was required. A selection of suitable team members is crucial, as well as the already-indicated management support for a successful TPM implementation. The simultaneous implementation of TPM caused insufficient resource allocation (Attri, Grover, Dev, & Kumar, 2013). Talib, Zillur, Qurenshi (2011) developed a hierarchy of TQM barriers with twelve barriers and the interaction among these barriers. Again, the missing top management commitment is ranked highest, followed by lack of coordination between departments and the attitude of employees towards quality. In TQM implementation, training, and education are also important and their absence is perceived as a barrier.

Similar barriers can be found in the implementation of lean production. Sim and Rogers (2009) name management commitment and the empowerment of shop floor employees as essential to successfully achieve a lean philosophy. In addition, further barriers include misunderstanding the concept and purpose of lean production, a lack of resource availability (time, expertise, and finance), cultural difference, a lack of top management support, a lack of clear communication, a lack of interest in and commitment to lean. Based upon a single case, Scherer-Rathje et al. (2009) found that the bottom-up implementation approach to the lean project produced a cascading effect of problems. This includes the lack of senior management commitment, team autonomy, organisational communication, and interest in lean. This let conclude that a lean implementation needs to start on top management with a high commitment and interest in lean.

Jadhav, Mantha, and Rane (2014) present an analysis of research on lean, focusing on barriers in its implementation. They conducted a systematic literature review on lean and TPS publications from 1991 to 2012, summarised and ranked barriers for a lean implementation. These barriers are shown in the box below (see Table 6), as later used in Chapter 4.

Table 6 *Summary of barriers to improvement initiatives*

1.	The lack of resources to invest or necessity of high investments/costs or financial constraints
2.	Lack of top/senior management involvement, lack of top management commitment, lack of top management support
3.	Workers' attitude or resistance (unionizes workers or unwillingness of workers)
4.	Cultural differences
5.	Lack of strong/good leadership, poor leadership, lack of committed leadership
6.	Backsliding or lack of perseverance
7.	Top Management resistance
8.	Lack of communication between management and workers
9.	Quality problems with suppliers
10.	Suppliers' resistance or lack of cooperation (support) from vendors/suppliers
11.	Lack of influence over suppliers or lack of involvement of suppliers in the actual implementation
12.	Lack of supplier collaboration or lack of mutually beneficial strategic partnership with suppliers
13.	Customers (supply chain members)
14.	Absence of a sound strategic action/logistical planning system
15.	Lack of empowerment of employees
16.	Lack of formal training for workers cross-functional conflicts
17.	Incompatibility of lean/JIT with the company bonus, rewards or incentives systems
18.	Lack of logistic support
19.	Lack of consultants in the field
20.	Lack of formal training for managers

Source: Jadhav et al. (2014)

Tsoukas and Chia (2002) mention that "... *that the main barriers to rethinking change are the ontological and epistemological commitments that have underpinned research into the subject"* (p. 569). It is important to handle change not as epiphenomenon, but knowing that change is central in the nature of socio-economic life (North, 1996).Talking and knowing about barriers of change support a better understanding of the organisation of an operational excellence support unit and helps to derive operational excellence-relevant activities. Thus, it is possible to avoid upcoming resistance and better embed operational excellence in the overall organisation. In literature different change enablers can be found. Smith (2002) identified the main factors affecting successful change as *"visible and sustained sponsorship, addressing the needs of employees, and having strong resources dedicated for the change"* (Smith, 2002, p. 81).

3.5 Drivers and potentials of corporate improvement initiatives

In literature several drivers for lean production and management as well as continuous improvement can be found. The general motivation for any continuous improvement activity is the desire of an organisation to eliminate waste (Choi, 1995). Sangwan, Bhamu, and Metha (2014) define drivers to a lean implementation *"... as the various factors that contribute to the easy adoption of lean in an industry."* (p. 570). According to Bhasin (2012) driver for lean implementation are improving performance, increasing customer pressure, increasing competitive pressure, and building team spirit for implementation of lean management. These drivers apply to any organisation regardless which sizes they have. Sangwan et al. (2014) categorise lean management drivers in internal, policy and external drivers, whereby their empirical context is the Indian ceramic industry. Internal drivers are low manpower productivity, high scraps/rework and rejections, poor skills, capabilities of worker, and unavailability of skilled workers; policy drivers are work process control, unbalanced workload on different workstations, poor workplace organisation and housekeeping, and lack of standard operating procedures. External drivers are fluctuating customer orders low quality parts of suppliers, long supplier delivery time, and high product variety (Sangwam et al., 2013). Hallgren and Olhager (2009) investigate internal and external factors that drive the choice of lean manufacturing and agile capabilities. They conclude that competitive intensity is an external driver for lean manufacturing and a competitive strategy as an internal factor drives the choice of lean (Hallgren & Olhager, 2009). Tersine (2004) indicates that *"(T) the primary drivers for continuous improvement strategies are the reduction of the triad of waste - the cutback of valueless time, valueless activity, and valueless variance in a process"* (p. 26). Important aspect for the implementation is the necessity. As already Toyota showed that the TPS arose out of necessities to react to the circumstances Toyota was faced with at the respective point, like the resource scarcity forced them to do the right things, resulting in providing only a product that a customer wanted (Modig & Ahlström, 2012).

Taking the drivers presented above it becomes clear what expectations are placed in improvement initiatives. In general the potentials for operational excellence, lean production, and continuous improvement are high. Based on the St.Gallen understanding of operational excellence the potentials of an operational excellence initiative are to achieve stable equipment, stable processes, low inventories and have an effective management system. At the end this leads to improvement performances of a production plant. Several scholars address manufacturing performance dimensions in their research field. Skinner (1974) described several, including short delivery cycles, supe-

rior quality and reliability, dependable deliveries, fast new product development, flexibility in volume changes, and low cost. Wheelwright (1978) focused on efficiency, dependability, quality, and flexibility; later Hayes and Wheelwright (1984) changed efficiency to cost. Krajewski and Ritzman (1987) identified five manufacturing competitive dimensions: cost, high performance design, consistent quality, on-time delivery, product flexibility, and volume flexibility. Hill (1989) outlined a set of ‘‘order-winning criteria’’ included: cost, product quality conformance to specifications and reliability, delivery speed, delivery reliability, and volume flexibility as the ability to respond to increases in demand. An additional driver is a continuous improvement culture on long term. Therefore it is important that tools are not operational excellence but appreciative exposure to employees to achieve operational excellence; what by definition cannot be achieved. Beside the measureable benefits and performance aspects there are several non-measureable benefits that come with operational excellence. These are an improved employee motivation, a higher employee satisfaction and identification with their work as well as a common language and understanding on improvement activities.

3.6 Analysis of the relevant literature and its implications

In this section, the analysis of the conducted literature research as introduced in Section 3.1 is presented. The literature research based upon vom Brocke et al. (2009) provided numerous papers. Section 3.6.1 provides details on the relevant papers found with a focus on the similarities or a link to the research topic, while Section 3.6.2 shows the implications of the in-depth analysis of the most relevant papers for this research.

3.6.1 Results of the literature analysis

In the following, the most relevant literature from the conducted literature is presented. The papers are selected based upon a refined analysis of the presented overview (see Section 3.5.1) following the criteria of a strong overlap of the selected research streams combined with a match of the research topic. In the chapter, empirical and conceptual papers as well as content of books with a high relevance or similarity in the research field are provided.

Production systems. Ruffini et al. (2000) studied relationships between the organisational design and the performance of production systems, based upon the understanding of operational excellence as a corporate improvement initiative. This dates back to Netland (2014), who suggested that a productions system - as an expression of corporate improvement initiatives - differs from how companies have traditionally organised

improvements. This is embodied in three aspects of a production system: 1) a lasting strategic programme and not a project; 2) tailored to the specific characteristics of the company; and 3) creates a common corporate language for improvements in the complete organisation (Netland, 2014).

Little research is available on different implementation and design concepts that suit different external and internal situations. Researchers are aware that the implementation cannot simply be a copy-and-paste from other lean implementations; rather, each company must find its own approach (Netland, 2014). Wildemann and Baumgärtner (2006) indicate four different ways how lean can be introduced from an organisational perspective, namely introduction to personal responsibility, a staff-led introduction, an introduction led by champions, and an introduction by a functional department as well as their combination (Wildemann & Baumgärtner, 2006). The four different ways are shown in Figure 19.

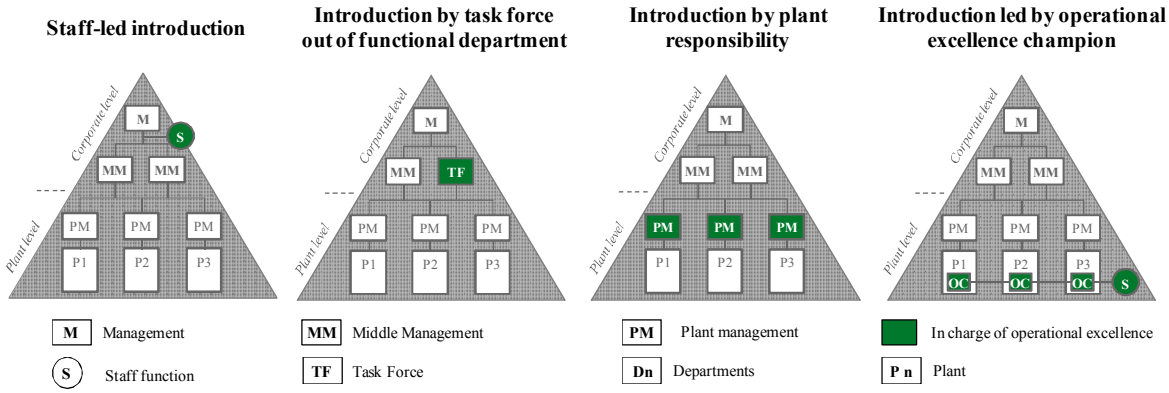


Figure 19. Different ways of introduction of a productions system (Wildemann & Baumgärtner, 2006).

They further refer to the area in which it can be introduced: implementation across the breadth of the location, topic-oriented implementation, limited-area implementation, and point-by-point implementation (Wildemann & Baumgärtner, 2006). These figures give a hind on the organisational position of an operational excellence support unit in the overall organisation. But no information is given of the organisation of the dedicated team itself.

Organisation of the production system at Toyota. As already presented in Section 3.2 on TPS, some few aspects are published on organisational and support functions to embed the TPS. The OMCD plays a key role in the TPS implementation. It is organised under the production control division and contains around 50 members, who are perceived as gurus of the TPS (Shimokawa & Fujimoto, 2009; Marksberry, 2012). In 2000, the OMCD comprised six senior and highly experienced executives (each with the responsibility for two Toyota plants and approximately ten suppliers). Besides the

six senior executives, another 50 consultants worked at OMCD, whereby around twenty consultants are permanent members of the OMCD and the rest are so-called 'fast track' employees. These employees should deepen their knowledge on the TPS via job enrichment and stay around three years at OMCD. Toyota's employees are relieved of all line responsibilities and are rather charged with leading improvement and training activities (Spears & Bowen, 1999). In general, OMCD conducts management-driven improvement activities but also helps suppliers by sending them a team of consultants for a period, ranging from one day to many months, whereby this assistance is free of charge to suppliers (Marksberry, 2012). In 1992, the Toyota Production System Support Centre was founded as a non-profit corporation in the United States with the objective to provide a similar service as the OMCD in North America.

In addition, TMC introduced the TPS promoter system at the five assembly plants in 1987. As a result, a structural change was made, putting each plant in charge of activities that used to be driven by the OMCD, including the TPS implementation and training. A TPS promoter was positioned as an important staff member reporting to the plant manager. At the same time, a TPS promoter alliance council was established at each plant. The purpose of this group was to promote exchanges of best practices in the network, as well as the further development of the TPS; at the plant level problem-solving teams address critical problems (Toyota 2015a).

The OMCD, the TPS promoter structure and the problem-solving team in combination with quality circles and an established organisation of a suggestion system at Toyota with a site and central suggestion committee help to promote and embedded the TPS into the Toyota DNA. As the dates show, TMC started to establish support functions for implementing and keeping alive the TPS in the late 1970s and has continuously improved and enlarged this structure. Today we know that quality circle activities were collected by a committee with a central quality circle promoting office. To this central office all quality circle promoting offices from the plants in the network reported to. For example plant A has a quality promoting committee and a plant quality circle promoting office. The conducted quality circle activities and improvements are discussed in an advisor meeting. The next higher level is the coordinators' meeting that is reporting to the plant quality circle promoting office. This structure can be found in Toyota plants (Lawler & Mohrmann, 1985). Quality circle programmes create a parallel quality organisational structure; meaning the volunteer participants of a quality circle operate independently and also in a different way from the existing, formal organisation. Quality circles and their organisation have been a first attempt for a structured and purposeful team set-up to drive continuous improvement in the organi-

sation. Semi-autonomous work groups, advisory groups, and task forces as well as multilevel councils and business teams show an attempt to further develop the concept of quality circles in the 1980s (Lawler & Mohrmann, 1985). *"Changing a quality circle into an institutionalized participative structure involves making many changes in important features of the organisation that do not naturally flow from the implementation of a circle program."* (Lawler & Mohrmann, 1985, p. 65).

Organisation of the production system at Mercedes Benz. Clarke (2003) researched in her dissertation the role and functions of standards in the automotive industry. The case of Mercedes Benz covers the evolution of the Mercedes Benz Production System (MPS), its institutionalization, its content, relating to other standards, and most important for this research its structure. The MPS is the expression of the Mercedes Benz specific corporate improvement initiative whereby the MPS consisted of 5 subsystems, 15 operating principles, and 83 best practice methods, so called tools. She analysed the driving forces for the standardisation process and conducted two identical surveys in a period of one year, in 2000 and 2001, to reflect the changes in the opinion of the shop floor employees due to the MPS introduction at a German production plant of Mercedes Benz. In her research, Clarke describes the organisational structures supporting the MPS. Clarke (2003)

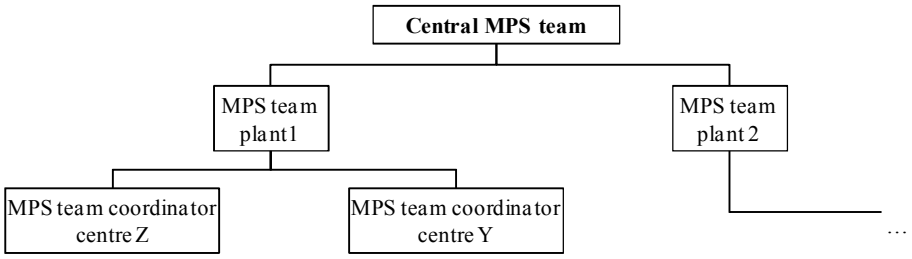


Figure 20. Level of Mercedes Benz Production System organisation (Clarke, 2003)

Different levels of the MPS organisation are on central, plant, and centre level. The central team is responsible for the consistent implementation, conceptual support, and cooridnation of the plants. The central MPS is part of the planning departement and the team is directly reporting to a board member. A group of eight person is responsible for the concept, the evolution, and the controlling of the MPS. A second group of five production system specialists, the MPS-trainers, is responsible for the training. Additionally, they prepare MPS implementation, its coordinations, controlling, and support. Each centre has a MPS coordinator who is selected by the centre employees. For every 1000 employees at each centre one MPS trainer was selcted. Critical are according to Clarke that the MPS trainers are accountable to the MPS centre coordinator. At centre level the MPS organisation is broken down in three

levels, namely the MPS steering committee at management level, sub projects and working groups within the departments. Clarke (2003)

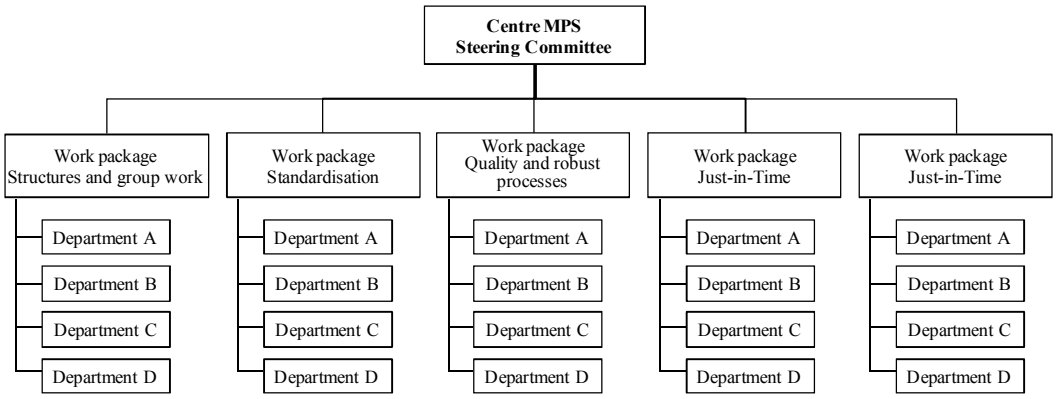


Figure 21. Mercedes Benz Production System organisation at centre level (Clarke, 2003)

The plant level organisation is in judeg of the functional leading of the MPS at plant level and MPS plant projects. In centrally coordinated sub-projects the team is supporting the MPS implementation. The plant level MPS team consists of core team and MPS trainers. Clarke (2003)

With her research she gave insights on the organisation of a company specific production system at an automobile company, but no insight or organisational model to describe, compare or optimisation for an operational excellence support unit is provided.

Lean manufacturing research and organisational aspects. Forza (1996) indicated that traditional organisations structures tend to have a high number of hierarchical levels with a low span of control. Furthermore, a high level of centralisation and large number of job classifications is associated with a rather functional or divisional organisation. Forza (1996) could clarify that lean production sites seem to use more teams for problem-solving, take employees' suggestions more seriously, rely more heavily on quality feedback for both workers and supervisors, document production procedures more carefully, and have employees able to perform a greater variety of tasks, including statistical process control. However, this is the ideal world after the organisation has reached a certain maturity level. To launch operational excellence, it is not possible to find an operational excellence support structure right at the start.

According to De Toni and Tonchia (1996) two of the major characteristics of lean production are the pursuit of excellence in terms of a suitable mix of performance and continuous improvement, rethinking work organisation in order to gain a flexible and effective organisational structure. Work organisation practices in context of lean and continuous improvement are addressed by several scholars (Forza, 1996; Olivella et

al., 2008; Hasle et al., 2012). Pettersen (2009) addresses the working organisation in the context of continuous improvement, focusing on team organisation, cross-functional training, employee involvement, and active participation (Pettersen, 2009). Table 7 provides a comprehensive overview and definition of work organisation practices. These thirteen work organisation practices based upon Forza (1996) are important to research the effect of continuous improvement on the working organisation.

Table 7 *Work organisation practices*

Variable	Definition
Commitment to continuous quality improvement	Employees believe that improving quality is their responsibility and they work to improve quality
Small teams problem-solving	Effective use of small teams to solve problems. Teams are used, and the opinions and ideas of team members are researched before making decisions; team members are encouraged to try to solve their own problems. Teams have really been effective in improving processes and in solving problems
Employee suggestions (realisation and feedback)	Perceived consideration, realisation and feedback of workers' suggestions. Workers and supervisors perceive that managers take all process improvement suggestions seriously. Managers actually say why suggestions are implemented or not and many suggestions are actually implemented
Supervisors encourage teamwork	Supervisors successfully encourage workers to work as a team, including expressing their opinions and cooperating with one another to improve production
Interactions between management, technicians and workers/supervisors	High interaction level between management, engineers and workers/supervisors on the shop floor. In particular, engineers are located near the shop floor to provide quick assistance, the plant manager is seen on the shop floor almost every day, and manufacturing engineers are often on the shop floor to solve problems
Feedback about quality performance to supervisors	Useful feedback given to managers and superintendents on quality performance and reduction of waste
Feedback to workers on quality	Workers receive timely and highly visible feedback on current process quality, such as rate of defects or machine breakdown frequency, using highly visible communication tools such as charts posted on the shop floor
Decentralisation of authority	Degree to which employees can make decisions without consulting their supervisors
Worker autonomy	The workers are authorised to stop production in the event of serious problems arising and above all if quality problems arise
Multi-functional employees	Employees are trained to perform a variety of tasks/jobs and they are cross-trained so that they can fill in for others if necessary
Workers performing statistical process control	A large portion of plant workers have the ability to execute statistical process control autonomously
Workers performing maintenance	Maintenance of the machinery used for production is undertaken by workers rather than a specific maintenance group
Documentation on production procedures	Systematic use of clear, easily accessible and up-to-date written documentation on production procedures

These work organisation practices give hinds on the interactions between supervisor and shop floor level, in particular continuous improvement elements like small teams and suggestions system as well as characteristics of a lean organisation, but a dedicated team for operational excellence and its tasks are not specified.

Lean literature. Netland and Aspelund (2014) discuss four dimensions that explain how subsidiaries deal with multi-plant improvement programmes. Their 4A model suggests the dimension adopting, acting, adapting, or avoiding of the improvement initiative from headquarter in the subsidiaries. Netland, Schloeter and Ferdows (2015) researched corporate input control practices and indicate that the use of dedicated lean teams is positively linked with more comprehensive implementation of a corporate improvement programme on plant level. The lean team can consist of lean experts, middle management but also shop floor employees. According to Netland et al. (2015) there are three advantages to form an dedicated lean support team 1) a dedicated team on plant level moves away from centralizing authority of top management and operates on plant level in coordinating and ensuring that the different elements of an improvement programme receive the necessary attention and progress; 2) a dedicated teams often receives training in both lean techniques and their implementation which enables the lean team to educate and assist other, e.g. the shop floor employees to implement lean elements and handle the accompanying changes; 3) often the performance evaluation and career opportunities of a dedicated team are linked to implementation success of an improvement initiative. Hence, the implementation might be enhanced by a team that has the knowledge, responsibility, and incentives to ensure and drive the improvement initiative. Netland et al. (2015) research how managers allocate responsibilities at plant level to implement the corporate improvement programme. They find a rule-of-thumb of one dedicated team member per 150 factory employees'. Their results are based on research of the lean implementation at different plants of one multi-national manufacturing company.

Kaizen event. Glover, Liu, Farris, and van Aken (2013) state that one common mechanism often used to implement lean concepts is the kaizen event. The kaizen event is *"a focused and structured improvement project, using a dedicated cross-functional team to improve a targeted work area, with specific goals, in an accelerated timeframe"* (Farris et al., 2008, p. 10). Kaizen events are known in the United States using other terms as well, for example, 'rapid improvement events', 'accelerated improvement workshops', 'gemba kaizen', and 'kaizen blitz' (Melnyk et al., 1998; Cuscela, 1998; Martin, 2007; Alexander & Williams, 2005). Kaizen events are related to the older and broader concept of kaizen or continuous improvement, which is recognized as one of the key principles developed by the TMC. Similar to kaizen, kaizen events emphasise incremental change, low-cost solutions, employee empowerment, and the development of an organisational culture of continuous improvement (Melnyk et al., 1998). Some research emphasizes that resources should be dedicated and prioritized based on the

initiatives that will provide the highest return on investment (Mathaisel, 2005). It is also important for practitioners to understand the tradeoffs in allocating resources across an organisation (Repenning & Sterman, 2002). Having a dedicated and defined source for resources after understanding these tradeoffs may be an effective way of ensuring that an established kaizen programme has the resources they need. *"Kaizen events appear to serve a similar purpose as other continuous improvement mechanisms, such as quality circles and continuous process improvement (CPI) teams"* (van Aken et al., 2010, p. 642). Specific programme attributes of interest are among others available resources, whereby the use of a 'kaizen office', including full-time coordinators or facilitators is investigated (Bicheno, 2001; Foreman & Vargas, 1999, Glover et al. 2013)

Continuous improvement research. Setting the focus on research in continuous improvement, major contributors to the research in Europe is a team around J. Bessant, who base their research in the context of the innovation literature. They understand continuous improvement as a routine that extends the involvement in the innovation process across a larger proportion of the organisation than is usually the case (Bessant, Caffyn, Gilbert, Harding & Webb, 1994). Their research is based in the Continuous Improvement Research for Competitive Advantage[6] (CIRCA) at the University of Brighton. The objective of the CIRCA project was to deliver a basic methodology for implementing and maintaining continuous improvement and its supporting tools. Bessant et al. (1994) indicate six success factors for the successful organisation of continuous improvement:

1) Continuous improvement needs a clear strategic framework;
2) Continuous improvement needs managing strategically;
3) Continuous improvement needs an underlying supportive culture;
4) Continuous improvement needs an enabling infrastructure;
5) Continuous improvement needs managing as a process; and
6) Continuous improvement requires a supporting toolkit.

[6] Through a collaboration between industrial and academic partners, the continuous improvement research for competitive advantage (CIRCA) project investigated how continuous improvement can be introduced and sustained in UK industry. CIRCA was a five-year study completed in 1997 which provided the foundation for a variety of later projects.

One of the major outcomes from this continuing research programme is the development of a behavioural model describing the evolution of continuous improvement capabilities (Bessant & Caffyn, 1997). Based upon the conducted CIRCA research, Bessant and Caffyn (1999) introduce an evolution of the continuous improvement performance and practice with five stages, namely:

Level 0: No continuous improvement activity

Level 1: Trying out the ideas

Level 2: Structured and systematic continuous improvement

Level 3: Strategic continuous improvement

Level 4: Autonomous innovation

Level 5: The learning organisation

Choi (1995) brings together the literature on continuous improvement in the manufacturing field and the literature on organisational change in the fields of strategic change and organisation development. His paper attempts to take a modest step towards bridging the interdisciplinary and theoretical gaps that exist between organisational change literature and continuous improvement literature. According to Choi (1995), specific ideas for improvement typically emerge from the workers through a suggestion programmes. Although ideas for improvement can be shared across plants and industries through benchmarking, but change activities tend to be organisation-specific (Choi, 1995).

Savolainen (1998) explores the continuous improvement implementation in an organisation as a form of organisational renewal. This involves innovative behaviour and encompasses reforms on two levels: in managerial ideological thinking and organisational practices. Savolainen (1998) has the following understanding of continuous improvement: a company-wide process of focused and continuous incremental innovation. In this paper, organisational renewal is defined based on Tichy and Devanna (1986) as *"The new way of thinking becomes day-to-day practice. New realities, actions and practices must be shared so that changes become institutionalized"* (Savolainen, 1995, p. 1205).

Lindberg and Berger (1997) studied the application of continuous improvement in different Swedish companies, finding that Swedish companies go beyond just creating a 'parallel' organisational structure when conducting continuous improvement activities. Instead, they try to ensure that improvement teams are part of the daily work. Lindberg and Berger (1997) analyse and describe strategies for the design, organisation, and management of continuous improvement. Based upon case studies and survey research, four basic strategies for the design and organisation of continuous im-

provement are identified, including three team-based strategies and one individually based strategy. These depend on the basic task design and whether the improvement task is integrated or parallel. Furthermore, it is shown that companies tend to move from expert-oriented strategies to more organic strategies as maturity evolves (Lindberg & Berger, 1997). Swedish approaches of continuous improvement seem more organic compared to the more expert-oriented Japanese understanding.

Lillrank et al. (2001) illustrate in their article 'Continuous improvement: Exploring alternative organisational designs' that successful continuous improvement efforts can be organised in various ways in different industry environments as well as cultural context. They understand continuous improvement as an organisational innovation with design principles rooted in the TQM understanding. Therefore they introduce a set of design principles derived from requirements understood as a minimum set of individual, group and organisational conditions that a manager aims to achieve (see Figure 22).

Want to do	• Compensation for time and effort • Reward for suggestions • Motivational message
Can do	• Time and facilities • Skills , tools and techniques
Know what to do	• Setting of direction and goals • Setting of the organizational arena • Implementation • Information and knowledge

Figure 22. Checklist for generic design requirements for continuous improvement (Lillrank et al., 2001, p. 46)

The design dimensions are a basic set of solutions that managers can choose from in order to meet the design requirements (see Figure 23). There are two basic options: 1) continuous improvement is part of the work; this is called integrated; 2) continuous improvement is extra; this is called parallel. In an integrated solution improvement is on its way to become integrated in formal job descriptions. In a parallel solution full overtime may be paid for all activities. On the example of the Japanese model, of SAAB, and of ABB, Lillrank et al. (2001) show different kind of improvement organisations, for example an improvement organisation as a permanent driver of change.

Social organization	• Individual or group
Magnitude and issue	• Single function or multiple function • Single hierarchy level or multiple hierarchy levels
Know what to do	• Parallel or integrated
Assurance of consistency	• Permanent organisation or continuously evolving vision or both
Goal setting and implementation	• Centralised or decentralised

Figure 23. Design dimensions for continuous improvement (Lillrank et al., 2001, p. 50)

Delbridge and Barton (2002) examine on an empirical study the formal structure of an organisation and management practices of continuous improvement. They explore links to performance and roles of the shop floor work organisation (production teams, routine problem solving groups, and target problem solving groups). They call these teams off-line teams or lean production teams. As organisations are addressing continuous improvement in different way, Delbridge and Barton (2002) consider the dimension specialization, centralisation, participation, and standardisation to describe the continuous improvement organisation. The roles of employees differ in line with the different forms on the organisation. This ranges from administration the suggestion scheme, technical specialists, methods and tools specialists, and senior specialist to champion of continuous improvement in a plant. But recurring similarities at different organisation are found: "*A striking feature of our initial interviews was the consistency with which plant managers reported the recent or imminent introduction of at least one specialist person with full-time responsibility for continuous improvement activities. The title of these posts varied, including "kaizen coordinator", "continuous improvement coordinator" and "lean manufacturing manager. […]. The presence of specialists is noteworthy but it is also important to acknowledge the range of roles designated to such employees"* (Delbridge & Barton, 2002, p. 685).

Van Aken, Farris, Glover, and Letens (2010) introduce a framework for the design and management of a kaizen event programme framework. They use case study and literature review, to develop the model which follows the pdca cycle. The model can be used as an effective reference guide to plan kaizen events and highlights the general importance of planning processes. They indicate activities in the support phase like manage the kaizen programme, motivate and educate employees.

A. Plan
A.1 Identify candidates
A.1.1 Derive strategic direction
A.1.2 Perform analysis to define candidates
A.1.3 Respond to engineering problem
A.2 Select Candidates
A.2.1 Define improvement strategy
A.2.2 Define portfolio of events
A.2.3 Schedule evens
A.3 Define selected candidates
A.3.1. define initial project charter

C. Sustain
C.1 Review results
C.1.1 Measure
C.1.2 Evaluate
C.1.3 Adjust
C.2 Share results
C.2.1 Standardize best practice
C.2.2 Share lessons learned

B. Implement
B.1 Prepare for event
B.1.1 Explore
B.1.2 Refine charter
B.1.3 Announce event
B.1.4 Select team roles
B.1.5 Prepare for the event
B.2 Execute event
B2.1 Kickoff event
B2.2 Build team
B2.3 Train team
B2.4 Follow structured approach
B.2.5 Report out
B2.6 Evaluate
B.3 Follow-up after event
B.3.1 Complete action items
B.3.2 Document changes
B.3.3 Define management processes
B.4 Deploy full-scale change
B.4.1 Complete full-scale implementation and deployment

D. Support
D.1 Educate employees
D.1.1 Orient and educate employees
D.1.2 Manage facilitators expertise
D.1.3 Manage team leader expertise
D.1.4 Provide training materials
D.2 Share results
D.2.1 Administer kaizen event program
D.2.2 Communicate
D.2.3 Define and manage budget
D.2.4 Improve the kaizen event process
D.3 Motivate employees
D.3.2 Set expectations
D.3.2 Reward and recognise teams

Figure 24. Kaizen event programme framework (van Aken et al., 2010, p. 647)

Anand et al. (2009) present an empirical paper with a framework of continuous improvement infrastructure, derived from the dynamic capabilities perspective and the underlying theory of organisational learning. Starting with the claim that today's challenge in continuous improvement initiatives such as lean production and six sigma lies in the creation of an infrastructure to coordinate continuous improvement projects, the paper seeks to identify the elements of such an infrastructure. Organisational learning is perceived as underlying theory and continuous improvement provides the organisational context for a dynamic capabilities initiative. According to Anand et al. (2009), a continuous improvement initiative consists of a number of practices, like a set of methods and tools commonly used for the execution of projects (Handel & Gittleman, 2004). For discussion about continuous improvement infrastructure, Anand et al. (2009) use a framework with the elements of purpose, people, and process (ref. Figure 26). Anand et al.'s (2009) framework of infrastructure elements is based upon the idea that continuous improvement is meant to be a dynamic capability (see Figure 25).

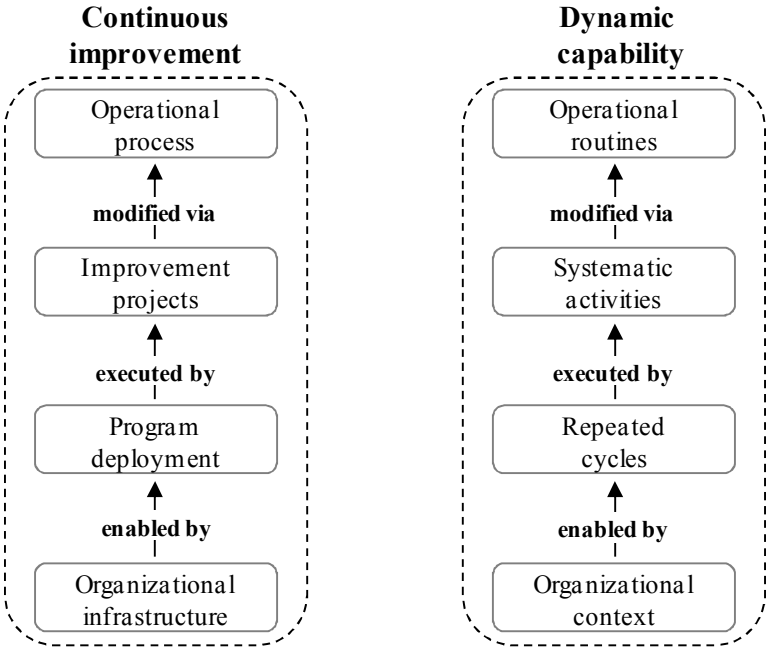


Figure 25. Continuous improvement as dynamic capability and Anand et al.'s continuous improvement infrastructure framework (Anand et al., 2009, p. 445)

Anand et al. (2009) studied continuous improvement initiatives in five companies and gained insights into the practices for each of the elements of their continuous improvement infrastructure. Anand et al. (2009) name eight continuous improvement infrastructure practices and their combinations This research makes two conceptual contributions to the study of continuous improvement: first, a clear definitions for process improvement and continuous improvement initiatives; and second, how organisational learning theory informs a theory of continuous improvement. For this research the category process is interesting. The model category process consist of the elements constant-change culture, parallel participation structures, standardized processes, standardized improvement method (see Figure 26).

Based on Anand et al.'s (2009) model of purpose, process, and people, infrastructural decision areas are assigned to each element: purpose involves organisational direction and continuous improvement goals, balanced innovation and improvement; process involves constant change culture and practical participation structure, standardised processes and a standardised improvement method; while people involves training and career path and information technology support. Anand et al. (2009) document that the companies they have researched use teams of cross-functional employees. These teams encourage the coordination of continuous improvement activities and serve as independent facilitators.

Infrastructure decision area	Intent
Purpose	Determine multi level goals while maintaining united strategic outlook
Organizational direction and CI goals	*Facilitate mid- and lower-level managers participation in strategy formulation and implementation* *Assure project goal congruence with strategic objectives; set and validate goals and results* *Maintain focus on CI initiative*
Balance innovation and improvement	*Incorporate stability and change objectives and process-improvement and new-process-design projects*
Process	Institute practices and structures gearing implementation towards purpose
Constant change culture	*Encourage proactive scanning for opportunities and threats* *Prepare employees for constant change and reorientations*
Parallel participation structure	Superimpose lateral structure for cross-functional cooperation
Standardized processes	*Avoid sub-optimization of organizational performance for functional goals*
Standardized improvement method	*Enable measurements and comparison for improvement projects* *Provide common scientific method for improvement and facilitate participation*
People	Invest in resources towards achieving purpose
Training and career paths	*Enable participants in CI projects* *Update body of knowledge and provide training when appropriate* *Clarify reporting structures and paths for personal development*
Information technology support	*Support process-measurements needs and provide repository of project reports*

Figure 26. Infrastructural decision areas based on Anand et al. 2009

Huang, Rode, and Schroeder (2010) analyse the effect of organisational structure on mass customisation capability. They determine which type of organisational structure (mechanistic or organic) is most conducive to the development of mass customization capability. Additionally they research whether the relationship between organisational structure and mass customisation capability is dependent on the customizer type. Therefore they consider two organisational dimensions, flatness and centralisation, as well as the division of labour with employee multifunctionality. Huang et al. (2010) argue that these three together reflect the key aspects of an organisational structure.

Magnier-Watanabe (2011) explores the implementation of kaizen in context of its organisational design and different knowledge management preconditions. He used a case-study based on previous in-depth research of New United Motor Manufacturing Inc.. The research focuses on kaizen's conditions in terms of organisational characteristics and knowledge management practices. Based on a literature review, the following four propositions state different requirements. From an organisational perspective kaizen requires: 1) horizontal organisational structure; 2) collective organisational membership; 3) ad-hoc organisational relationships; 4) hybrid reactive and innovative organisational strategy as well as ambidextrous exploitation and exploration knowledge application. Based on these requirements Magnier-Watanabe (2011) found that kaizen may be carried out in those firms with a task-force organisation as opposed to a

bureaucratic organisation. The first named displays a higher degree of autonomy, openness, and self-discipline.

Learning from other disciplines – Quality management. In basic books on operations management, Seghezzi, Fahrni, and Friedli (2013) and Westkämper (1999) address the design and description of the general and the specific organisational concept of an integrated quality management following a structural design, operational, and organisational structure, as well as a specific structure. In the research field of quality management, Naor, Goldstein, Linderman, and Schroeder (2008) investigate the interplay of organisational culture, infrastructure and core quality management practices, and manufacturing performance. Two results are that first the organisational culture has a stronger influence on infrastructure quality management practices than on core quality management practices and second that infrastructure quality management practices have an effect on the manufacturing performance (Noar et al., 2008). These infrastructural practices are already addressed by Flynn et al. (1995), who categorise seven quality practices into two clusters: infrastructure, comprising top management support, workforce management, supplier involvement, and customer involvement; and core practices which are quality information, process management, and product design. The infrastructure practices belong to behavioural attributes of quality management, whereas the core practices relate to the technical aspects. One key result of the research is that in developing and encouraging problem-solving skills of a quality team, it is important that management functions as a facilitator and coach rather than giving subordinates orders (Flynn et al., 1995). Naor et al. (2008) suggest that organisational culture is positively related to infrastructure quality practices. Their results indicate that infrastructure quality practices have a higher impact on manufacturing performance than core quality practices (Naor et al., 2008). Kaynak (2003) asserts that organisations with high levels of top management commitment produce higher quality products. Management provides the resources that are necessary for conducting training how to use new quality management practices and creates a work environment with employee involvement in the change processes. Overall, this research indicates that infrastructure practices have a significant positive effect on manufacturing performance.

Learning from other disciplines – Supply chain management. Kim (2007) suggests a set of best organisation structures for an efficient supply chain management. He derives different organisation types according to the formalisation and centralisation level of an independent department responsible for supply chain management. Thereby, he considers the hierarchical relationship in organisational position and op-

erational responsibility between the supply chain management department and existing other functional departments (Kim, 2007). A key result is that overly-excessive centralisation and formalisation of a supply chain management department interrupts the supply chain integration and has a negative impact on the improvement of the performance (Kim, 2007).

Learning from other disciplines – Strategy management. Kaplan and Norton (2005), famous for the balance scorecard, provide research on the root causes of the disconnection between strategy and performance learning. According to them this is a missing strategy execution process. Kaplan and Norton (2005) suggest an office of strategy management as a new unit at the corporate level of an organisation. This office oversees all strategy-related activities from strategy formulation to its execution. The office of strategy management has an important coordinating role to sustainably work on company-wide strategy activities (Pateman & Kaplan, 2005).

3.6.2 Implications

Summarising the conducted literature review on TPS, lean, continuous improvement, operational excellence, organisational design, - organisational development, and organisational structure little research can be found on the organisation of an support unit dedicated on operational excellence on corporate and plant level.

1. Less information in literature on requirements for a dedicated operational excellence support unit are provided.

When starting a continuous improvement initiative, executives have to deal with an existing organisational structure. An operational excellence initiative with continuous improvement as the underlying philosophy comprises structural and behavioural changes per definition. These changes from a traditional work organisation to an operational excellence require different activities to form a dedicated team of experts to provide an on-going support for the improvement initiative. Less information is provided on the requirements of an operational excellence support unit to unlock the potential of an operational excellence initiative.

2. Recent publications do not investigate tasks of a dedicated operational excellence support unit and the interplay with the organisational structure.

Research on operational excellence does not address dedicated operational excellence teams in the context of organisational structure. In terms of the sustainable implementation of operational excellence and making an initiative more successful, the consideration and purposeful selection of a suitable organisational structure for the opera-

tional excellence support unit is necessary. Neither a parallel structure nor the structure in which operational excellence experts are working in is described in literature.

3. ***Establishing an operational excellence organisation to release operational excellence in its full potential with continuous improvement projects has been neglected in the past.***

The adaption of an organisational structure is an instrument to design an organisation to reach organisational objectives. Neither research on continuous improvement and the relationship to organisational structures nor on how a dedicated operational excellence unit can create a structure to embed operational excellence in an organisation is available. Establishing suitable operational excellence organisation to coordinate operational excellence tasks and continuous improvement projects is a crucial challenge, but has been neglected in the past.

4. ***There is no sufficient information on the adaption of an operational excellence support unit over time.***

The changes from a traditional work organisation to an operational excellence environment require new tasks and structures for the operational excellence support unit over time. No model in research provides information on the adaption of an operational excellence support unit over time.

3.7 Summary on the theory of continuous improvement, operational excellence, and organisational change & -design

Chapter 3 provides the theoretical basis for this thesis. The relevant literature has been analysed and the basic knowledge on continuous improvement, operational excellence, organisational change, organisational design, and organisational development has been provided. It becomes clear that improvement is a continuous approach in its nature. Therefore, continuous improvement has been established as a synonym for ongoing incremental and fundamental changes and an improvement concept. Continuous improvement finds its application in the TPS, lean production, TPM, TQM, JIT, and consequently in operational excellence. Overall, continuous improvement is perceived as not only the notional fundament but also the practical procedure of improving processes on a continuous basis. Continuous improvement is conceived as a general element and critical factor for a comprehensive operational excellence initiative. From a historic basis, continuous improvement is not a pure Japanese phenomenon, although it became famous with the rise of the Japanese economy after the Second World War, and especially at TMC. Imai (1986) and Shingo (1988) asserted that continuous improvement was the single most important factor in Japan's manufacturing success. To-

day, corporate improvement initiatives find their expression in company-specific production systems with improvements carried out on a continuous basis (Netland, 2013). Westkämper (2006) sees continuous improvement and lean as methods to manage the company-specific production system. Operational excellence is a corporate initiative improving efficiency and effectiveness by compiling structural and behavioural changes. In a big picture, improvement initiatives that are based on one or a combination of continuous improvement elements retain the same purpose but often under different names. *"They share a common goal of improving the productivity of manufacturing operations through improving the processes"* (Netland & Aspelund, 2014, p. 392). Taking potentials, drivers, barriers, and characteristics of operational excellence helps to derive the requirements for a corporate and plant operational excellence support unit. Knowing the characteristics helps to delimit the field of action, knowing the potential of operational excellence provides a starting point and 'north star' for the objective of an operational excellence support unit. Drivers for operational excellence are the continuous improvement of processes in terms of managerial, administrative, communication, and technological processes. This knowledge leads to a better understanding on barriers to and driver for the implementation of operational excellence as corporate improvement initiative and answers the RQ a) "What are the drivers for and barriers to continuous improvement?"

Chapter 3 also provides knowledge on the relevant organisational basics, including different elements of a department, organisational forms, integration and differentiation, as well as organisational structures. An organisational structure is determined by the division of labour (differentiation) and work organisation (integration) (Koufteros & Vonderembse, 1998). The adaption of an organisational structure is an instrument for a purposeful design for an organisation to reach organisational objectives (Kieser, 1995; Spath & Koch, 2009). To understand the dynamic time perspective, organisational changes over time - represented by the concepts of organisational design and development - are introduced. It is clear that an organisational structure cannot be designed in one project and is rather a long-term activity with different projects that accumulate over time. The organisational structure provides the framework for the social-operational-control system and influences individual and group behaviour.

4 A model for an operational excellence support unit

Start by doing what's necessary;
then do what's possible;
and suddenly you are
doing the impossible.
Francis of Assisi

In order to implement and maintain elements of operational excellence, decisions need to be taken by top management on how to set up an operational excellence organisation – meaning the corporate and local resources allocated to operational excellence and the structure in which these experts operate. Literature provides no framework that allows describing an operational excellence initiative from organisational perspective and guides operations managers in the decision about the design of an operational excellence support unit or the one of an operational excellence organisation.

The conceptual research phase of this thesis is based on practical insights which are complementary to the conducted literature analysis and show the research topic in an illustrative way. In Section 4.1 the ascertainment of the different specifications an operational excellence support unit on corporate and plant level is done. This is a first step to better understand the operational excellence support unit characteristics and shapes in practice. In Section 4.2 and 4.3 the dimensions of a model to illustrate an operational excellence support unit are conceptualised; in Section 4.2 these are the tasks to perform and in Section 4.3 the organisational structure of an operational excellence support unit itself. In both chapters the respective research topic is conceptualised. Conceptualisation is understood as the identification of the different dimensions of a construct (Kieser & Kubicek, 1992). Thereby the conceptualisation phase is based on empirical data gathered with qualitative research methods. In addition, theoretical basic knowledge and the results of the literature analysis are used (see Chapter 3). Section 4.4 provides the operational excellence structure which binds together corporate and local operational excellence support teams. Chapter 4 ends with a summary.

4.1 Getting familiar with an operational excellence support unit

First, the different specifications of an operational excellence support unit are investigated. Therefore interviews were conducted following a semi-structured interview guideline, which is based on the implications and research gaps as provided in Section 3.6. Objectives of the interviews were to gain deeper insights on the research topic and

enlarge the knowledge from the literature with a practical view to describe a phenomenon better that is present in operations companies in different specifications. Interviews were conducted with operational excellence employees from different companies. The interviewees are in charge of operational excellence on corporate or plant level and working on different facets of improvement programmes for several years. In short, we collected two types of data from practice: interviews and documents. The author interviewed 20 operational excellence key personnel from 18 different manufacturing companies and industries (see Appendix); not all are used on this section. Additional information on the companies is provided at the beginning of each short case to frame the described operational excellence support unit in different contingency factors, like organisational form or number of employees. All activities were conducted personally by the author per telephone or face-to-face at the companies' facilities. The interviews were carefully prepared, recorded, and relevant sections transcribed. From different companies internal documents were provided. Additionally, official information from companies' homepages or publications was studied with a focus on the research topic. Doing this, the author searched more than 150 pages of additional documents for confirmation purpose. In order to prevent a prejudice on the illustrative cases because of a company name, all companies' identities are kept anonymous. The different illustrative cases are provided with an imaginary name, the industry, the number of employees, the organisational form, and the number of production plants. These facts help to better understand and set the described improvement initiative in a company-internal context. This is followed by a short description of the company. Then the operational excellence initiative is briefly described from an organisational perspective. At the end of this section a schema of different operational excellence organisation types is presented.

The illustrative cases help in the conception phase of the research object 'operational excellence support unit' and enable the design of a model which reflects the reality in a simplified way. The ontological assumptions behind the framework are grounded in the introduced theories and the understanding of Weick (1979) that and organisational design determines activities and derives an organisational grouping.

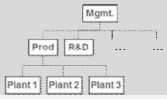
In the questionnaire for the interviews Wildemann and Baumgärtner´s (2006) suggestions on four different ways on how to introduce a company-specific production system were taken as a basis. These are staff led introduction, introduction by task force and functional department, introduction to site responsibility, and introduction led by champion (see Section 3.5.2). But more insights are presented in the following cases on the organisational aspects of an improvement initiative. The following eight

cases show the different organisational set-up of an operational excellence support unit as well as provide first details on the tasks on a corporate and plant level as well as the structure connecting these two levels.

The first illustrative case describes the organisation of the operational excellence initiative at CxO Pharma Inc. The pharmaceutical company is a development, manufacturing, and packaging Good Manufacturing Practice (GMP) compliant contract manufacturer with headquarters in Germany and having factories in Europe as well as the United States. The interview was conducted with the director of operational excellence at the corporate level.

CxO Pharma Inc. ***Industry:*** *Pharmaceutical*

Employees: *~ 600*



3 plants

At the end of 2009, the management of CxO pharma decided to start an operational excellence programme. Since the start, operational excellence is understood as an umbrella term for CxO Pharma Inc., and as such it is not an independent methodology or tool for process improvements. At CxO operational excellence is consisting of different approaches, which aim to achieve outstanding operational results. Based upon the operational excellence vision, a tailored roadmap is developed, focusing on the planning and post-tracking of the operational excellence competence development.

Right from the beginning a dedicated operational excellence department was established to achieve a sustainable cultural change. The department operational excellence is led by a director of operational excellence, initially supported by two employees. In 2011, the operational excellence support team had been strengthened by two further employees, who changed from functional departments of the company in the operational excellence team and one external operational excellence specialist. At present, the department is organised as a staff team with five employees. These leads to a ratio of one operational excellence FTE for 80 plant FTEs. According to the director of operational excellence this number seems sufficient for key projects to achieve a significant improvement of processes while achieving cost savings and quality improvements. The director of operational excellence support teams reports directly to the CEO and is at the same hierarchical level as the vice presidents, meaning CEO-1.

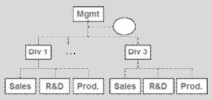
CxO Pharma Inc. initially concentrated on introducing lean methods such as 5S, value stream analyses, rapid changeover, process mapping and standardisation of processes. 5S had been introduced previously, although it was neglected due to a lack of responsibility for its implementation. In 2011, the existing processes were deepened and other applications such as the measurement and improvement of machine efficiency, total productive maintenance and poka yoke was undertaken. 2012 was marked by the integration of customers and suppliers. The expected financial benefit over a three year period is around 3 million euro.

A challenge is to convince other departments and their vice presidents about the benefit of operational excellence. Given that many of them have been long in the company and are not familiar with operational excellence but need to work with this 'new approach', this represent a major barrier to implementation.

The second case describes Medical Care Inc., a world-leading healthcare provider specialised in four different fields, represented by divisions. The interview was conducted with the head of the operational excellence of division A. Additional information is provided on division B. The organisational form of division A can best be described by a matrix structure with product region mix.

Medical Care Inc. ***Industry:*** *Healthcare*

Employees: *~50.000 overall*



5 plants (division A)

The division A started their operational excellence journey independently from the overall organisation. A forerunner in terms of lean was another division out of the four starting the first lean activities already in the mid-1990s, before other divisions followed in the early-2000s. Nonetheless, a corporate operational excellence initiative did not start until 2006.

The following insights describe the initiative at the two divisions A & B: This division started its lean activities in the year 2003. First, all operational excellence activities were strongly driven by the line and there was no central operational excellence team. In 2011, a decision was made for a corporate operational excellence function, which was properly launched in 2012.

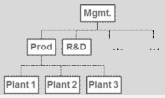
Operational excellence at Medical Care Inc. is organised with dedicated resources as staff team on corporate level. Top-down, all operational excellence activities were bundled under one umbrella and directed in a unity of purpose by the central operational excellence function. The central operational excellence head is also the moderator in terms of strategy activities in the entire company. Division A has a so called lean working group that is controlled via a steering comitee which is directly linked to the executive board. Each business unit has an own Medical Inc-Production-System office on business unit level. At the plants employeees are working as Medical Inc-Production-System specialists. Division B's head is also part of the executive management team of Medical Pharma Inc. The operational excellence support unit at division B is organised as a staff team and directly reports to the division B head. The functional allocation is to the production department. Operational excellence always has a focus on processes, organisation and products. Summarised, at both divisions A & B are corporate and local operational excellence employees. The Medical Care Inc. performance system supports the company's production and logistics to increase efficiency Ultimately, it comes down to cost aspects with lead times, quality, cost, and time need to be balanced. This combined expertise is grouped together at Medical Care Inc. 'centre of excellence'.

The new CEO joining the Medical Care Inc. played a key role in the operational excellence implementation. Following the CEO, the board wants to anchor awareness of operational excellence responsibility in line functions (target cascade).

As already indicated in Chapter 1, the pharmaceutical industry started the operational excellence journey in the beginning of the 2000s. Another form of the introduction of operational excellence is shown at Machine Tools Inc I, a drill manufacturer headquartered in Germany. The company has plants, in Germany and China, and two business segments. The interview was conducted with the head of industrial engineering, order fulfilment who is working in the supply chain and production department.

Machine Tools Inc I ***Industry:*** *Power tools*

Employees: *~ 2,000*



2 plants

Since 2006 Machine Tools Inc I has been conducting diverse singular lean activities which were in charge of different teams on project base. The lean activities were initiated and driven by the technical board member with an isolated pilot where different singular methods were tried out. After the retirement of the board member, lean was not on the agenda. In 2010 another top management employee joined the company with a strong lean background. Lean activities were henceforth more prominent and the focus was set on production and supply chain improvements. At this point of time no staff team was responsible, but rather a small team in the functional department supply chain & production. No dedicated team and in past no proactive and

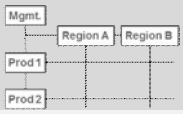
planned operational excellence team and functions was in place, but rather individual projects for process optimization. The biggest challenge the employees are facing are questioning routine, a low level of standards, and the change from a traditional way of working with big lot size to small lot size with small change over times.

As the headquarter and plant are at the same location the lean team works both on strategic topics for the management team and actively conduct operational improvements. From a strategic perspective they work on a lean vision aligned to the targets. Due to missing resources there is a need for facilitators and multipliers on the shop floor. A small team is in charge of the lean implementation but they do not drive shop floor improvement by themselves. The tasks of the lean team are to enable people and show how to generate improvement ideas. They introduce KPIs, employee qualification, describe standards, and conduct audits to see if implemented standards are met. Further the team helps the supervisor in coaching routines. Teaching team heads to work according to lean principles.

Once a month the team facilitates a lean event. Within a one-day workshop cross functional teams work on improvement. In the workshops the participants learn to work with lean tools like A3 reports and then immediately apply these between the monthly. After one month the results are presented and at least one board member participates at the workshop result presentation. Being on shop floor improves the credibility of top management.

Other industries started the implementation of operational excellence elements much earlier. One of these companies is Machine Tool Inc. II. It is a global leading company having continuous growth with double digits in turnover and return. For more than two decades no employees got fired due to economic issues**.** The interview was conducted with a corporate head of operational excellence.

Machine Tool Inc. II ***Industry:*** *Machine tools*
Employees: *~22.000 employee*



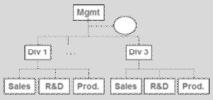
12 plants

The lean history of Machine Tool Inc. II started in 2009 with first lean activities in manufacturing. The first years were characterised by working on standards, methods and a lean book for the company. In the following years lighthouse projects were conducted and lean activities spread to other areas. In the last years a strong focus was set on end-to-end value stream thinking and a lean@ tool inc initiative, understanding lean as relevant for the whole enterprerise, was started. The activities were conducted following the enabling-execution-sustaining routine. First enabling the employees, than perfoming kaizen workshops and different lean projects. Following this working on the normative level with train-the-trainer and coaching as well as on leadership and culture to influence the DNA's company. According to a lean roadmap, which is in line with the company's growth strategy and agreed upon with the top management, the global lean team works in an infrastructure consisting of a lean network of experts, a lean academy, and a lean award system. In global activities information are shared using a global accessible share point.

Objective of any activities is to turnaround the operational way of working. This includes the breakdown of the silo mentality to achieve a more holistic improvement with the overall goal to reduce lead time. This is achieved by an end-to-end value stream mapping and project support in operations and development by lean office.

Another very successful, family owned company has worked for more than two decades on their excellence initiative and company-specific production system. Mechanical Engineering Inc. is a mechanical engineering company for fabricating equipment serving areas like sheet-metal processing and electronic applications. The company is divided into three business divisions, which are combined under the

umbrella of the management holding company. A global network of production, sales, and service companies supports the business activities of all business divisions. Production locations are in Europe, America, and Asia. Interviews were conducted with a site head from a production plant in Austria, the head of operational excellence of a Swiss production plant and the respective site head.

Mechanical Engineering Inc	***Industry:*** *Machine industry* ***Employee:*** *~10.000*		 *10 plants*

Machine Tool Inc. started its lean journey in the late-1990s. Driven by top management and one site in role model, the company established a production system with the elements vision, objectives, principles, methods & tools, and assessment. The company established a pull production and strongly focused on processes. The success was marked by rising productivity, lower lead times, higher flexibility and improved quality. In 2009, Machine Tool Inc. lowered its lean activities due to the economic crisis and restarted in 2011 with an advanced and redesigned production system. Coming from a strong tool focus, the new system prioritises process, management, and behavioural excellence, with the overall objective of achieving sustainable success. This led to turning away from the method and tool focusing on managerial ability, reverting back to the simple things and pragmatism. Machine Tool. Inc uses a hoshin kanri process that enables local plants to meet the corporate goals.

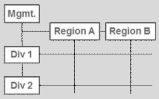
The Machine Tool Inc. support organisation employees are responsible for basic lean topic, technical operating and maintenance resources, the implementation of corporate standards on a plant level, and people topics. At the corporate level, lean is based in the industrial engineering department and deals with company-wide quality and lean topics. At the site level, the lean department is organised as an independent department at the department leader level (site head-1 level). The lean support department at the site level is also responsible for quality issues. Additionally the Machine Tool. Inc support organisation has specialist on the company´s production system elements, methods and tools as well as consultants. Both are internal resources who serve as production system facilitator. On plant level the core production system team is embedded in both production and administrative departments of each facility. In the company, a dedicated lean team exists at the corporate and site level.

Machine Tool. Inc operational excellence structure has different elements. Highest operational excellence committee is the production system steering committee, who directly reports to the COO. This core team consists of the head of production system consulting, different plant heads of the big production plant in the manufacturing network, the head of quality management, the head of purchasing, and the head of the companies' work council. This set-up represents a multi-discipline board with corporate employees enriched by people close to the production to incorporate the needs of production plants. The team has a coordination function and kicks-off new topics relevant for production.

The COO and co-owner was and is the strong driver to manage a change towards a continuous improvement culture. He took over the role as highest operational excellence manager in the organisation and did not delegate this responsibility to other management levels. This incorporates a rather long term view.

Another industry, namely the automotive sector, is a role model in implementing lean production. This perceived role model may be due to the fact that lean activities started in this industry at the beginning of the 1990s. Illustrative case V is an automotive supplier II, and is one out of two divisions of a multinational company. The division itself is organised with a matrix structure with product region mix. The

company headquarters is in Germany. The interview was conducted with the corporate head of operational excellence of division I.

Automotive Supplier II	***Industry:*** *Automotive and truck industry* ***Employees:*** *~13.0000*		**No data available**

Brake Inc. started in the year 2007 an corporate excellence initiative which brings together ten group-wide initaives. All programmes aim at process optimization and form a common platform that combines initiatives in different disciplines. Previously, in the area of production the Brake Inc Production System was introduced at different plants and in 2002 systematically from corporate level. The productions system was integtrated in the corporate excellence initiative in 2007. The production system is aiming for standardized processes across the global production network.

The excellence initiative at division I: The tasks at central level: the team develops and conducts trainings, describes methods which are anchored in the visualised company specific production system, writes handbooks, conducts audits following a standardized questionnaire once a year, establishing a system/platform for best practice sharing. Conduction training and executing projects is relevant in particular for smaller plants which do not have a dedicated operational excellence team. Overall objective is to achieve synergies and have a certain level of standard. Additionally the central team is planning a world meeting of all production system employees which takes place once in a year. Barrier is leadership on corporate managing director level. The head of production system has a separate IT team for KPI extraction.

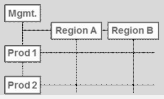
The plants have a different operational excellence plant structure; big production sites with around 1000 employees have a dedicated team, while smaller plants with 100-400 employees have no dedicated team and the production head or the production engineering team is responsible for operational excellence activities. Reflecting the last years and the progress sites made, the interviewee indicates that the plants with dedicated operational excellence teams are more successful and have a better productivity as well as improvement curve. The tasks on plant level are to initiate and conduct improvement projects, like tool exchange workshop, value stream mapping, and trainings. With this task production system specialists are seen as multipliers. Beside the methodological execution of production system elements the employees of the production system office are the contact person for the implementation of a new production line according to lean principles. A production system specialist is internally hired from expired practitioners and shop floor people. Their lean competency development runs through a four week training whereby each participant is receiving a certification. Generally, Automotive Supplier Inc. has a more decentralized organisation with pull from business units. Rather more dedicated operational excellence employees are at plant compared to corporate level.

In 2012 the company established an academy realising the importance of training. With specialised training, among others for value stream mapping to enable employees to eliminate waste and design optimized processes e.g. with a shorter lead time. 2014 was the start of a coordination process with the objectives to increase synergies in the management systems between the two divisions. Interestingly the excellence initiatives in production are named differently at the two divisions. Division1 names the responsible department operational excellence and division 2 industrial engineering.

In case VI Automotive Assembly Inc. is an automotive supplier and contract manufacturer, specialised in the assembly, logistics, and development of automobile interiors. The company is headquartered in central Europe. The interview was conducted with the head of industrial engineering. Additionally two personal meetings were conducted – one with the head of industrial engineering, the other with the head

of industrial engineering and his corporate head of operational excellence. In this company operational excellence is part of the functional department.

Automotive Assembly Inc. ***Industry:*** *Automotive*
Employees: *~ 4000*



21 plants

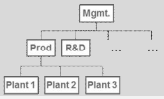
The Automotive Assembly Inc. started a company-specific operational excellence system - the Automotive Assembly Inc. way of continuous improvement - in 2008 at the corporate level and in the same year at some plants. Reasons for launching an operational excellence initiative were the continuous improvement of operational processes and corporate growth, while barriers were deficits regarding employee capabilities, a reluctance to change throughout the company and the company-specific adaption of operational excellence methods as well as missing operational excellence structures.

An expression of the operational excellence initiative exists in the form of a production system that provides the shared principles. The operational excellence system at Automotive Assembly Inc. has a strong culture orientation and is not perceived as a tool. The operational excellence system is perceived as being required for success. The production system comprises four elements, which are heavily based upon continuous improvement: person-oriented continuous improvement activities (suggestion system), group-oriented continuous improvement activities (5S), management-oriented continuous improvement activities (hoshin kanri, best practice exchange) and a continuous improvement process.

For the implementation, dedicated operational excellence resources exist. The implementation of the Automotive Assembly Inc. is not the responsibility of operational excellence experts. Beside operational excellence activities for a standard and their constant improvement, a quality management system - named as the "Cockpit Specialist System" - exists. Operational excellence has been applicable to everything that Automotive Assembly Inc. does. It should move away from decision-making based upon experience, focusing more on decisions based upon facts and figures. The KPIs used are produced parts per employee, the number of improvement ideas, OEE audits, non-quality losses, and plant productivity plans.

But not only medium to large multi-national companies work on operational excellence. Automotive Supplier III is a supplier to the automobile industry which designs and manufactures torsion-bar springs and anti-roll bars for use in commercial vehicles. The interview was conducted with the head of industrial engineering

Automotive Supplier III ***Industry:*** *Automotive*
Employees: *~ 600*



3 plants

The company has no dedicated operational excellence employee or team. Improvement activities, which also follow the lean production principles, are conducted by the head of industrial engineering and directly by motivated shop floor employees. A major reason for this set-up is missing resources. There is no responsibility for the coordination of ongoing and plant improvement initiatives. Initiatives started because of cost pressure and efficiency increase as well as quality improvement. Operational excellence is not part of the company´s strategy. A reluctance to change can be found throughout the company, resulting in a lack of employee involvement. Because of cost reasons no dedicated team has been implemented over the last years.

These eight different short case studies show that there are manifold ways to implement operational excellence in a manufacturing company. But there are patterns observable which repeat in different cases. No matter what industry or organisational form, operational excellence is either driven by dedicated teams or by employees who got operational excellence as an extra task. One thing these approaches have in com-

mon is the shift from independent, local or site optimisation to a corporate and aligned programme summarizing different improvement concepts under one excellence umbrella, what we understand as operational excellence. In order to distinguish between the different forms of operational excellence organisations, Figure 27 provides a classification of the organisation of operational excellence.

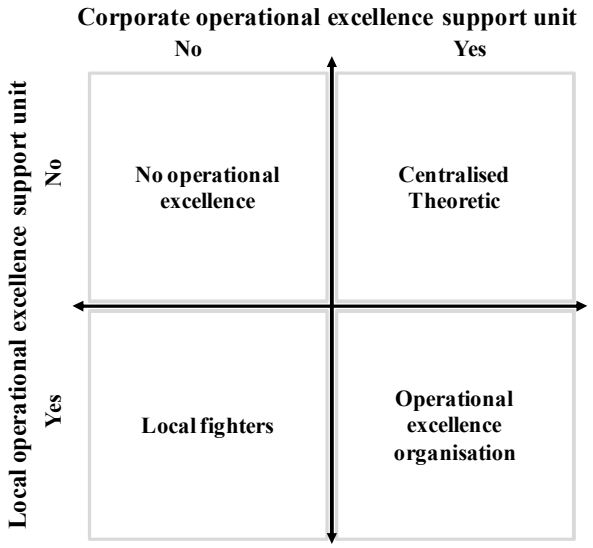


Figure 27. Four conceptions of an operational excellence support organisation

First on a horizontal axis is shown whether the initiative has a dedicated corporate operational excellence support team or not; on a vertical axis is shown whether the initiative is guided by a dedicated local support team for operational excellence. This results in four types of operational excellence organisational forms visible in a formal structure. Figure 27 show that there are four generalised types of organising operational excellence, which are described in the following.

Non operational excellence. The corporate initiated operational excellence programme has no dedicated operational excellence support team on corporate and none on local level. After the decision of top management to have an operational excellence initiative, these are driven by local and corporate employees as additional work. On local level this can be employees from the operations department working on operational excellence, e.g. one day a week. But too often their working time is dominated by daily operations and they are stuck in this. In reality there were times where there is no time for operational excellence at all.

Local fighters. This category is characterised by having only a dedicated local team at plant level and no dedicated corporate operational excellence team. This team can be positioned at different levels. They work on the operational excellence implementation and its maintenance at plant level with a rather low level of corporate conformance.

Centralised theoretic. In this form a corporate dedicated team exist. This team can be positioned at different organisational set-ups; from staff to functional department. They work on strategic topics like operational excellence vision, mission, and road-map. In the journey to operational excellence, seen as corporate initiative, this set-up is a first step before establishing dedicated units at plant level. For a plant where no dedicated local team gets established this 'centralists' can support the operational excellence implementation.

Operational excellence organisation. In this set-up corporate and plant teams dedicated to operational excellence exists. Operational excellence is perceived as a corporate improvement initiative. Guidance and governance topics like standard material or trainings are prepared by a corporate team and provided for the local teams. Following the slogan 'from corporate for local'; additionally the corporate team takes care about managerial tasks like convincing the top management from the benefits of operational excellence. Ideally, the corporate operational excellence team is not pushing but rather waiting for what local teams are pulling. This sense of self is different from the perception corporate teams generally have as centralist employees. The local teams follows the principle 'from local experts for local experts'. They care about the local implementation and ask for the support from corporate in terms of standards or audits.

Looking at different companies we could identify denominators of an operational excellence support unit: comparing plants with no dedicated operational excellence team to plants with a dedicated operational excellence team significant differences regarding the level of operational excellence implementation got reported by the interviewees. The cases also show that plants often individually started singular improvement initiatives in the past. As operational excellence is seen as a programme, many companies start operational excellence with a selected number of full-time dedicated resources. What these dedicated operational excellence support units do is explained in the next sub-chapter.

4.2 Tasks of an operational excellence support unit

One major component of an organisation is the tasks performed by its employees (Nadler & Tushman, 1988). What tasks has an operational excellence support unit to fulfil? What are the tasks on corporate and on plant level? This sub-chapter helps to answer these questions. Therefore the introduced cases from Section 4.1 are deepened with the different tasks performed by the operational excellence support unit. After some practical insights the introduced tasks of a dedicated operational excellence support unit are conceptualised according to categories, which are borrowed from tradi-

tional and modern organisational theories. Taking a look at the practice and the cases provide first insights on the tasks. Again each illustrative case is enriched with additional company data to get a better understanding of the overall conditions.

Company	Activities
CxO Pharma Inc **Industry:** Pharmaceutical **Employees:** ~ 600  3 plants **Start of operational excellence:** 2009 **Perspective:** corporate operational excellence team	Develop tailored operational excellence roadmap
	Training and coaching of project managers located in the functional departments
	Conduction of improvement projects
	Tracking projects as well as the calculation of project benefits in cooperation with the controlling
	Whitebelt workshop for new project managers.
	Executive management greenbelt for top management.
	Planning and post-tracking of the operational excellence competence development
	Introduction of lean methods such as 5S, value stream analyses, rapid changeover, process mapping and standardisation
	Implementation of machine efficiency, total productive maintenance, and poka yoke
	Convincing top management of benefits of operational excellence

The case of the Global Pharma Company Europe provides the task from a plant perspective.

Company	Activities
Global Pharma Company Europe. **Industry:** Pharmaceutical **Employees:** ~ 50.000  5 plants (one business unit) **Start of operational excellence:** 2011 **Perspective:** plant level	Coordinate training (different six-sigma belts and lean)
	Maintain the lean initiative
	Support in project execution to ensure quality of six sigma projects
	Administer database of lean six-sigma project
	Report to top management on metrics (maturity level of lean initiative and quality)
	Enable green and yellow belts through certification
	Conduct training (incl train-the-trainer and coaching)
	Accountability boards on a routine basis
	Audit, standardize, and sustain the visual management programme
	Provide material support to improvements in supplier system

The provided overview of tasks of an operational excellence support unit give first insights for corporate and plant level activities. Several studies exist on the tasks of managers and leaders (see Section 3.3). Some of the understanding originates from bureaucratic research, e.g. conducted by Fayol (1949) or Weber (1947). We take these for starting the discussion and reflect if they are still fitting today´s working environment and the requirements of an operational excellence support unit. First, we take Fayol´s (1949) managerial activities (see Section 3.3.1) as a starting point to see if the described task of an operational excellence support unit fit can be categorised in theoretically provided generalised tasks. Fayol (1949) describes managerial activities planning, organisation, command, coordination, control. We exclude command and control. Based on the conversation we had in the focus group meetings and from the interviews it becomes obvious to exclude command as well as control as seen in bureaucratic organisations. In today´s post-bureaucratic organisations, authority depends not on hierarchical levels and command and control but rather on one's ability to attract followers (Hamel & Zanin, 2016). According to Hackmann (1987) four general functions need to be accomplished whenever work is performed in a purposive organisation. A person or team 1) executes work; 2) monitors and manages work processes as well as initiates changes; 3) structures the performing unit, sets up the tasks, and organises resources; 4) specifies the goals and objectives which need to be accomplished. Kotter (2016) is differentiating between management and leadership. He states that management incorporates planning, budgeting, organising, staffing, measuring, problem solving, doing what we know to do exceptionally well and producing reliable dependable results constantly. In contrast leadership consists of establishing a direction, aligning people, motivating, inspiring, and mobilising people (Kotter, 2016).

Table 8 *Overview of managerial tasks*

Fayol (1949)	**Hackmann (1987)**	**Hamel (2007)**	**Project Management Institute (2013)**
Plan	Execute work	Setting of objectives	Programme strategy alignment
Command	Monitor, manage work processes; initiate changes	Motivation and alignment	Programme benefit management
Coordination	Structure the performing unit, set up the tasks, and organise resources	Coordination and define objectives	Programme stakeholder engagement
Organisation	Specify goals and objectives	Development of talents	Programme governance
Control		Collection and application of knowledge	Programme lifecycle management
		Establishment and fostering networks	Common activities like: communicating and reporting, align programme efforts, responding proactively to risks

We further borrow from programme management literature some activities. Programme management is understood as linking different projects under one programme, like an improvement initiative (Project Management Institute, 2013). But comparing these managerial tasks with the insights from Section 4.1 and 4.2 so fare, the categories do not fully describe the tasks of an operational excellence support unit; we used the focus group meeting to discuss the task. Based on a suggestion, the focus group participants discussed and aligned on the four categories coordinating, enabling, communicating, and executing. Kotter´s (2016) leadership tasks are not further considered as according to Bennis and Nanus (1997) leadership is a learnable capability for managers, who are willing to invest energy and effort. Leadership is the foundation and key success factor of the change and heavily depends on personal expertise and capabilities (Kotter, 2016).

In the following the four tasks are described more detailed and in particular why these categories are chosen and important for an operational excellence support unit.

4.2.1 Enabling

Why is enabling important? Barriers in change process are missing transfer of management skills (Klassen & Whybark, 1994), management fails in coaching (Sim & Rogers, 2009), and missing empowerment of shop-floor employees. Starting an operational excellence initiative confronts employees with new working areas (see Section 3.4.) and the application of new tools requires new competencies. Without new skills fear can arise and the change process can be slowed down. Taking TMC as an example, T. Minoura, who worked under T. Ohno, stated that *"Developing people is the starting point for monozukuri (making things) at Toyota (…) There can be no successful monozukuri (making thing) without hito-zukuri (making people)."* (Toyota, 2003). Skilled workforce represents a competitive advantage (Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012). Out of the success factors of change projects, training is listed in several studies (e.g. Picot et al. 1999; Sim & Rogers, 2009). It is not only about empowering employees, but also to get a common understanding and speaking one 'operational excellence language'. A missing understanding of operational excellence elements is additionally named as a barrier in several studies (e.g. Chan et al. 2005, Co et al. 1998). The lack of formal training for managers is another barrier. Bessant et al. (1994) name as one of the critical success factors for continuous improvement a supporting toolkit. Without knowledge in the application of methods and tools and the underlying philosophy that is behind these methods, operational excellence and its benefits are not understood and resistance to change arise due to lacking knowledge.

What is enabling? Enabling subsumes all qualification activities which lead to higher competences; this includes training and coaching. Training helps people to build skills and gain knowledge. *"Training can be thought of as the planned and systematic activities designed to promote the acquisition of knowledge (i.e., need to know), skills (i.e., need to do), and attitudes (i.e., need to feel). "* (Salas et al., 2012, p. 77). It is important to understand that learning and training are related, but are not the same. Learning is a desired outcome of any conducted training. Too often expensive trainings fail because participants have no application afterwards. This is crucial because a lot of learning occurs outside of a training classroom and rather on the job (Kraiger, Ford, & Salas., 1993). Expertise is seen as the combination of qualification and experience. Consequently, training is not a one-time event that is conducted that people get certificates. It is more important to view trainings 'as a system' (what happens before, during, and after training) and give the training a purpose (why should an employee participate?) (Salas et al., 2012). In order to yield positive results training must be designed systematically and based on the science of learning as well answering 'who' is being trained, 'how' is the training conducted, and 'what' factors influenced the training effectiveness (e.g. motivation to learn). The motivation to learn is related to the fact that trainees believe the training is relevant. Therefore a strategy is necessary; a comprehensive training strategy does four things (Salas & Cannon-Bowers, 2001): 1) conveys information to the trainees; 2) demonstrates the desired behaviour and attitudes; 3) creates opportunity to practice the learning content; 4) gives feedback to the trainee. So, conducting a training needs analysis of what needs to be trained, for whom, and within what type of organisational system is the operational excellence activity taking place.

A training for operational excellence comprises different formats like manager training, team training, cross-cultural training, and all forms from beginner to expert training. A training can be conducted in different learning structure which can be a classroom training or a computer-based training like a web-based training or single work station training. Another training format is simulations referring to a using a representation of reality which is simplified (Galvao, Martins, & Gomes, 2000). Developing trainings for leaders and managers is challenging as the learning objectives are multidimensional, e.g. knowledge, skills, and competencies. But as the cases I (Section 4.1) shows, management commitment is key and the corporate support team conduct management training. Training this level is in particular important because developing a 'kaizen consciousness' is the responsibility of the management (Ballé et al., 2016).

In the management environment coaching is a powerful method to foster change and drive an operational excellence initiative. Coaching is related to individual per-

sons, deals with leadership style, and is a continuous process. Coaching helps people to change routines; and this is hard work as is saying management thinking and routines are not visible (Rother, 2009). Inspired by Japanese management research and in particular Toyota the wording kata is widely used in the last years. The word kata routines from Japanese martial arts and describes structured practice routines, which become through physical practice second nature that people do not to think about the application. Kata helps to learn new skills and internalize these in the mindset. Two kinds of kata exist: the improvement kata and the coaching kata. The first is for the employees who want to learn; the second is for the coach (Rother, 2009). The coaching kata helps leaders to support employees applying the improvement kata in their area of responsibility. Typical operational excellence work organisation characteristics are small group activities, kaizen events, quality circles. To achieve more teamwork of multifunctional qualified employees, the number of tasks in which employees receive training increases. The central operational excellence team should provide trainings, knowledge exchanges, and individual coachings.

Importance for an operational excellence initiative. Training improves skills and job capabilities of the workers which also help increasing the motivation and morale of employees. Training of workers and creation of multifunctional teams is an essential aspect of improvements in an organisation; poor skills of workers can be a driver for an unsuccessful operational excellence implementation (Sangwan et al., 2014). Due to training, employees get empowered and higher competencies increase the degree of participation in the improvement initiative. Consequently employees are more involved in decision-making or might even make decisions as they are able to.

4.2.2 Coordination

Why coordination? One of the greatest barrier in a change process is the lack of coordination between departments (Talib et al., 2011). A corporate operational excellence initiative aims at a company-wide implementation of operational excellence elements which leads inevitably to collaboration of different functions. Operational excellence is an umbrella initiative combining different approaches all aiming to improve effectiveness and efficiency. Following the St.Gallen understanding of operational excellence with TPM, TQM, and JIT in the technical area, these three approaches address different areas in an organisation. To prevent that work is done several times and in order to enhance learning from each other coordination plays a crucial role. In particular in multi-national companies with a production network more plants, coordination is key to align the different ongoing projects and enable best practice learning.

What is coordination? Netland et al. (2015) indicate that a dedicated lean employee has a plant-wide coordinating role. This includes inter-plant coordination of individual improvement initiatives as well as corporate coordination activities between plant and production networks. Coordination does not mean that all plants in the network do the same but how best practices can be used in the network, experience is shared on how new knowledge can be applied in the best way. Fayol´s (1949) understanding of coordinating is harmonising and unifying different activities in order to maintain the balance between ongoing activities of an organisation. Mintzberg's (1980) distinguishes five basic mechanisms of coordination (mutual adjustment, direct supervision, the standardisation of work processes, outputs, and skills):

- Coordination through mutual adjustment is based on informal communication between people conducting interdependent work resulting in a synchronisation of activities.
- Coordination through direct supervision is achieved by one individual person defining the direction of the work of others.
- Coordination through standardisation of work processes is specifying the work content in rules and standards resulting in routines to be followed.
- Coordination through standardisation of inputs / outputs builds upon the clarification and specification of expected results as well as the input.
- Coordination through standardisation of skills and knowledge builds specified and standardised training and education resulting in a common understanding.

Importance for an operational excellence initiative. With the shift from plant-specific improvements to corporate improvement initiatives aiming to be implemented throughout the entire company the coordination effort is high. As standardisation is key in any continuous improvement initiative, coordination through standardisation can help to make operational excellence more efficient as customer expectations are fulfilled and waste and consequently money is saved. Operational excellence is not a project with a starting and ending point but a strategic, long term initiative. Consequently operational excellence has no end and results in the continuous improvement of continuous improvement activities (Bessant et al., 1994).

4.2.3 Communication

Why communication? At the implementation of different elements of an improvement initiatives (see Section 3.3) and in a change process (see Section 3.4) one of the most named barriers is a lack of communication between management and workers (Jadhav

et al., 2014). A weak communication of , e.g a strategy leads to missing knowledge and consequently employees do not know or understand the strategy. Several authors indicate the communication of concrete objectives, of the change itself as a success factor in change projects (see Section 3.4). Equivocality during the implementation of an improvement initiative needs to be avoided.

What is communication? Communication is not understood as simple transfer of information (Rüegg-Stürm & Grand, 2015). Following Rüegg-Stürms and Grand (2015), who refer to Berger and Luckmann (1966), *"communication is seen as a process in which a shared understanding of specific situations and abstract relationships, past events, and decision reached is established as commonly shared reality"* (p. 49). Communication is understood as the exchange among each other and the discussion with each other; thereby information and communication are two different things (Doppler & Lauterburg, 2008). One of Weick's (1979) contributions to organisation science has been the concept of reducing equivocality between actors. In his view organizing consists of reducing differences among actors (Tsoukas & Chia, 2002). This led to the vertical view on communication by Weick (1979) with the focus on the concept of information equivocality. In this, equivocality needs to be reduced and a common interpretation of the external event is communicated within an organisation. Consequently organisations must do more than purely processing large amounts of information. This leads to two tasks: 1) levelling of information where a common view is possible; 2) processing a sufficient amount of data that a coordination and task performance is possible (Weick, 1979). It is important to notice that Weick (1979) talks about the relationship between equivocality and interlocked behaviour cycles and not about the relationship between equivocality and communication. When equivocality increases in practice, employees are less able to rely on rules and routines in order to handle new situations and communication gets more important. *"Communication is dependent on language. Language should be broadly understood (...) Verbal language, body language, imagery, and other asthetic forms of symbolic expression all form part of language"* (Rüegg-Stürm & Grand, 2015, p. 49). The internal communication allows employees, beside the collecting of information, to articulate and share their opinions on operational excellence. But the communication needs to be coordinated and conducted continuously; this is a task of the operational excellence support unit.

The direction of the communication flow in traditional bureaucracy organisation is predominantly from top to bottom, meaning from management to workers. Indeed, communication today is top-down, bottom-up, horizontal, and diagonal, wich is a

multi-directional communication flow. The fast communication of information, e. g. new ideas, is enabled by the optimisation of the comunication flow (Miller, 2014). Therefore different channels of communication, means through which employees in an organisation exchange information and communicate, exist. This can be a face-to-face communication but also, in electronic or written form video conferences, blogs, intra-net-portals and sharepoints, which are accessiable from cross-functional teams. Communication in the different channels can be formal and highly structured, e.g. in a board committee meeting, but also completly informal like a conversation during lunch. Additionally, communication can be routinised in form of a regular team meeting like a stand-up every day at the same time or a small talk in the elevator. *"Through the systematic processing of topics, issues, and challenges, manager communities are established as specific communities of practice that can be seen as communication communities (...)"* (Rüegg-Stürm & Grand, 2015, p. 54).

Importance for an operational excellence initiative. In an operational excellence initiative communication is important as, e.g. horizontal communication encourages the exchange of ideas and successful practices between departments and plants. The top down as well as bottom up communication is important in hoshin kanri. The bottom-up communication is important for the submission of improvement ideas. However, just providing information is not communication, especially in today´s time of information overload. Having the right information at the right time at the right place to communicated to the right people helps people to fulfill their tasks and understand changes. Communication is essential for an effective organisational change (DiFonzo & Boradi, 1998).

4.2.4 Execution

Why execution? Execution is important to prove seriousness of the management to go the journey to operational excellence. Therefore capable resources in an operational excellence support unit are necessary. xecuting proves the credibility of an operational excellence team itself; being on the shop floor with the line team is one crucial aspect, e.g. by conducting audits and improvements projects by the support unit at plants. But there should be no shift of tasks from line employees saying "*For operational excellence activities we have an operational excellence team in the organisation"*.

What is execution? Execution is the most operational one out of the four tasks and is understood as working actively on an operational excellence specific activity. This does not mean that execution is only done on plant or shop-floor level. Execution on a strategic level does also mean working on an operational excellence roadmap, con-

ducting and moderating workshops or working out standards. Furthermore conducting audits is part of execution for corporate operational excellence support employees. In audits the employees from corporate go to the plant and conduct there with local employees operational excellence audits. These audits help to better understand the maturity levels respective to the level of implementation of operational excellence. To know if conducted activities have been beneficial, data to assess the different kinds of performances in the form of measureable KPIs, like lead time, inventory, or set-up times, are needed. This leads to improved data-based decisions. Therefore, KPIs need to be implemented and collected to steer strategic activities in order to be able to track the development of an improvement initative. But execution consists also of hands-on activities on the shop floor and working actively with local employees in improvement projects. Execution is important to show in pilots the successful implementation and benefits of operational excellence elements. By creating 'light houses' (successful projects which are benfical for employees) at different organisational levels and in the manufacturing network, operational excellence attrack followers. Once the specialist conduct an improvement project and apply an operational excellence tool, plant employees can learn and at the next time work with the tool under the guidance before they use it without support from the corporate operational excellence team. In the execution of improvement projects, that are combined with the application of methods and tools, specialist enable employees. Followed by the train-the-trainer approach line emplyoees can learn from operational excellence support employees and then train others. So the operational excellence support team does not only executed but also trains through execution and initiates changes. Driving change by execution is a key activity of an operational excellence support unit.

Importance for an operational excellence initiative. Section 3.2.2.4 introduced the principles of continiouos improvement, among others speak with data and process orientation. Taking these two principles as example the importance of execution gets clearer. In order to 'speak with data' the right metrics need to be established and a KPI system needs to be broken down from top management to shop floor level with suitable KPIs for each level. Establishing such a system and keeping it alive is crucial as data serves as a starting point for improvements and helps to focus on the right area of improvements. Processes orientation is another important continuous improvement principle. Such process orientation can e.g. be achieved with the value stream activities. These activites can be iniatiated and moderated by an operational excellence support unit employee. Furthermore execution supported by specialist helps to achieve a fast adaptability of an organisation. And adaptability requires experiments, which are

more likely to go wrong than right (Hamel & Breen, 2007); these aspect can be covered by an operational excellence suppor team more ealy than by a line team.

4.3 Organisational structure of an operational excellence support unit

In literature on organisational theory different dimensions of an organisational structure are provided (see Section 3.3.5). These serve as a basis for the discussion of the organisational set-up of a corporate and local operational excellence support unit. Before elaborating the different dimensions of an operational excellence support unit, some illustrative cases are provided to better understand the topic.

Company data	Organisational set-up operational excellence support unit
Medical Care Inc. **Industry:** Healthcare **Employees:** *~50.000 employee*  5 plants for business unit **Start of operational excellence:** 2006 **Perspective:** corporate and plant	*Overall at Medical Care Inc. 85 people operate worldwide directly for operational excellence. In division d, 6.5 FTE are directly engaged in operational excellence, thereby one person has a central division d function, 5.5 FTE are allocated to two sites, 4.5 FTE to production location and 1 FTE Admin & Prod. The work of operational excellence people is measured by eight success factors: willingness to change, process vision, operational excellence organisation (workshops, projects), communication, training, method and tools and metrics.* *Small teams are allocated to site management, which are also responsible for operational excellence for two sites at 5.5 FTE. Site A has 350 employees including Admin, whereas site b has 860 people, comprising head office and production; 4.5 FTE who report to factory management. In two of four production areas, additional employees work on operational excellence. These are not included in the 4.5 FTE as they undertake operational excellence as an additional task. In some places, resources are made available to take care of the operational excellence issues. Isolated and supportive staff are trained in operational excellence*

Company data	Organisational set-up operational excellence support unit
Automotive Supplier II **Industry:** Automobile **Employees:** *~13.000 employee*  no data **Start of operational excellence:** 2007 **Perspective:** One out of two divisions; corporate and plant	*Three persons are working in the corporate operational excellence team at division level.* *By requirement of corporate management each production plant needs to have one person to be 100% available for the Brake Inc Production System. This is evaluated from the corporate operational excellence team in the yearly evaluation process.* *Taking a deeper look at one German plant which operates successfully in the field of operational excellence. At the plant the operational excellence support team is organised as a staff team with three dedicated employees; each one out of a business from the three business units at the plant. The employees are reporting to each respective business unit´s head and via dotted line to corporate production system office* *A Brake Inc. steering group embeds the excellence initiative at the very top level of the group and its corporate divisions. The process management team makes recommendations to the Brake Inc. steering group. Additionally the process management team generates new ideas.*

Based on the instrumental understanding of an organisation, organisational structures are a tool to achieve objectives (Hill et al., 1994). Different authors provide a multiutude of organisational sub-dimensions (see Section 3.3.5; e.g. Damanpour,

1991; Daft, 1998; Germain, 1996). Thus far, the literature on sub-dimensions of organisational structure varies and there is no universal agreement on the dimensions of an organisational structure. On the dimensions of an operational excellence support unit only very little information exists. For this research centralisation, standardisation, specialisation, span of control, and hierarchical position are used to conceptualise an operational excellence support unit. "*Conceptualizations are extremely important in both natural and design science. They define the terms used when describing and thinking about tasks.*" (March & Smith, 1995, p. 256). The chosen structures and why these are chosen are explained in detail in the following.

Level of span of control. Span of control refers to the number of subordinates reporting directly to a supervisor (Vickery et al., 1999). Fundamental to the span of control concept is a mathematical principle set forth by Graicunas (1933): as the number of positions reporting to a superior increases arithmetically, the number of possible interrelationships increases geometrically (Delbecq, 1968). Proceeding from this principle, the hypothesis has been generated that *"no superior can supervise the work of more than five, or at most six, subordinates whose work interlocks"* (Urwiek, 1956, p. 34). The span of an operational excellence support unit is operationalised in the box below.

The span of control for an operational excellence support unit can be operationalised in two ways. First of all as classical understanding providing a figure how many operational excellence employees are reporting to a global (corporate) head of operational excellence on corporate level and on plant level how many employees from the plant operational excellence support unit are reporting to the local (plant) head of operational excellence. More interesting is to set the number of corporate and local operational excellence support unit employees in a ratio to the number of plants for corporate and the number of employees at a plant for local operational excellence. These two numbers are related as the number of 'customers' for the operationalexcellence support unit, meaning the plants for the global team and the number of employees for the local team. Knowing this numbers allows to compare plants and the differences of the implementation with higher or lower ratio

Hierarchical position of the operational excellence support team. There is a strong interdependence of hierarchical levels and communication channels and the degree to which vertical communication is slow, difficult, and limited versus fast, easy and abundant (Nahm et al., 2003). The hierarchical levels are named as 'number of layers in a hierarchy' and understood as the degree to which an organisation has many versus few levels of management. The greater the number of layers in the hierarchy of an organisation, the steeper the pyramid of an organisation chart. Span of control and layers of hierarchy are strongly connected and influence each other. In order to describe and discuss an operational excellence support unit the number of layers in an organisation or at a plant is important because it provides the basis to see on which hierarchical level the operational excellence support unit can be positioned. This has a high influ-

ence on the way of working for the operational excellence support team; being able to communicate fast, being able to get important information fast; having access to top management and only some to mention. In order to describe an operational excellence support unit the second organisational structure sub-dimension is hierachial position of the corporate and plant operational excellence support unit. The hierarchical position of an operational excellence support unit is operationalised in the following.

An operational excellence support unit´s hierachical position on corporate level can be described taking the C-level where the board members are placed at the highest hierchical level. Subtracting one number for each hierarchical level below the C level (board) results in a meaningful number to describe the organisational position of an operational excellence support unit. For the local team it is plant management subtracted the hierarchical level to get data about the hierarchical position on plant level.

Level of centralisation. Centralisation reflects the degree to which decisions are made higher versus lower at global organisational levels. An organisational structure is called centralised when decisions are only made at the corporate level of firms as a whole. By contrast, an organisatiol is decentralised when decision-making has been disaggregated into a number of sub-units, each making its own decisions (Nahm et al., 2003). Decentralisation allows for the interplay between a variety of perspectives and leads to a rich internal network of diverse knowledge resources. More operational excellence relevant insights are shown in the box.

In the context of global manufacturing companies and based on the understanding of operational excellence as corporate initiated initiative it is important to distinguish between centralisation at different levels: the corporate (macro) level and centralisation at plant (micro) level (Adler, 2012; Aiken & Hage, 1968; Koufteros, Nahm, Cheng, & Lai, 2007). This allows to distinguish between two kinds of decisions: work-related decisions and strategic decisions (Aiken & Hage, 1968). The first refers to the amount of participation and the autonomy workers have in making decisions about their environment, e.g. the speed of the assembly line, while the second concerns ‘real’ power or the responsibility for setting strategic direction (Koufteros & Vonderembse, 1998).

Degree of standardisation. A standard is the currently best way to perform a task. Standardisation replaces occasional with general regulations in the form of a defined sequence of activities. Standards are important to achieve the comparability of processes or areas. Standardisation allows for a high degree of transparency, which enhances understanding among employees (VDI, 2015). Standardisation is strongly connected with formalisation. The degree of formalisation specifies the extent to which an organisation uses rules and procedures to prescribe behaviour (Hall, 1977; Gupta et al., 1997). Thus, formalisation specifies how and by whom tasks are to be performed. A high level of formalisation eliminates dubiety, although it also limits organisation members’ freedom of decision-making (Olivella et al., 2008).

Standardisation is the basis for any continuous improvement activity. Standardisation applies for processes as well as documents and roles. Process orientation is a key aspects of operational excellence. Standardised processes in a company can be designed with the support of an operational excellence support team and as best practice shared in an organisation. Standardised documents can e.g. include training materials for operational excellence which are used in the organisation.

Specialisation. Delbridge and Barton (2002) indicate *"there is widespread evidence that plants are appointing specialists to lead or facilitate continuous improvement"* (Delbridge & Barton, 2002, p. 689). Specialisation is a key attribute of both the operational excellence support unit on corporate and plant level. Consequently specialisation is not integrated in the conceptualisation.

Example The Machine Tool. Inc.: The support organisation has employees responsible for basic lean topic, technical operating and maintenance resources, the implementation of corporate standards on plant level, and people topics. Additionally the Machine Tool. Inc support organisation has specialists on the company´s production system elements and methods and tools as well as consultants. Both are internal resources with knowledge serving as production system facilitator. With the core production system team embedded in both production and administrative departments of each facility, every part of the company has the ability to have lean as part of the daily life. Machine Tool. Inc uses a hoshin kanri process that enables local plants to meet the corporate goals.

The four elements of an organisational structure are suggested in this dissertation as one dimension of a model to picture the organisational configuration of an operational excellence support unit; for both corporate and plant levels. The four dimensions were discussed with different operational excellence experts from the focus group and in 15 interviews. All practicioneers agreed on the suggested dimensions as useful to describe an operational exellence support unit from an organisational perspective.

4.4 The model for operational excellence support units

The knowledge gained in Section 4.2 and 4.3 is used to derive a model for an operational excellence support unit. The model can be used to describe the organisational configuration of an operational excellence support unit. The model should fulfil certain criteria that ensure trustworthiness. These criteria are credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985).

4.4.1 A model for an operational excellence support unit

Seeing the tasks and formal structure as key components of an organisation, exactly these two dimensions are considered to establish, describe and optimise a dedicated team of operational excellence specialists. March and Smith (1995) and Hevner, March, Park, and Ram (2004) distinguish artifacts between instantiation, construct, method, and model. For the research at hand the developed artifact is a model with organisational focus. The model is understood as *"... relations between construct ele-*

ments can be explicated and certain aspects of reality are abstracted (e.g., through meta models or reference models).” (Cleven, Gubler, & Huener, 2009, p. 3). For a models constructs are used to represent a real world situation of a design problem and its solution space (Simon, 1996). Constructs provide the language in which problems and solutions can be described. The architecture is developed primarly for multinational corporations *“consisting of a group of geographically dispersed and goal disparate organizations that include its headquarters and the different national subsidiaries.”*(Ghosal & Bartlett, 1991, p. 2). The model as provided in Figure 28 has three dimensions. Dimension 0 provides information on the organisational form of the operational excellence support unit. The second dimension shows the four categories in which every tasks of a corporate and local operational excellence support unit can be assigned. The third dimension and outer circle represents the four dimension of organisational structures to describe an operational excellence support unit.

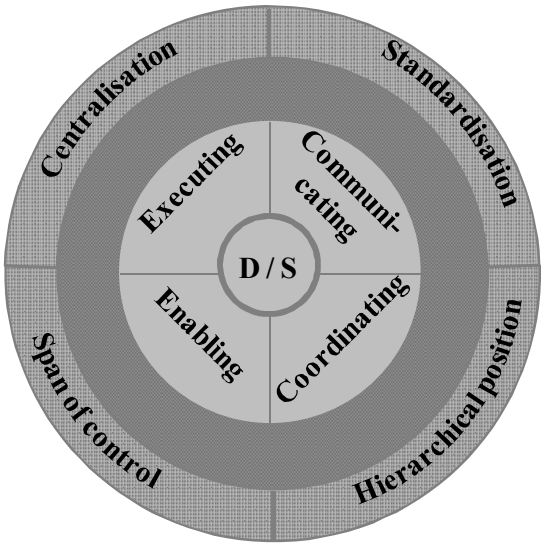


Figure 28. *The operational excellence support unit model*

Dimension 0 – Organisational form. As shown in Section 4.1 an operational excellence support unit can be designed as a staff function or as a functional department. The inner circle describes whether the operational excellence support unit is a staff team or part of a functional department; In the model ‘S’ stand for staff and ‘D’ for department. As functional department the operational excellence support unit can be a team as part of a functional department, e.g. in an industrial engineering or production.

Dimension 1 – Tasks. Tasks are a major component of an organisation and necessary to transform ideas into concrete actions and create value. Section 4.1 started with the “What tasks has an operational excellence support unit to fulfil? What are the tasks on corporate and on plant level?”. Summarising Section 4.1 and adding results of the literature research (see Section 3.6) an operational excellence support team has four ma-

jor tasks, namely communicating, coordinating, enabling, and executing. The activities provided by the practical research partner can be assigned to this four categories. Table 9 provides an overview on the activities and on which level each task is conducted.

Table 9 *Overview of tasks and categorisation according to corporate and local level*

Tasks	Task category	Corporate level	Local level
Administer database of improvement project	Execute	X	
Calculate project benefits in cooperation with controlling	Execute	X	
Coach according to kata	Enable	X	X
Conduct audits on the implementation level of operational excellence	Execute	X	(X)
Conduct benchmarkings	Execute	X	
Conduct improvement projects	Execute	X	
Conduct trainings	Enable	X	X
Conduct workshops	Execute	X	X
Consult in the implementation of operational excellence methods	Execute	X	X
Convince top management of benefits of operational excellence	Communicate	X	X
Coordinate improvement projects	Coordinate	X	X
Create questionnaire for audits	Execute	X	
Describe lean methods (e.g. for intranet as standard)	Execute	X	(X)
Describe methods of company specific production system	Execute	X	
Develop company-specific operational excellence roadmap	Execute	X	
Develop plant-specific operational excellence roadmap	Execute	(X)	X
Develop and improve company-specific production system	Execute	X	
Develop training	Enable	X	X
Establish and care about platform for best practice sharing	Execute	X	
Generate training materials and standard working sheets	Enable	X	X
Implement operational excellence elements like TPM	Execute	(X)	X
Initiate improvement projects	Execute		X
Introduce lean methods such as 5S, value stream analyses	Execute		X
Moderate operational excellence workshops on different hierarchical levels	Execute	X	X
Moderate workshop	Exceute	X	X
Marketing for operational excellence (flyer, info material…)	Communicate	X	X
Plan and post-tracking of the operational excellence competence development	Enable	X	X
Support in project management office of large projects	Execute	X	X
Report to top management on metrics (quality, maturity level of lean / six sigma initiative)	Execute	X	X
Support in project execution to ensure quality of projects	Execute	X	X
Support in the application of the method on plant level	Execute		X
Train management team (e.g. management greenbelt)	Enable	X	
Train shop floor employees in different lean method	Enable		X
Work on standards	Enable	X	X
Write handbooks for communication purpose	Communicate	X	

The tasks as provided in Table 9 were discussed with different operational excellence experts in practice via interviews. Nearly all practicioneers agreed and at the end only some company-specific characteristics could be found (see Table 9: these are marked with (X) e.g. at TPM implementation for corporate level; in this case no local team was established and in consequence the corporate team supported in these activities). The four categories execution, communication, enabling, and coordination were introduced to the focus group. The focus group participants agreed on these four and provided content for these categories which could be seen live at two plant tours.

Dimension 2 – Organisational structure. Four organisational structure dimensions are presented in this thesis (see Section 4.3). These are centralisation, standardisation, span of control, and hierarchical position of an operational excellence support unit. The data from the cases were used to operationalise these four dimensions.

Operationalisation of span of control
The following two data sets can be used as measurement items for span of control. 1) Corporate and local span of control for operational excellence support unit Corporate (global): 1 – 10 employees reporting directly to the global head of operational excellence Plant (local): between 1 – 10 employees reporting directly to the local operational excellence head 2) Ratios For corporate: Number of corporate operational excellence support employees/ Number of plant For plant: Number of plant A operational excellence support employees/ Number of plant A FTEs Based on the data provided in the cases the ratio can be visualised on a tension line. On the left side is a high ratio of 1 operational excellence specialist/ 5 plants (global) respective 50 plant FTE is placed while on the right site is 1 operational excellence FTE/ 20 plants (global) or 500 plant FTE.

Operationalisation of hierachical position of the operational excellence support team
The following two data sets can be used as measurement item for hierachical position of the operational excellence support team: As many operational excellence support units are postioned as staff unit we take for a staff unit -0.5. For corporate level we take C level minus the number of layers at which the operational excellence support unit is positioned. Fors example C-3c means that the corporate operational excellence support unit is positioned three levels under the board. PM-2p mean that the plant operational excellence support team is placed two hierarchical levels under the plant manager.

Operationalisation of centralisation
The following two questions can be used as measurement item for centralisation: 1) Corporate level: The extent to which strategic decisions are made at relatively high levels in the organisation 2) Plant level: The extent to which work-related decisions are made at relatively low levels in the organisation These two questions can be answered using a scale from 0 (decentral) to 5 (central).

Operationalisation of standardisation
The following four questions can be used as measurement item for standardisation: 1) What is the degree to which goals for operational excellence are explicitly formulated and standardised? 2) What is the degree to which processes for operational excellence are explicitly formulated and standardised? 3) What is the degree to which roles for operational excellence are explicitly formulated and standardised? 4) What is the degree to which documents for operational excellence are explicitly formulated and standardised? These four questions can be answered using a scale from 0 (no standard) to 5 (high standard).

By making the task and organisational set-up of an operational excellence support unit discussable and providing a common language on the topic, the model supports the institutionalisation of the term operational excellence support unit. *"Institutionalization is a process. It is something that happens to an organisation over time (...). In what is perhaps its most significant meaning, "to institutionalize" is to infuse with value beyond the technical requirements of the task at hand"* (Selznich, 1957, pp. 16-17). Following these remarks, this chapter helped to institutionalise the term operational excellence support unit. An operational excellence support unit supports the corporate and plant management in every task related to the conception, design, implementation, and ongoing maintenance of the elements of operational excellence, like TPM, TQM, and JIT based on the St.Gallen operational excellence understanding.

4.4.2 Application of the model

The model serves as a 'tool' to encourage conceptual and systematic thinking and talking about an operational excellence support unit on corporate and plant levels. The model can be applied in different ways in practice as shown in Figure 29.

Discussing an operational excellence support unit. The model helps operations managers to discuss organisational aspects of an operational excellence intiative. The dimension 'tasks' helps to see from a managerial perspective if the operational excellence support team is working on the right topics and if the activities are performed in the right functional scope. For example, the model can be used to compare the organisaztional configuration of severa operational excellence support units in a production network. Taking on the visualisation of the 'model' for each plant and corporate level provides an overview of the different status quo of the plants in a visual way. The model can graphically be enlarged by four lines (one for each task) and a scale from 0 to 100% in order to estimate to which extent each task is performed. The sum of the

estimation should result in 100%, representing the work load of an operational excellence support team assigned to tasks.

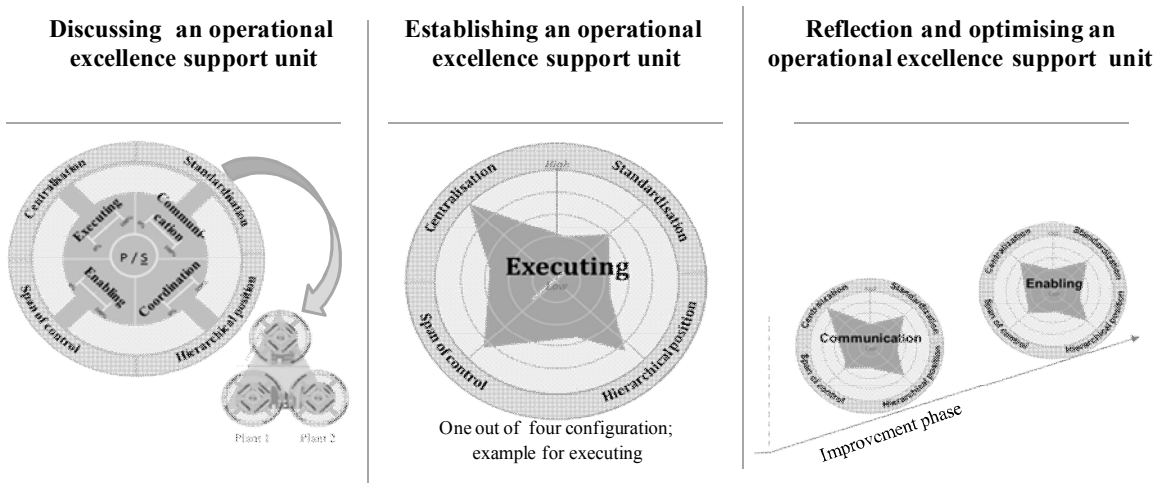


Figure 29. Application of the operational excellence support unit model

Establishing an operational excellence support unit. Once operations managers and the top management team as well as a plant leader and the plant management team decided to establish a dedicated operational excellence team, the model helps to consider different design dimensions. In this thesis an organisational structure for an operational excellence support unit has four dimensions; some of them affect the described tasks of an operational excellence support unit positively and specific tasks of the operational excellence support unit can be performed in a best way under selected characteristics of the organisational structure. Consequently, the model can be used to find suitable organisational configurations for specific tasks of an operational excellence support unit. Therefore the model is graphically adapted and the operationalised dimensions can be used as 'spider diagrams'. Filling out the specification of each of the four dimensions purposefully allows to compare different specifications for different tasks as well as to compare different plants. This can for example look like the second picture in Figure 29. In order to achieve that execution can be performed in a best possible way, the selection and choice of dimensions according to the following specification can help: high standardisation, high centralisation, high span of control, and high number of hierarchical position to perform the task execution in a best possible way. For enabling, the level of centralisation can be low, standardisation should be high, the span of control also and the hierarchical position can be on middle level. For communication centralisation should be high, standardisation on a middle level, the hierachical position rather high, and the span of control below middle. For coordination, the centralisation level should be high, standardisation middle level, the hierarchical level high, and the span of control middle.These configurations are conceptual ideas and only discussed with some practicioneers, but provide a starting point.

Reflection and optimising an operational excellence support unit. As seen in Chapter 4.1 many companies already established an operational excellence support unit on different organisational levels. Some of them are historically grown; the model helps to reflect if the dedicated team developed in the right direction but also provided levers to improve. Is the operational excellence support team on the right hierrchical levels? Are enough or even to many people working in the dedicated team? Is the level of centralisation too high and may be a pull from the plant a desired state for a corporate operational excellence support team. Using the operationalisation items for the four organisational sub-dimensions (see Section 4.4.1) the model can serve to reflect on and optimise an operational excellence organisation.

The practical application of the model in the pharmceutical industry is shown in Chapter 5.

4.5 Summary

In this chapter an artefact in form of a model of an operational excellence support unit is introduced. The model has strong exploratory and descriptive character as so far no model in literature is known which serves the purpose to describe an operational excellence support unit from an organisational perspective. The general underlying assumption is that *"organisational structures provide the framework for a social-operational-control system, influencing greatly individual and group behaviour"* (Avdelidou-Fischer, 2006, p. 173).

The model development is case study and literature based. Based on illustrative cases the operational excellence support unit in practice is described. The phenomenon of an operational excellence support unit in practice is named differently; lean office, kaizen office, production system office. Based on this introduction the operational excellence support unit is conceptualised as a multi-dimensional framework encompassing a functional and an organisational construct. Exisiting research is extended as Anand et al. (2009) already said that "c*ontinuous improvement initiatives consist of two broad areas of action required for sustained improvements, namely the execution and the coordination of process improvements projects"* (p. 446). The functional construct represents the tasks which are enabling, executing, communication, and coordination. The organisational construct is conceptualised using dimensions to describe the organisational structure of an operational excellence support unit. These dimensions are standardisation, centralisation, span of control of the operational excellence support unit, and hierarchical position of the operational support unit on corporate and site levels. The level of specialisation is taken as given and high as the operational excellence

support team needs to be highly specialised. For this conceptualisation information from the ten cases is used and discussions with the focus group provided insights and verification of the chosen dimensions. Additonally, theoretical knowledge from the literature analysis was used. This results in a body of knowledge with practical relevance enriched with theoretical knowledge underpinned by the introduced theories. The functional construct answers the RQ b) What functions should an intra-organisational operational excellence support unit have to fulfil?; The organisational construct gives insight on RQ c) How are intra-organisational structural mechanisms shaped to support continuous improvement?.

5 From theory to practice – case studies in the pharmaceutical industry

Knowing is not enough;
we must apply.
Willing is not enough;
we must do.
Johann Wolfgang von Goethe

This chapter provides an empirical description of operational excellence organisational support units in the pharmaceutical industry. The term 'empirical' means *"knowledge based on real world observation or experiments, is used here to describe field-based research which uses data gathered from naturally occurring situations or experiments"* (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990, p. 251). The chapter begins with an introduction to the pharmaceutical industry, the application of operational excellence to this industry and an extract from the St.Gallen operational excellence database. This leads to a presentation of the cases themselves following a short introduction to case study methodology and the methods used for data collection. The cases serve to 1) test the application of the developed model in pharmaceutical practice, 2) test whether the model does indeed capture the practical reality of the situation and, finally, 3) test if the organisational set-ups are possible in practice, by addressing the applicability and utility of the management model. The empirical context for all cases is the pharmaceutical industry. The chapter closes with a cross case analysis and an evaluation of the model.

5.1 The pharmaceutical industry

The pharmaceutical industry is responsible for the development, production, and marketing of medications. Thus, it has immense importance for society worldwide. The IMS Institute for Healthcare Informatics predicted that in 2014, greater access to medicines by the world's rapidly expanding middle class, together with stronger economic prospects in developed nations, should bring total spending on medicines to the one trillion U.S. dollars and to 1.2 trillion U.S. dollars by 2017 (IMS Health, 2015). Figure 30 depicts the worldwide revenue of the pharmaceutical market between 2001 and 2013. In 2001, worldwide revenue was around 390.2 billion U.S. dollars; ten years later it was almost one trillion U.S. dollars (Statistica, 2015).

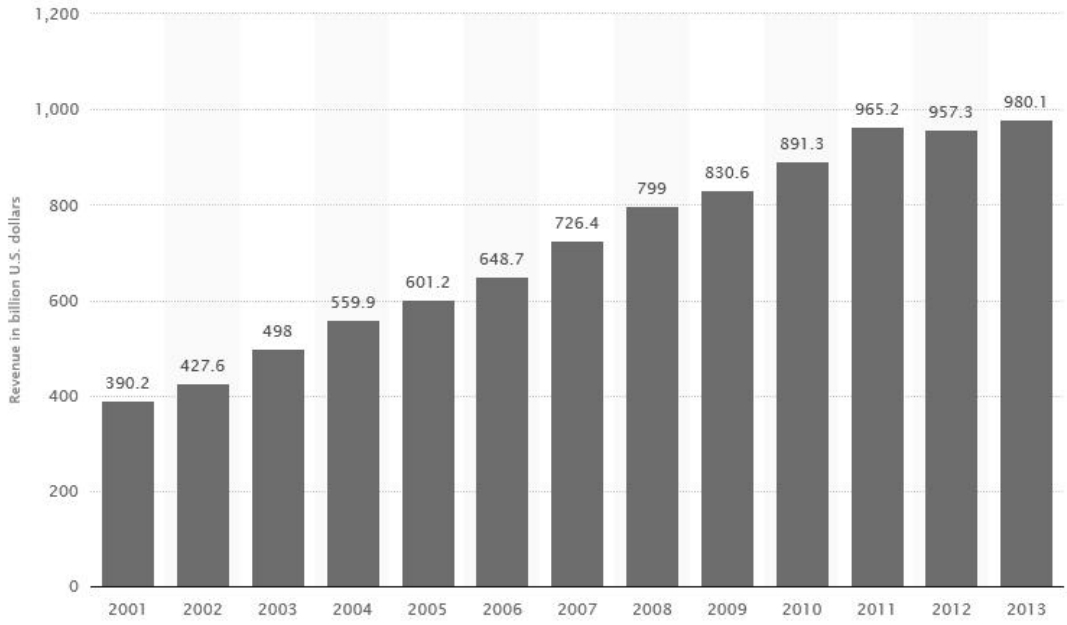


Figure 30. Development of the worldwide pharmaceutical industry (Statistica, 2015)

In comparison to other goods, the production of pharmaceuticals is highly regulated by national and international laws, regulations, guidelines, and recommended practice. Besides national regulation agencies such as the U.S. Food and Drug Administration, the pharmaceutical industry orientates its activities according to GMP guidelines. GMP represents the commitment of drug manufacturers to produce proper, hygienic, well-documented and strictly controlled drugs. The purpose of GMP is to provide a standard for drug manufacturing and fulfil basic global quality requirements (Fischer & Breitenbach, 2010). The tasks of operations employees are therefore highly influenced by manufacturing instructions, which are themselves subject to regular reviews so as to ensure the validation of the production process. Technically the pharmaceutical industry is highly complex due to different operational processes. Qualifying design, installation, operational and performance qualification is meant to achieve quality requirements right from the beginning of product and process development (Fischer & Breitenbach, 2010).

The pharmaceutical manufacturing landscape has changed notably over the past: *"As pharmaceutical manufacturing evolves from an art to a science and engineering based activity, application of this enhanced science and engineering knowledge in regulatory decision-making, establishment of specifications, and evaluation of manufacturing processes should improve the efficiency and effectiveness of both manufacturing and regulatory decision-making"* (Food and Drug Administration, 2004). Pharmaceutical companies face rising pressures of cost, the end of blockbuster business, and the productivity crisis in pharmaceutical research & development in combination with a push from regulatory authorities. In consequence, pharmaceutical manu-

facturing companies have begun to implement certain new principles, methods, and tools to increase efficiency, all primarily under the umbrella of operational excellence. Compared to other industries, the pharmaceutical industry was rather late to start programmes to increase operational excellence and strive for continuous improvement. First implemented only ten years ago, the history of operational excellence in the pharmaceutical industry is relatively short and by the late 1990s, only a few actions of rather limited scope had been taken. The first phase was the 'Pre-operational excellence' phase, which lasted until the late 1990s, followed by a 'Best-practice transfer' phase, which gave way to today's 'Transformation' phase. Looking ahead, it seems it will soon be possible to add a fourth phase to this: an 'Integrated operations systems' phase (Friedli et al., 2010). According to Friedli et al. (2013), some of today's pharmaceutical companies are already on the threshold of entering this fourth phase. Indeed, increasing numbers of pharmaceutical companies have begun to report success stories on their way towards unlocking the potential of operational excellence, and it can be said with a fair degree of certainty that the pharmaceutical industry has invested a great deal of time and resources in developing some of the most sophisticated operational excellence management frameworks across all industries.

5.2 Extract from the St.Gallen operational excellence data base

Research on operational excellence in the pharmaceutical industry has been conducted at the Chair of Production Management at the University of St.Gallen for more than ten years. The starting point was the appointment of the International Association for Pharmaceutical Technology as collaboration partner and the work of Kickuth (2006). Research activities and practice projects have been conducted with manifold pharmaceutical companies from that time until today.

Since 2004, the Department of Technology Management at the University of St.Gallen has performed an on-going operational excellence benchmarking in the pharmaceutical industry. These powerful databases currently consist of 290 datasets from pharmaceutical sites from over 120 different companies. The St.Gallen operational excellence model (ref. Section 3.3) serves as a guiding framework. The questionnaire consists of the already introduced technical and social subsystems and is framed by structural as well as cost factors. Beside KPIs which are assigned to the different sub-elements, the focus is set on enablers at the implementation of manufacturing practices. Between 2004 and 2015 the data has been collected via an Excel-based questionnaire. This questionnaire had already been used previously in the dissertation of Kickuth (2006), and items as well as KPIs have been validated with the on-going application. The operational excellence benchmarking helps to assess scientifically the

status quo of operational excellence implementation and its effect on operational performance in the pharmaceutical industry. In the present thesis the KPIs from the effective management system sub element in the St.Gallen operational excellence model are relevant, as they show data such as span of control, hierarchical levels, and suggestion quality as well as quantity. Table 10 lists these KPIs and their definition as used in the questionnaire for St.Gallen operational excellence benchmarking.

Table 10 *St.Gallen operational excellence KPIs (own illustration based on St.Gallen Operational excellence benchmarking questionnaire)*

KPI	Definition	Unit
Management layers	Number of management levels between production workers and the highest ranking manager at the site (e.g. Worker - Supervisor - Manager of the department - Site-leader = 4 Levels).	Number
Span of control	The average number of employees directly reporting to supervisors.	Number
Group work	Percentage of production workers that are organized in self directed teams in terms of e.g. holiday planning and team meetings.	%
Functional integration	Number of production workers that are qualified to work on 3 or more technologies/functional areas as a percentage of all workers.	%
Suggestions (Quantity)	Average number of suggestions per employee in the last year.	Number
Suggestions (Quality)	Estimated total savings per year due to suggestions that were implemented.	thousand
Employee turnover	Employees leaving per year your site due to terminations, expired work contracts, retirements etc. as a percentage of all employees.	%
Sick leave	Total time of employees absent (e.g. sick leave) as a percentage of the total working time.	%
Overtime	Hours worked in paid overtime (excludes the overtime which is compensated with free time) in the last year as a percentage of the overall working time.	%
Training	Number of training days per employee (all kinds of training off- and on the job) in the last year.	Days
Level of qualification	Number of workers **with** prior work related qualification/education as a percentage of the total number of workers at your site.	%
Level of safety	Reportable incidents due to accidents and safety on average per month that are internally (on site) reported	Number per month

The current research uses the existing data set to acquire an overview as to how the management layers, span of control, suggestions (quantity and quality) developed at a pharmaceutical site over time. This helps in providing a better understanding of the effects of operational excellence at the on-site level. Therefore the data set was reviewed and only sufficient data sets were used. In addition, for the research emerging market (Kenya, South Africa, India, and China) data were excluded, ultimately resulting in the use of 275 data sets out of the full 290. Table 11 depicts the general development; in general, it can be seen that the span of control increased.

Table 11 *Extract of the St.Gallen operational excellence database (own illustration)*

	Unit	2005 - 2009 (n= 89)	2010 - 2014 (n=83)
Management layers	Number.	4,36	4,69
Management span of control	Number.	10,59	13,60
Group work	%	52,95%	29,77%
Functional integration	%	44,65%	54,89%
Suggestions (Quantity)	Number.	0,56	20,30
Suggestions (Quality)	thousand	245,26	617,87
Employee turnover	%	7,36%	6,88%
Sick leave	%	4,56%	4,01%
Overtime	days	n/a	0,07
Training	days	5,64	8,00
Level of qualification	%	86,41%	74,98%
Level of safety	Incidents per month	8,99	1,18
		2005 - 2009	2010 - 2014
Overall numbers of FTE	**Av number of FTEs per plants**	**295,79**	**302,58**

The number of hierarchy levels at a pharmaceutical production plant is, on average, four for the time between 2005 and 2009 and five for the period from 2010-2014. Looking at these data it needs to be considered that the data sample from 2010-2014 has on average 303 FTE while the sample from 2005-2009 has 296 FTE on average. Nevertheless, it is possible to conclude that the number of levels is not reduced over time or, in other words: the pyramid of a pharmaceutical production plant did not become flatter. The span of control can also not be said to have increased significantly in the two time periods, this being a span of control of 11 in the period of 2005 to 2009, and 14 between 2010 and 2014. More significant is the increase of suggestions as regards quality and quantity. Here it can be inferred that the awareness and importance of employee suggestion is indeed on the increase. This is a positive fact and demonstrates the higher relevance of employee involvement and participation in improvement initiatives. In effect, one can conclude that this is an indicator towards an operational excellence culture as people appear to be thinking not only about working in their processes, but also rethinking current standards and improving their processes. Another increasing figure relates to the number of training days. This figure was shown to increase by 33% from six days in 2005-2009 to eight days in the period of 2010-2014. This certainly emphasizes the higher importance of training; however from the figure it is not possible to ascertain whether these two days were spent in operational excellence training.

In saying all of this one difficulty still remains: the data do have limitations in describing an organisational operational excellence support unit. Consequently, it is important to set a focus on qualitative data in the next section, which presents results of conducted interviews, workshops, and plant tours in the case studies.

5.3 Case studies

Before beginning with the cases themselves, it is first necessary to describe the methodology, case and data selection. This is of particular importance in light of the fact that case studies generally *"lack details in how the study is framed and how the analysis is conducted (thus compromising) the basic scientific mode of inquiry that would call for transparency (...)."* (Barratt, Choi, & Li, 2011, p. 339).

5.3.1 Methodology

Remembering that the research has an explorative character helps to both systematically organise an operational excellence support unit as well as dealing with the RQ 'How should an operational excellence support unit in the pharmaceutical industry be designed to support continuous improvement?' Following Yin (1984), one reason that the case methodology fits both the research at hand and its question is that *"case study research has been recognised as being particularly good for examining the how and why questions"* (Yin, 1984, p xx). A second reason is that the cases help in better understanding the dynamics within specific settings and, in particular relation to the current study, the operational excellence support unit can be studied in its natural setting (Eisenhardt, 1989). These facts lead to the conclusion that the chosen methodology is especially suited to the RQ: *"a case study is a history of a past or current phenomenon, drawn from multiple sources of evidence. It can include data from direct observation and systematic interviewing as well as from public and private archives"* (Voss, Tsikriktsis, & Frohlich, 2002, p. 197). Indeed according to Voss et al. (2002), a further objective is to fulfil the criteria for scientific progress as a result of the improved understanding of the research problem. This allows for better management of the reality (Kubicek, 1977).

Of particular importance is the use of a systematic procedure to make the most of the existing data and conducting case research presents a wide set of options in this instance. Such procedures include how many cases are to be used, the case selection and case sampling (Voss et al., 2002). Thereby case studies combine different data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative or quantitative or both (Eisenhardt, 1989). Case selection, sampling and data collection in the present thesis are described in the following.

5.3.2 Case selection and case sampling

The research follows a multiple case design with a single unit of analysis, the operational excellence support unit on a corporate or plant level respectively. The presented

cases are enriched with retrospective and longitudinal aspects. The choice whether to use retrospective or current cases is an artificial distinction as both current and past information is included (Voss et al., 2002). The cases focus on corporate operational excellence programmes of pharmaceutical companies with the dedicated operational excellence team. Different possible connections between the corporate and plant level are shown in the case study to address the expression of an operational excellence structure. The case studies are chosen on data access and different context factors, such as the size of the company and age of the operational excellence activities. Choosing multiple cases allows for greater generalisability of any conclusions and avoids an observer bias. The selection of the cases is grounded on the following criteria:

1) First, multinational companies operating within the pharmaceutical industry are selected.
2) Second, the companies are headquartered in the U.S., Europe and Japan: this makes it possible to demonstrate the application of the model in different environments in the pharmaceutical industry.
3) Third, organisations operating in different business models with different organisational sizes are shown: a different focus is set in terms of business types in the pharmaceutical industry that is from an R&D focus to generic business. The size here varies from some thousand FTE to over 20,000. This helps to reduce any sampling bias associated with size.
4) Fourth, companies are chosen based on their different operational excellence experiences in terms of time from ten to one years since the official start of the corporate operational excellence initiative. This describes the application of the model at different time periods and applications on both corporate and plant level. As the thesis investigates an issue that is neither well known nor evident for operational excellence, it is important that the selection comprises two companies with experience and long histories in operational excellence. Another company's operational excellence history is relatively short; in this context the application of the model is shown. All pharmaceutical companies were chosen based on the selection from the St.Gallen operational excellence database between 2013 and 2014.
5) Fifth, one plant has a strong centralized structure and two with decentralized structures. This allows for testing the model on both the plant and headquarters level. Table 12 presents a general overview on the case companies.

Table 12 *Case overview*

	Employees	Head-quar-ters	Number of plants	Started corporate operational excellence	Established operational excellence support unit	Central operational excellence support team	Plant opera-tional excellence support team
Gx Pharma Inc.	26000	Germany	36	2013	Yes	Yes	Yes
Speciality Inc.	2000	Switzer-land	3	2014	Yes	No	Partially
R&D Asia Inc.	30000	Japan	13	2008	Yes	Yes	Yes

5.3.3 Data collection

Empirical data were collected between 2013 and 2015 with the objective of generating an in-depth insight. Following Voss et al. (2002), field data collection was performed via triangulation consisting of the use and combination of different methods to study the same topic including questionnaires, interviews, content analysis of documents, direct observations, and archival research. In the present thesis the focus was placed on semi-structured interviews which were repeated with various people in the organisation. The data analysis was carried out simultaneously with the data collection. This procedure allowed for flexible data collection influenced by an increase in understanding and knowledge due to the iterative process between the literature reviews, interviews and data analysis. Different data sources were used to avoid interviewer and respondent bias, as well as to clarify details and cross check previous answers. Voss et al. (2002) indicate: *"Field research with case studies is an iterative approach, which frequently involves multiple methods of data collection, multiple researchers and an evolution of concepts and constructs"* (p. 210). The data collection method is based on historical document analysis, interviews (on and off-plant), and surveys as indicated as follows.

Historical documents. *"If historical data are being collected, rather than real-time observation, it is important to use multiple sources and crosscheck carefully before attributing cause and effect. It can be very helpful to construct a timeline of key events being studied"* (Voss et al., 2002, p. 210). Information from previous work addressing operational excellence enriches the cases. In addition, presentations of the case companies provided sharpened understanding of each respective case.

Interviews. The guideline was designed based on practical and research relevance. The interviews were conducted based on a semi-structured interview guideline. The questions were prepared in advance and address the operational excellence support unit.

Some questions followed a standard format to allow for a certain degree of comparison between interviewees. These questions were latest and approved scientific items and derived from literature. For the four design variables of the model, items from the following authors were borrowed:

- for formalization and standardisation items based on Nahm et al. (2003),
- for the number of hierarchies and hierarchy factors items based on Kim (2007) and Koufteros et al. (2007),
- for centralisation factors based on Kim (2007), Nahm et al. (2003), and Karlsson & Ahlström (1996).

Some of the questions were developed out of the interview. Overall, the same questions were asked to a number of people to enhance the reliability of the gathered data. The interviews were recorded and accurate minutes were taken. Where possible, the minutes were sent back to the interviewee or project partner for checking and their feedback was added. Interviews were conducted at multiple levels ranging from corporate operational excellence management to plant top, middle management, and front-line workers. A case research protocol was piloted in initial interviews within organisation from other industries.

Plant tours. In the three cases at least one off-site event was conducted. This took place either at headquarters or at least at one of the plants. To augment the on-plant interviews, tours of the manufacturing facility were arranged. These tours allowed for a visual check and comparison of each firm's efforts in areas such as the implementation of the operational excellence method as well as the application of tools, and level of technology relative to others in the industry.

Survey. All of the companies introduced in the cases participated in the St.Gallen operational excellence benchmarking. The relevant data were used partially for the cases. The questions were asked according the field TPM, TQM, JIT, EMS, and structural as well as cost data (see Friedli et al., 2013, p. 488-512). The current research included only data from the EMS section, in particular: number of layers, span of control, quality and quantity of suggestions. The data refer to a single plant, but help to analyse the operational excellence application in the specific company.

5.3.4 Cases on operational excellence support unit

This section presents the three cases. The names and data of the case studies have been changed due to compliance reasons. The definition of operational excellence is broad enough that all three companies have a similar understanding, which in turn matches

the operational excellence understanding of St.Gallen despite implementation differences at the three companies.

Case 1: Gx Pharma Inc.

Company profile. Gx Pharma Inc. is a leading generic company. The company is among the top 10 generic companies worldwide and offers a wide range of different products that are not protected by patents. In addition to strong organic growth, Gx Pharma Inc. has made some acquisitions including in Slovenia, Germany, and the U.S. The company employs over 25,000 people worldwide and has sales of around nine billion U.S. dollars. It should be noted that Gx Pharma Inc. is the division of Pharmaceutical Group Inc..

Gx Pharma Inc. is organised in matrix form and has approximately 30 plants worldwide. The company offers different products from solids and steriles to creams. A closer look at the organisational chart makes it clear that, on a meta-level, the matrix organisation is organised along its products. However as a result of its history, growing markets and acquisitions the network is also arranged according to technology, meaning active pharmaceutical ingredients, bio, solids, steriles, and special technologies as well as along regional lines in the form of divisions namely U.S. & South America, Europe & India and plants with a focus on regional access in emerging markets in particular (see Figure 31).

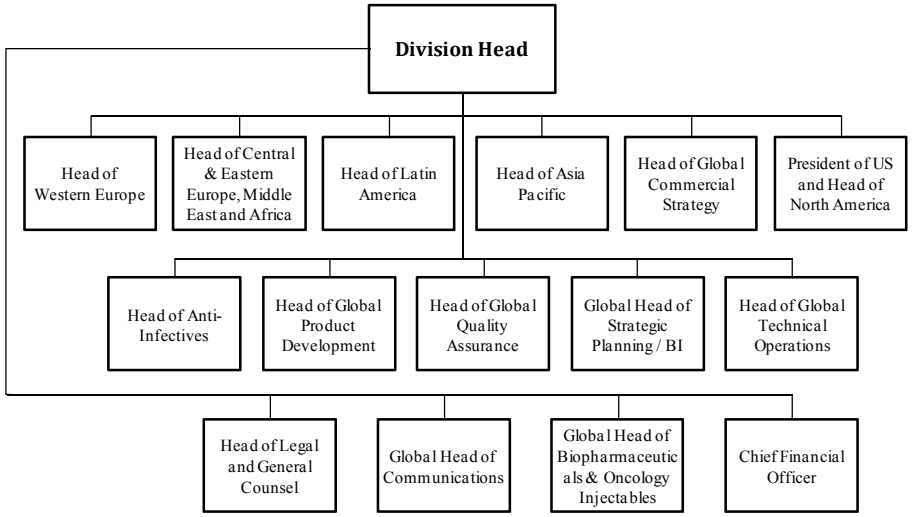


Figure 31. Organisational chart of Gx Pharma Inc.

Company specific operational excellence initiative (in general). Pharmaceutical Inc. launched an operational excellence programme at the beginning of the 2000s to create, deliver and improve value for customers. This initiative provides governance that, in particular, encompasses lean six sigma with its different methodologies and tools. The Pharmaceutical Inc. improvement initiative is based in the OpsTech department. The

operational excellence initiative is expressed in a productivity, quality & innovation programme which is a companywide initiative for Pharmaceutical Inc. The productivity, quality & innovation programme constitutes of lean manufacturing with a strong focus on lean six sigma, orientated process organisation, and business process reengineering. In 2012, Gx Pharma Inc. launched a corporate operational excellence initiative described in detail below.

The rising importance of operational excellence for the company is reflected in similarly rising cost pressures, which is also why operational excellence is a part of the Gx Pharma Inc. strategy. Further reasons for starting a corporate operational excellence initiative included the continuous improvement of operational processes, competitive pressure, quality improvement, and initiating a cultural change for continuous improvement. The main barriers were a lack of operational excellence structures and either no or insufficient understanding of operational excellence throughout the company as well as different maturity levels of manufacturing plants.

Launch Phase. Similar to other companies, Gx Pharma Inc. plants began with their own improvement activities before the start of the corporate operational excellence initiative. Plant leaders gave the responsibility to motivated people to improve the current bottlenecks with well-known lean and process management methods and tools. Gx Pharma Inc. rolled out its own operational excellence initiative, which for the most part was independent of the Pharmaceutical Inc. operational excellence initiative in 2012 as there were no company specific Gx production systems.

Organisational set-up of the corporate operational excellence support unit. The operational excellence heads at the corporate level were assigned to the previously named regions' respective products and it was only in certain parts that operational excellence heads were actually assigned. When launching the corporate-wide operational excellence initiative, at the corporate level 1.5 operational excellence FTE forms the central operational excellence support unit at Gx Pharma Inc. In turn, at the corporate level of Gx Pharma Inc. operational excellence is based in the OpsTech department. It is the operational excellence support unit at the corporate level which most accurately describes the organisational type of Gx Pharma Inc. The organisational set-up during the launch of the operational excellence initiative is a mix of introduction between functional departments with one global resource, two regional resources for four regions and introduction through plant champions. The reasons for this were the lack of personnel resources and other organisational matters. Four employees from the production area were responsible for operational excellence during the initial phase where the initiative included only the production area. The hierarchical position of the

person in charge of operational excellence at the Gx Pharma Inc. corporate level was N-4 (being N = CEO). The hierarchical position of the person in charge of operational excellence at the plant level was N-5 or N-6. The level of centralisation was high as operational excellence relevant decisions were made at the corporate level. The level of standardisation was low as a strong focus was on conducting the project in order to save costs. Each cluster or product sub-division has a dedicated network manager also with the aim of having a head of operational excellence for each division.

Functions of the corporate operational excellence support unit. The operational excellence global head is part of the OpsTech leadership team and is responsible for developing the strategies, the talent pipeline to achieve continuous quality and productivity improvements in alignment with global initiatives. This is achieved first by implementing the methodology and tools to support regional/plant objectives and then driving the strategy across 'OpsTech active pharmaceutical ingredients' including the support functions. Initially the role is centred on building a strong team across plants that is capable of identifying and driving Continuous Improvement projects and processes so as to ensure that continuous improvement is an integral part of the business unit. The main corporate method, lean six sigma was conducted in a row of different certification programmes. A project list with the main KPIs has been used to track the success of operational excellence since the start in 2012. The focus is on cost optimization of plant period costs (target in $) and % of plants with lean six sigma trained resources. At the plant level, a productivity, quality & innovation programme specialist was based in the plants to work on lean six sigma. Gx Pharma Inc. chose a selected role, starting with two plants followed by another two and so on. Continuous improvement managers are responsible for the execution of continuous improvement projects in the area of OpTech. The reporting systems are strongly structured and aligned with the project list. These data were gathered from the corporate level, which were selected and controlled and aligned with the set targets.

Zoom in one division – the corporate organisational set-up. The sterile and special technology unit consists of six plants with around 3000 employees. During the launch, the function of the central operational excellence head of the division steriles and special technology related to the manufacturing processes only. Execution was thereby the most important activity. This included working in projects and delivering the right figures. The activities followed the slogan 'No long term strategy without short term delivery'. Execution is important then, where it is clear what is to be done. This only is possible with a high coordination effort, which in this case was lacking due to focus on execution. The operational excellence project list was collected at the corporate level

and results were aligned to the set targets. This placed a high cost aspect on the first conducted operational excellence initiatives. Beside these activities the corporate travelled to the plants and conducted optimization projects.

Zoom in one division – the plant perspective. A challenging fact from a plant perspective was that operational excellence heads did not communicate from the central level as expected. Each plant received a plant operational excellence plan consisting of several projects, which in the main placed a strong focus on costs. The difficulty, however, was that no guidance was offered as to how project objectives could be achieved so the plants simply made the best use of their existing operational excellence knowledge with employees who mainly worked in other functions and performed operational excellence as an add on. With 300 FTEs, Plant A has had a dedicated operational excellence employee for one year. He is part of the plant leadership team with his duties including shop floor management participation and project execution. This operational excellence employee also participates in daily shop floor meetings at the different lines, which conclude with a wrap up by the plant leader. The Plant B operational excellence head coaches the employees in operational excellence methods and tools at all levels and ensures alignment with global initiatives. He is obliged to ensure that the correct methodology for developing the strategies is being used, just as he is responsible for training to achieve continuous quality and productivity improvements in the region. These goals are achieved by implementing the methodology and tools to support and foster an environment that enables the most efficient and effective work processes by applying continuous improvement methods. At Plant C, operational excellence activities are mostly felt in the duties of the plant leader. Here, defined KPI's had no global standard and no training on a regional level was conducted. Taking Plant D out of the six plants from the special technology and steriles sub-network it became clear that its operational excellence journey started in 2008. Prior to 2010 various improvement projects had been conducted, however operational excellence was discontinued between 2010 and 2014 due to regulatory affected quality initiatives and their high pressure on the business. Operational excellence was then re-launched at the plant in connection with the corporate initiative in 2014. Currently, the operational excellence support team at the plant consists of three persons – one operational excellence leader and two specialists. Their job is to train employees and most of their capacity centres on project execution. The operational excellence team is organised as a staff team, whereby the leader is part of the plant leadership team. Implementing a standardized global operational excellence model on a regional level is not perceived as being especially beneficial.

The maintaining phase. Two years after the start, the main task of the operational excellence department basically remains unchanged: the coaching and coordination responsibilities having grown in number due to the increased number of plants in focus (further roll out). The total number of FTEs currently dedicated to operational excellence at the corporate level has also increased to 2.5. Thus each plant at this stage now has established dedicated operational excellence functions. The total number of FTEs currently dedicated to operational excellence at the plant level is 24 while the hierarchical position of the person in charge of operational excellence at the corporate level remains unchanged at N-4. So as to give the network a new operational excellence momentum, at the initiation of the corporate level the Gx Company participated in the St.Gallen operational excellence benchmarking with their special technology and steriles. However, the lack of top management support for the operational excellence initiative roll out has led to the lack of understanding among the plants that operational excellence is a cultural change in its approach to problem solving and driving excellence, which in turn has resulted in a lack of operational excellence structures in certain regions (regional level) and many plants therefore accorded either no priority to operational excellence or treated it as short term project; similarly the lack of support from the quality department has led to underexplored opportunities in quality improvements.

Operational excellence structure. The respective director for operational excellence is part of the regional leadership. Each plant and regional manager has regional/plant objectives. At the plant level, the operational excellence head is part of the plant management team in all plants.

Reflection. Remembering that the model in Chapter 3 has two dimensions, these being the tasks of the operational excellence support unit and the organisational structure of the operational excellence unit, these do indeed appear to be relevant to discussing the organisation of an operational excellence support unit as the cases show. In the model, the tasks are divided into the categories enabling, communication, executing, and coordination. In particular, the central operational excellence unit in Gx conducts the task execution and coordination. The local operational excellence heads, on the other hand, are primarily responsible for enabling employee and execution projects. The level of coordination in the division seems to be low and only oriented towards fulfilling the requirements of the project list. The organisational structure dimensions, centralisation, standardisation, hierarchical position and span of control, seem to be useful in acquiring a better picture of the operational excellence support unit. It is necessary to know the level of centralisation so as to know where operational excellence decisions

are made. In this case rather decentralised and the site have a strong autonomy. The hierarchical position of the central operational excellence head is important to reflect organisational power and the assertiveness of operational excellence interests. The span of control describes he resources he can access well. The level of standardisation is closely linked to the level of centralisation and a necessary dimension of the model upon which to discuss the basis for a network-wide continuous improvement.

Case 2: R&D Asia Inc.

Company profile The company as it is known today was established in 2005 through the merger of two enterprises. R&D Asia Inc. has its world headquarters in Japan, with its European base located in Germany. R&D Asia Inc. does business in about 50 countries around the world. With net sales of nearly nine billion U.S. dollars in 2014, R&D Asia Inc. is one of the world's 20 leading pharmaceutical companies. R&D Asia Inc. employs almost 30,000 people, who work at ten production plants worldwide. R&D Asia Inc. is separated in different pharma and chemical divisions. The global management structure includes three functional units and seven business units, all reporting to the CEO. Business Units include four corporate entities in the regions where R&D Asia Inc. operates as well as three business organisations. One of the corporate entities in the region is R&D Asia Inc. Europe. The unit of analysis is the pharma division and its European business. The case focuses on the pharma division.

The European organisation of R&D Asia Inc. consists of several separate legal entities with two production plants in Germany and France. In the German plant pharmaceutical development, manufacturing of active pharmaceutical ingredients, bulk and finished pharmaceutical products, and pharmaceutical services take place. R&D Asia Inc. Europe's plant in Germany acts as a global plant of R&D Asia Inc. delivering products to ten Europe subsidiaries as well as the U.S. and Japan. As regards the German plant, future challenges include adapting to customer requirements in terms of packaging as well as their requirements as concerns distribution (smaller shipments to more customers). Naturally, such changes result in higher complexity while expiring patents stimulate greater cost pressure. The European region is rather autonomous as far as its operational excellence activities are concerned. The plant leader is part of the European and global management leader team. The organisational chart of TechOps of R&D Asia Inc. Europe is presented in Figure 32.

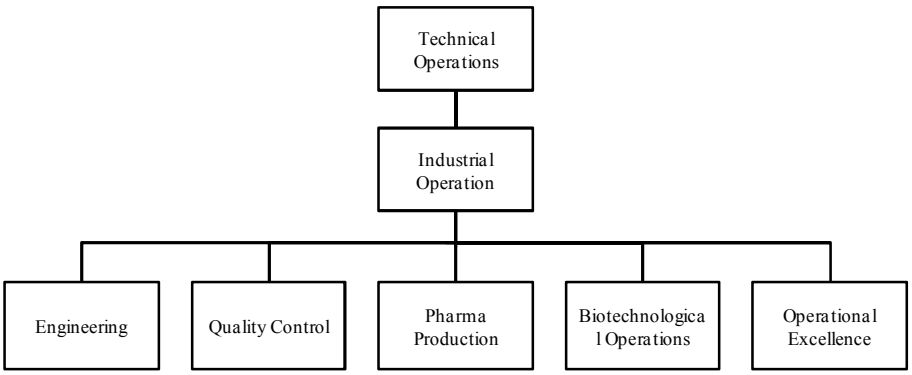


Figure 32. Organisational chart of R&D Asia Inc. Europe

Company specific operational excellence initiative (in general). operational excellence is part of the corporate strategy of R&D Asia Inc. and started as a corporate initiative in 2008. The most important reasons behind the efforts made toward operational excellence included continuous improvement of operational processes, cost pressure, competitive pressure, efficiency increase, reducing lead times and inventories. Beside the monetary aspects a particular focus was set on the development of employees and long-term thinking behind the activities, which is where the Asian culture comes into play. Indeed, an additional reason for operational excellence was to initiate a cultural change for continuous improvement followed by increased cost awareness, increased employee involvement, increased employee empowerment, the reduction of lead times and inventory, and a change in the quality focus from final product to process quality. The improvement initiative is strongly linked to the understanding of kaizen based on Imai (2012) and quality improvement aspects. Consequently, the corporate operational excellence initiative is labelled as kaizen and quality improvement although no specific operational excellence label or production system as an expression of the corporate improvement initiative exist.

At the corporate level an objective agreement in the form of a five years programme plan was conducted. The overall company objectives were to formulate the plan in an iterative process with different stakeholders. Within this five year plan there was no operational excellence specific agenda, however projects seen as relevant for operational excellence are indeed part of the plan. This can be kaizen reporting or inventory optimization whereby there is a special focus on cost of goods sold optimization in Europe.

Launch. The initiative was launched as a pilot project in selected plants with an Asian focus. In R&D Asia Inc. Europe, operational excellence started at the plant level in 2010. For the European plant the main barriers during the initial phase included lack of personnel resources, too little linkage to the corporate strategy, different maturity lev-

els of manufacturing plants, a missing alignment with other on-going initiatives, and either no or an insufficient understanding of operational excellence throughout the company. Top management commitment as regards the operational excellence initiative was high. During the launch no specific methodology was applied for improvement and, to date, a complete lean six sigma programme has not been implemented.

Function of the corporate operational excellence support unit. The major task of the operational excellence team during the initial phase was conducting operational excellence activities with a main focus in Japan. However the consequence of this was that the European plant fell behind in terms of operational excellence. The main activities included selecting best practices, the implementation of best practices and standards, as well as the establishment of corporate operational excellence objectives. The executing function of the corporate operational excellence department during the initial phase was very low. For example, executing operational excellence methods such as Six Sigma at the plant level was not a task of the operational excellence department. Coordinating functions of the operational excellence department during the initial phase was centred on supervising the pilot implementation process coordinated operational excellence activities in the company. Ensuring the local adaptation of the operational excellence initiative was a function of the operational excellence department. The operational excellence team functioned as a linkage between top and plant management. The operational excellence team controlled the entire implementation process. The enabling functions of the central operational excellence team during the initial phase in terms of corporate training activities were rather low. The plants followed the slogan 'where there is a bottleneck, what is the financial benefit?'

Organisational set-up of the corporate operational excellence support unit. A dedicated operational excellence support unit as a staff function inside the supply organisation has existed on a global scale in Asia right from the very beginning. The corporate quality improvement team played a major role as the initiative was launched as a quality improvement initiative based on a kaizen understanding. The kaizen and quality improvement leader directly reports to the chief executive officer. Their hierarchical position was vice president in the respective organisation, one level below the chief executive officer. The total number of FTEs dedicated to the initiative on corporate level during the initial phase was 11. The span of control at the corporate level was ten as only the ten team members had to report directly to the person in charge of operational excellence at the corporate level. As compared to other well-known activities the level of standardisation is relatively low. Standardisation activities were conducted in terms of quaöity improvement and kaizen meetings and with the network in Japan.

The standards themselves were set by the central operational excellence team. During the initial phase, the total number of FTEs dedicated to operational excellence at the plant level was 25 for 10 plants in the worldwide production network. However there was no professional or disciplinary supervision from Japan to Europe.

Operational excellence at the plant level. The commitment from the plant head and leadership as concerns operational excellence was high. Yet similar to other companies several different improvement activities were conducted on plant level before starting a corporate initiative. The different activities were based on effects and shortcomings and addressed bottlenecks or the short-term improvement of planning quality in an unstructured manner. There was no operational excellence department when launching the operational excellence initiative and a comprehensive lean or six sigma programme has still not been implemented to date. The branding of the operational excellence initiative is under the label of kaizen. The approach strictly follows the effect and deficit oriented stage model, in which the greatest shortcomings or potentials are identified and processed in projects. Based on the achieved standards this is either further improved or a new 'burning platform' project with corresponding potentials to implement. A 'suggestion scheme' started two years ago did not lead to the desired success due to the absence of a holistic approach. Thus any new approach no longer needs to concern itself with improving or perfecting the employee suggestion system but rather to focus on the new ways of thinking (right first time), a new leadership (employee-oriented management) and new ways of working (process orientation) as part of the in-plant, previously established operational excellence activities.

Organisational set-up of the plant operational excellence support unit. A formal operational excellence team has been at the plant on the German site since 2011. Tech-Ops at the German plant is arranged as a functional organisation with operational excellence integrated in the production management. The explanation for choosing this organisational type is based on historically-grown organisational reasons and enhancing the visibility of operational excellence. Today, operational excellence comprises its very own department and a hierarchy equal to the other departments such as quality or engineering. The operational excellence department has five team members responsible for different operational excellence related activities. The employees in the operational excellence team are from the production, administration and supply chain departments. In consequence, the operational excellence department primarily focuses its work on the business areas of production, supply chain, and administration. A holistic bottom-up approach is not yet in evidence, the slogan of the plant being: 'we want to specifically introduce the employee in the position to bring improvements'.

Function of the plant operational excellence support unit. The operational excellence team does not consider itself to be a specialist at the plant. The operational excellence team has low shop floor attendance of operational excellence employees and a strong focus on data with a high maturity level in business intelligence system and KPIs system. operational excellence relevant projects for the plant are either derived from a five-year plan, problem or simply from urgent needs. Currently at least, activities have become increasingly kaizen oriented based on the Japanese approach. The head of operational excellence at the site level has the application service of SAP key user to allow the business analyst to pull the right data. All activities are based on an integrative approach with controlling and a strong focus on data. Reporting exists with regular meetings including a global data warehouse, whereby there is a strong use of SAP. Information technology plays a critical role for R&D Pharma Inc. There is a strong focus on KPIs which are seen as an asset when using a Business Intelligence system. The operational excellence team at the site level has a dedicated person for IT issues.

Operational excellence structure. On a global level the exchange of operational excellence topics is once a year with an incentive event. Here, each local team presents different improvement projects derived from the five-year plans. This also involves poster sessions, discussions and workshops on different projects with various continuous improvement leaders, followed by a presentation on best practices and Q&A sessions. A trophy is awarded for the best improvement project inside the global organisation and the success is celebrated.

There is a weak connection between corporate and European plant level at the beginning of the operational excellence initiative. However increasing efforts have been made by the Japanese plant to integrate more fully and act in a network. Communication between corporate and plant level is performed with what is called a window person. This refers to a corporate person who has been in Europe for a certain length of time and has the function of a communication specialist due to poor level of English at the Asian headquarters. In principle, the company holds a board of directors meeting every month to resolve key operational execution matters. Furthermore, in order to create a management structure that can respond speedily and flexibly to changes in the business environment.

Case 3: Speciality Pharma Inc. – The plant perspective

Company profile. Speciality Pharma Inc. is an international speciality pharma company that researches, develops, produces and markets its own pharmaceutical products. In its market, Speciality Pharma Inc. has a strong market position and is among the

world leaders in its business. In 2014, the company increased net sales by 6.6 % to 700 million U.S. dollars with close to 2,000 employees. Specialty Pharma Inc. is organised in a functional form with four major products. The capabilities of the company extend from late stage development to commercial stage deals. The company is headquartered in central Europe and has three production plants in Europe, although with a network of affiliates and partners all over the world. The operations division is organised according to Figure 33 below.

In 2014 an opinion poll demonstrated room for improvement and, in general, an insufficient situation with room for improvement. With regard to the operational excellence status individual comments from the corporate survey include: "Continuous Improvement Process needs to be performed more professionally", "Lean is not consistently followed. Concepts are implemented straightforwardly with a clear objective forecast." In mid-2014 Specialty Inc.'s operational excellence journey received a new momentum however as a new chief executive officer totally committed to operational excellence joined Specialty Inc.

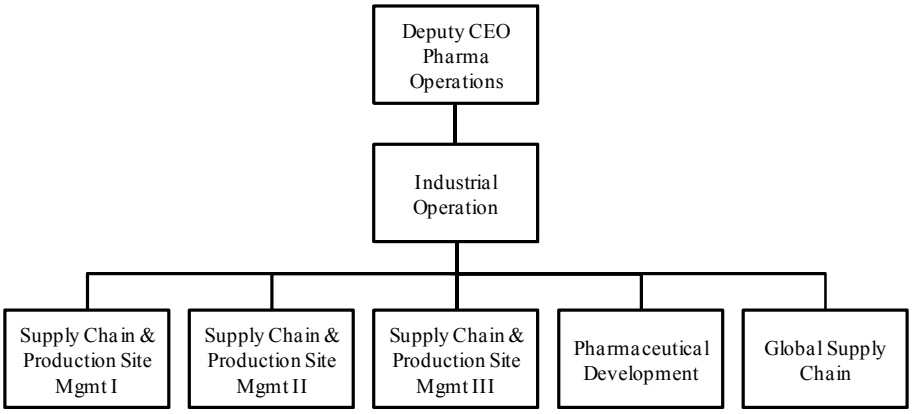


Figure 33. Organisational chart industrial operations of Specialty Inc.

Company specific operational excellence initiative (in general). The management team chose to initiate a corporate operational excellence initiative in 2013. Previous work by consultants and their request for a 'breakthrough approach' was perceived as being too complex. operational excellence at Speciality Inc. is understood as key to strengthening the existing core business and is part of the corporate strategy as the chief executive officer's objective is for the company to become more effective and efficient. He supported putting in place the appropriate structures and processes. Before the corporate initiative began, the single plants had individual operational excellence initiatives and in the previous five years the main challenges for Specialty Inc. related to doubled contracted volumes. Under the supervision of the head of industrial operations the management team launched the operational excellence initiative company-wide. The reasons for launching operational excellence included reducing lead

times, competitive pressure, and increasing efficiency. The management team was confronted with barriers for implementing operational excellence such as deficits regarding employee capabilities, non-existent or insufficient top-management support, different maturity levels of manufacturing plants, and non-existent or insufficient understanding of operational excellence throughout the company.

Launch of the operational excellence initiative. Before launching its own operational excellence initiative, the Specialty Inc. management team visited several pharma plants in Germany already in possession of an advanced operational excellence system. As a first step to overcome its insufficient understanding, Specialty Inc. conducted two days of training for the complete management team from all plants, including biotech production, export, industrial operations, logistics, manufacturing, pharmaceutical development, production, quality assurance, quality control, supply chain and technical project management.

The launch can be described as a strong employee-oriented stage model with a functional and deficit-oriented approach. In the launch phase there was no dedicated operational excellence team at the corporate level. The industrial operations head and his plant management team decided that at the beginning no central operational excellence team would be put in place to support the operational excellence launch. His statement: “we have four plants, we have four shoots” made it clear that the way forward would be to go with a decentralized approach, where all four plants independently decided what to do along their operational excellence journey. As a result the plants conducted individual activities. Plant I in Switzerland conducted a two-day operational excellence training course with the same content as in the management training course conducted some months previously. Plant II did not start with any operational excellence activities as there were no resources. Plant III conducted several operational excellence activities, however, given the presence of a different language they completed a different training course to Plant I. There was no coordinating role to align the training.

Plant I organisational set-up of the operational excellence support unit. In September 2014 the operational excellence initiative was officially launched with the announcement by the plant head of the impending operational excellence support unit at the plant conference. The structure consists of one operational excellence champion and four operational excellence ambassadors. operational excellence ambassadors are responsible for supply chain, quality control, production, administration and engineering. The five persons are not fully dedicated to operational excellence, these issues accounting for only 20% of their weekly working time. The operational excellence

champion is a new member of the plant management team and operational excellence is on the agenda in every plant leadership meeting.

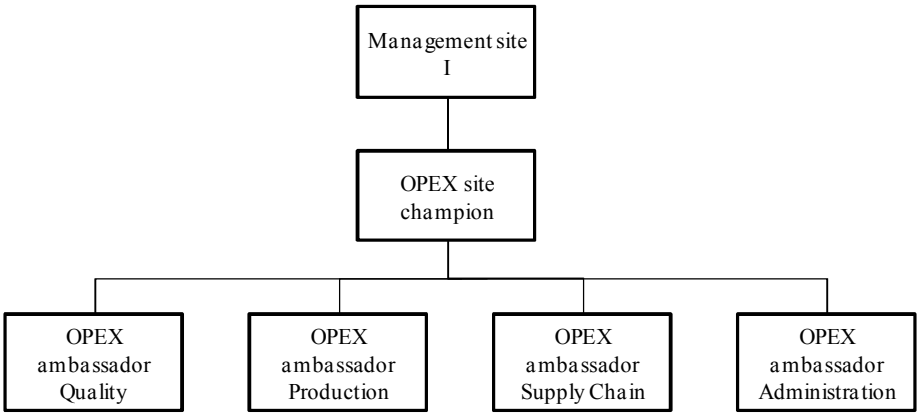


Figure 34. Operational excellence structure Plant I of Specialty Inc

The level of standardisation at the plant was high as training documents and visual management were on one scale right from the beginning. The background of the operational excellence champion is in engineering and he continues to spend 80% of his working time in engineering department. Aside from this he is on the plant committee where the plant leader and all department heads meet regularly, although it must be said that he is not on the same hierarchical level as the department heads. The operational excellence ambassadors have different roles and take on functional tasks such as the deputy head of quality, supply chain is manager supply chain processes. It can be concluded that operational excellence is present in different departments, but with only 20% of resources not fully supported.

Functions of operational excellence support unit at the plant level. In the first phase the operational excellence support unit introduced operational excellence tools and established the use of these tools. Therefore the team coordinated on-going projects. In their departments, the ambassadors worked according to 'train-the trainer' principles to establish the tools. The first point of importance as concerned the training was to identify and discuss improvement potentials. Several aspects were addressed here one of these being the eight kinds of waste. For example it has not yet been possible to receive regular KPI data on time, which leads to many reminders. Other difficulties concern the fact that responsibility assignment matrix has still not been defined, unreliable forecasts leading to overproduction, poor layout labours/offices leading to motion, unstable processes leading to waiting, a lack of job rotation resulting in an underutilization of employees, searching tools leading to motion, buffers in every production step and too much row material leading to inventory and, finally, too many in-process controls leading to over processing.

Among the tasks in the job description of the operational excellence champion is to create a consensus towards a lasting enthusiasm for operational excellence. In this sense he should plan and work towards a culture of continuous improvement via the identification of operational excellence projects, through their coordination and control up to the execution of the project. In this way, the operational excellence champion supports in the processing of projects as an operational excellence expert and provides 'best practices' and benchmarks to foster their implementation. In addition, he is tasked with specifying optimization goals and objectives as well as promoting an atmosphere of trust by creating situations and communicating success stories.

The operational excellence ambassador conducted projects in their area. For example the quality department had training courses on 5S and the eight kinds of waste. After assigning employees voluntarily, workshops were conducted to clean the storage rooms. In parallel, activities in the field of visual management were conducted in front of the laboratory. An information board on the operational excellence organisation, a picture and contact data of the operational excellence ambassador, and on-going activities were placed. In addition, pocket cards were added to the board with information on visual management and 5S. The cards were changed every four weeks and new cards with a further lean method or tool were placed on the board. In addition, communication was improved by bringing together different teams from the quality department in a weekly meeting.

Operational excellence structure in network. Regular meetings between the plant operational excellence champions and the head of industrial operations commenced in mid-2014. place a meeting held at the vision, branding and communication and a logo for the operational excellence strategy and the communication of the strategy should be defined.

Reflection. The tasks at Specialty Inc. can be categorized according to the model. This is enabled by the fact that the training of the department representatives and additional plant employees is conducted by an operational excellence plant champion under the supervision of an external operational excellence specialist with the same material as used in the management training courses at each plant. As concerns coordination category this refers to: agreement on objectives in key activities in the field of Maintenance, Industrial Operation and Quality. This links the operational excellence Initiative and the resulting projects with daily work. For the execution function this equates to a strategic level with KPI measurement with the following KPIs: safety, energy efficiency increase 5%,right first time >90%, high availability, no inspections shortcomings, reduced employee absence, higher overall equipment effectiveness, training ac-

cording to the training matrix. On the operative level the objectives include the conducting of 5S in administration and the technique department. For communication purposes, pocket cards are designed and placed on the information boards. In the first operational excellence pocket card, operational excellence goals are listed on the front. On the back is the operational excellence organisation with operational excellence plant champion is displayed, together with the operational excellence ambassadors.

5.4 Cross case analysis

The cross case analysis is conducted using analytical methods to compare observed key points of interest such as the drivers for and barriers to operational excellence as well as statistical analysis on data that is necessary to better understand the research field.

The first point of interest as regards the analysis relates to the reasons and barriers for implementing operational excellence and to see how the companies reacted to the operational excellence organisation. The existing data are organised systemically. To analyse this data, a word table presenting the narrative data was used. Table 13 below presents a comparison of different reasons for launching operational excellence, the reasons for and barriers to launching operational excellence, all compared between the case companies.

Table 13 *Cross case comparison of reasons for launching operational excellence*

	Gx Pharma Inc.	R & D Asia Inc	Speciality Inc
Rising cost pressure	x	x	x
Continuous improvement of operational proceses	x	x	
Competitive pressure	x		
Quality improvement	x		
Iniiaing a cultural change for continuous improvement	x	x	
Monetary aspects		x	
Development of people and long –term thinking			
Saving due to operational excellence projects are accounted			
Increase employee involvement		x	x
Increase employee empowerment		x	x
Reduce lead times and inventory		x	x
Efficiency increase			x

Common reasons for launching operational excellence include competitive pressure, reducing lead time and cost pressure. This leads to rather short-term activities and project bases. In addition, common reasons include the continuous improvement

of operational processes and initiating a cultural change and development of employees to long-term thinking so as to initiating a cultural change for continuous improvement. This addresses long-term activities which need to be managed and followed up so that employees do not fall back on previous routines.

Comparing the barriers to corporate operational excellence implementation, Table 14 shows that a common barrier to all three companies is non-existent or an insufficient understanding

Table 14 *Cross case comparison of barriers to launching operational excellence*

	Gx Pharma Inc.	R & D Asia Inc	Speciality Inc
Missing operational excellence structure	x	x	x
No or insufficient understanding of operational excellence	x	x	x
Different maturity level of manufacturing plants	x	x	
Lack of personal resources		x	
Too little linkage to the company strategy		x	
Missing alignment with other on-going initiatives		x	
No or insufficient understanding of operational excellence throughout the company		x	x
Deficits regarding employee capabilities			x
No or insufficient top management support			

These data align with the findings from the literature and the conducted interviews on reasons for and barriers to an operational excellence initiative. Indeed there seems to be no difference between the industries in terms of reasons and barriers.

Aside from the analytical analysis, it is necessary to conduct a statistical evaluation of the number of dedicated operational excellence employees in the different companies on corporate and plant level: *"the quantitative orientation of case research can also manifest itself in research design. In a multiple case study, for instance, one engages in cross-case analysis by explicit comparison of cases in terms of measurable characteristics"* (Ketokivi & Choi, 2014, p. 233). The cross case comparison for the presented research used a quantitative orientation in terms of comparing dedicated operational excellence FTEs at the respective corporate and plant levels. This number is set in comparison to the overall number of employees and the average plant size from the available data. The St.Gallen operational excellence database proved to be of considerable help here, as the respective operational excellence reports provides the number of FTEs on plants. Table 15 presents an overview (the data refer to 2014).

Table 15 *Cross case comparison of operational excellence FTE ratios*

		Gx Pharma Inc.						R & D Asia Inc	Speciality Pharma Inc		
Overall FTEs		26.000						30.000	2.000		
FTE in division / unit		3.000						2.000	2.000		
Sites		1	2	3	4	5	6	1	1	2	3
FTE site	Overall	223	92	1087	269	433	655	334	284	75	188
	Direct	134	38	586	112	242	238	117	126	26	46
	Indirect	65	31	385	107	129	336	184	157	48	142
Operational Excellence support unit	Corporate	3						5	0		
	Site	1	0	0	1	1	3	5	2	0	2
Ratio 1	Corp. Operational Excellence / FTEs in division	0,10 %						0,25 %	/		
Ratio 2	Site Operational Excellence / site FTEs	0,45 %	0,00 %	0,00 %	0,37 %	0,23 %	0,47 %	1,49 %	0,70 %	0,0 %	1,1 %
Ratio 3	Site Operational Excellence / Direct site FTs	0,75 &	2,63 %	0,1 %	0,89 %	0,41 %	0,42 %	4,27 %	1,58 %	0,0 %	4,4 %

In addition, this number is split into direct employees, meaning those working on product creation directly as the used definition in the operational excellence database. As Table 15 shows, the plants have different figures. The ratio of corporate operational excellence FTE to overall FTE is between 0.01%-0.02%. The ratio of Plant operational excellence FTE/Plant FTE is between 0. and 1.46% on average which means 0.5% resulting in one operational excellence FTE for 200 plant FTE (overall). This data is in accordance with the interview data of successful plants. The ratio of Plant FTE/ operational excellence/ direct FTE is between 0.75% and 4.27%.

The three different case companies are currently working in different phases on operational excellence. R&D Asia Inc. began in 2009, GX Pharma Inc. in 2011 and Speciality Pharma Inc. in 2013. Certainly, there is no significant change when taking the ratios of Plant operational excellence FTE and Plant FTE into consideration. Speciality Pharma Inc. did not change its operational excellence capacities at the plant level. Rather, it started with one FTE, and then split this to five 0.2 FTE. The plan is to increase this number to 1.8 FTE while having at least one full time and four with 0.2 FTE. Gx Pharma Inc. increased their central operational excellence capacity from 1.5 FTE to 3 FTE, whereby the plant operational excellence capacity remained at the same level or increased from zero operational excellence FTE to one operational excellence FTE.

Coming to the end of this analysis it is important to make a few remarks on the aspects already researched and the effect on the operational excellence support unit.

The age and size of an organisation both have an important effect on the organisational structure as has been shown in previous research. First of all, it seems clear that, on average, the larger the organisation, the larger the site of its department (Blau & Schoenherr, 1971). Similarly, the older and larger the organisation, a increased structuring of activities and decreased concentration of authority can be observed (Inkson, Pugh, & Hickson, 1970). When taking the operational excellence support organisation under the loophole, the cases show that an older operational excellence support unit is larger than that at the launch of an operational excellence initiative and, certainly, there is no evidence in the cases or the interviews that an operational excellence support unit decreases in size over time. However in spite of economic reasons there is no further investment in the operational excellence support unit. This appeared at the interview company Mechanical Engineering. They started their operational excellence initative in 2002. However between 2009-2011 there was no dedicated operational excellence team at the corporate level due to the crisis but given the fact that prior to 2009 the benefits of an operational excellence team had been clear, the company's top management re-launched the operational excellence team in 2012. This restart was also used to re-brand the initiative and focus on excellence.

5.5 Evaluation of the model and discussion

Evaluating the model in this context takes into account methods and criteria from other research fields. According to March and Smith (1995), "*evaluate refers to the development of criteria and the assessment of performance against those criteria"* (p. 258). In literature, for example in design science research or information systems research, there are several criteria for the assessment of artefacts such as models, constructs or methods (March & Smith, 1995).

The object of evaluation, therefore, is either an artefact or its construction process. (Cross, 2001). For the thesis at hand it is the artefact itself. How the evaluation is performed is represented by the methods used. Naturally there are various design evaluation methods such as observational, analytical, experimental, testing and descriptive methods (Hevner et al., 2004). For the research at hand observational in the form of case studies and field study are used. The in-depth business study as well as the applicability of the artefact is shown in the interviews. The cases confirm the application of the model in practice and demonstrate that reality can indeed be pictured with the model. Several interviews also show that different organisational set-ups are possible. The architecture was applied as a descriptive model and could serve as guideline for installing an operational excellence support unit at the plant level (Speciality Inc.), making operational excellence and its structures points of discussion (Gx Pharma Inc.)

and in picturing reality at the plant level with the model (R&D Pharma Inc.) For the last case the model may provide implications towards establishing a closer connection between the corporate and site level.

The model was introduced to the St.Gallen operational excellence research group meetings on a regular basis and continuously development iterative with the input from research group members, all highly experienced operational excellence managers. This knowledge helped towards understanding the research topic, but also the input, critical reflection, and confirmation of the model (see Chapter 4).

The design science community evaluates artefacts according to three dimensions, namely utility, quality, and efficacy (Hevner et al., 2004). Pfeffers et al. (2007) provide a three-step approach based on information science, namely: demonstration (find suitable context and use artefact to solve problem), evaluation (observe how effective and efficient it is) and communication (scholarly publications). For the present research the utility of the model was demonstrated in a discussion of operational excellence in the pharmaceutical industry. As interviews confirmed, the model is reproducible, however, dealing with organisations operating in different environments means a completeness of the model is difficult to achieve. As the model addresses organisation in different situations it can only display a strongly generalized picture of reality yet the subcategories have been chosen on a sufficiently broad scale that functions and organisational dimension can be discussed in practice. And the model has been published in an article in 2015.

5.6 Summary and discussion

This chapter has presented the application of the model in practice. The creation of artefacts, in this thesis a model, serves its purpose as a basis for discussing and solving real-life challenges. Thereby the model is on a high level of abstraction and it is designed to reduce the overall complexity of operational excellence support unit as well as allows the discussion of the application on different organisational levels. In order to answer the ‘how’ research question of this thesis the case study was selected as the primary research method (Yin, 1984). This method allows for high validity with practitioners and serves an explorative purpose (Voss et al., 2002). The use of the artefact was demonstrated within the cases. Thereby, the three case studies have confirmed the practical usability and functionality of the model to describe an operational excellence support unit. The model also helps to improve reality as it aids discussion and a better understanding of the design of an operational excellence support unit as well as the organisation of an operational excellence initiative.

It is first important to describe the characteristics of the pharmaceutical industry so as to better understand the chosen empirical context of the cases. Certain regulatory requirements or process validations can make changes more difficult than in other industries. Consequently, continuous improvement activities require attention. A data extract from the St.Gallen operational excellence database provides an overview on data describing the organisation of a pharmaceutical production plant. Taking into account two different time periods, there is no significant change in the KPIs despite the number of suggestions or indeed the quality of suggestions. Organisational layers and span of control related to a plant did not change.

The cases show how three different multi-national pharmaceutical companies organise their operational excellence launch and how they allocate dedicated resources at both the corporate and plant levels. The cases are based on an iterative process during the conducted research and on a different data collection: *"reliability of data will also be increased if multiple sources of data on the same phenomenon are used"* (Voss et al. 2002, p. 206). For the research at hand a multiple case study design was chosen with a single unit of analysis, with three cases in three different pharmaceutical organisations. As multiple cases cover the same issue more intensely several implications can be drawn from the analyses. Analytical and statistical analysis of the cases allowed for a certain level of generalisation as seen in the cross case analysis in Section 4.4, companies have similar reasons for and barriers to implementing an operational excellence initiative. By comparing the dedicated operational excellence FTEs a ratio of plant operational excellence FTE to overall plant FTE it could be observed which led to the conclusion of one dedicated operational excellence FTE for 150 plant FTE. This ratio is in line with data from the interviews conducted before, during and after the model design. Outside the case studies similar sequence and connection of the construct's task and organisational structure were found in several interviews with practitioners to whom the model was also introduced (see Appendix).

The evaluation showed the utility of the model. In particular, qualitative feedback from practitioners on the utility of the artefact could be shown. The demonstration of the use of the artefact with several real examples was chosen for this thesis. The in-depth business study as well as the applicability of the artefact is shown in the interviews. The approach is qualitative, the artefact's focus is on organisational, and the artefact type is a model. The usefulness in the given context, namely the pharmaceutical industry with different time periods since the start of the operational excellence initiative is given. The same can be said as concerning reliability of the studies, as their usefulness is shown in other industries meaning the model is reproducible. Due to

the characteristics of the pharmaceutical industry (see Section 5.1) performed tasks need to align with regulatory authorities like the Food and Drug Administration.

To follow Hevner et al. (2004) and Pfeffers et al. (2007), the research closes with the 'communication' of the research results. Thus with this guideline in mind the research results have been communicated in a publication in the *Zeitschrift für wirtschaftlichen Fabrikbetrieb*, Nr.05, S.302-306 with the title *"Die Organisation einer Operativen Exzellenz Initiative"*.

6 Practical recommendations for an operational excellence support unit

Coming together is a beginning;
keeping together is progress;
working together is success.
Henry Ford

Based on the conducted literature analysis (Chapter 3), the model (Chapter 4), and practical insights (Chapters 4 & 5) it is possible to derive several recommendations for managers dealing with operational excellence. This chapter begins with the introduction of a revised version of the St.Gallen operational excellence model and its underlying definition. Section 6.2 presents a reference operational excellence organisation and practical recommendations, followed by Section 6.3 with the discussion of the development of an operational excellence organisation over time. The chapter ends with a summary.

6.1 The St.Gallen operational excellence definition and model revised

The St.Gallen operational excellence model has been successfully used as artefact to discuss operational excellence on plant level (Section 3.2.3.2). But organisational aspects and a corporate perspective are missing in the actual version. The insight on an operational excellence support unit gained in this thesis close the gap from an organisational view. In this section a revised model is introduced which is derived from an original, general model. Thereby the existing St.Gallen operational excellence model is extended without removing any of its original aspects. Before discussing the revised model two new definitions are introduced: a definition of an operational excellence support unit and an operational excellence structure.

In the context of the St.Gallen operational excellence model and based on the knowledge from the conducted research in this thesis an operational excellence support unit is defined as:

> *'An operational excellence support unit is a dedicated team of specialists supporting an organisation in all operational excellence relevant activities including execution, enabling, coordination, and communication.'*

The definition is explained in detail in the following:

'*… dedicated team of specialists …*'

This research and other authors (e.g. Netland et al., 2015) show that employees working dedicated for an improvement initiative are beneficial for the implementation of an improvement program. These teams consist of specialists supporting the overall, formal organisation on different levels. Per definition operational excellence is a long term and holistic approach. Consequently, best possible operational excellence addresses the normative, strategic, and operative level of an organisation. At the normative level this engages with the cultural aspects of an organisation; addressing these aspects is necessary to make operational excellence from a long term perspective part of daily work. The strategic level is important as the necessary objectives and action plans are derived from the strategy. A key element of an operational excellence initiative is working with data; these are also KPIs and objectives which are transparent from the shop floor up to the top management and can be influenced by the respective organisational level. At the operative level, operational excellence needs to be part of daily acticities. This means that employees need to become familiar with operational excellence methods and tools and change previous routines. Learning and applying new tools on operational level is key to a sustainable operational excellence initiative.

'*…supporting an organisation in all operational excellence*…'

This emphasizes how the operational excellence team supports the organisation and empowers employees to take on responsibility so as to achieve sustainable operational excellence implementation. Empowerment can be understood as a comprehensive version of participation. It is a set of motivational techniques that are designed to improve the performance of employees through a increased levels of employee participation as well as self-determination (Vecchio, 1995). In this situation, it is important that those who are working with operational excellence on the shop floor, in the administration, or in R&D feel responsible for their activities. The operational excellence support unit is not responsible for operational excellence, but helps in the preparation and supports of all relevant activities to make operational excellence work.

'... relevant activities including execution, enabling, coordination, and communication.'

Of course, the content of different activities and extent of single actions need to be specified for each company. Similar to a company specific expression of a production system or a company specific understanding on improvement elements, the scope, and content of operational excellence activities needs to be tailored to each company's individual requirements, too. But based on the conducted research all operational excel-

lence activities can be assigned to the four areas execution, enabling, coordination, and communication (see Chapter 4).

In order to professionalise and make operational excellence more successful, an operational excellence support unit needs to be established at both the corporate and plant level. The infrastructure between the corporate and plant operational excellence support unit is called the operational excellence structure. Based on the conducted research an operational excellence structure is defined as:

'An operational excellence structure is providing the context for action and serves as medium for a routinisation of operational excellence with different coordination mechanisms.'

The definition is explained in detail in the following:

'*An operational excellence structure is* providing the context for action …'

Based on Hage and Aiken's (1967) definition of structure, the operational excellence structure refers to the organisation's internal pattern of different operational excellence relationships, operational excellence authority, and communication in terms of operational excellence. This understanding is enhanced by the fact that an operational excellence structure creates social rules of behaviour and activities.

'*…and serves as medium for a routinisation of operational excellence …'*

A medium is understood as infrastructural transportation, that is, to obtain the relevant information at the right time, with the right quality, and quantity flow in a structured manner so as to convince employees of the benefits of operational excellence. So operational excellence is anchored in the company. Routines are generically defined as *"a way of doing things"* (Winter, 1986), and imply a certain level of stability. In particular for operational excellence, routines are important to transfer a new way of working, indeed a new way of thinking in the DNA of an existing working environment. Fostering such routines in an operational environment requires resources, however. For instance, in their research Anand, Gray, and Siemsen (2012) point to the decay in adherence to operational routines over time in the worldwide pharmaceutical industry and the importance of constant management attention to routines.

'... with different coordination mechanisms.'

Section 3.3 introduced various formal coordination mechanisms. These 'tools', with their vertical, horizontal, and lateral expressions are utilized to establish an operational excellence structure. The vertical (hierarchical) coordination is based on a direct superiority and takes place through the formal chain of command. The lateral view

covers meetings, committees, and coordinating roles, all of which should be concerned with operational excellence.

The two definitions introduced here enrich the existing research on excellence and continuous improvement with organisational aspects. The introduced terms and underlying definitions are combined resulting in the term operational excellence organisation which is for the first time defined and provided in this thesis as followed:

'An operational excellence organisation is a goal- and purpose oriented, open socio-technical system with a horizontal and vertical operational excellence structure and different supports units on different organisational levels.'

As a result of the conducted research in this thesis and based on the new definitions introduced above the St.Gallen operational excellence model is revised. In the existing model as introduced in Chapter 3 the new elements operational excellence support unit and operational excellence structure are embedded. The revised St.Gallen operational excellence model is depicted in Figure 35.

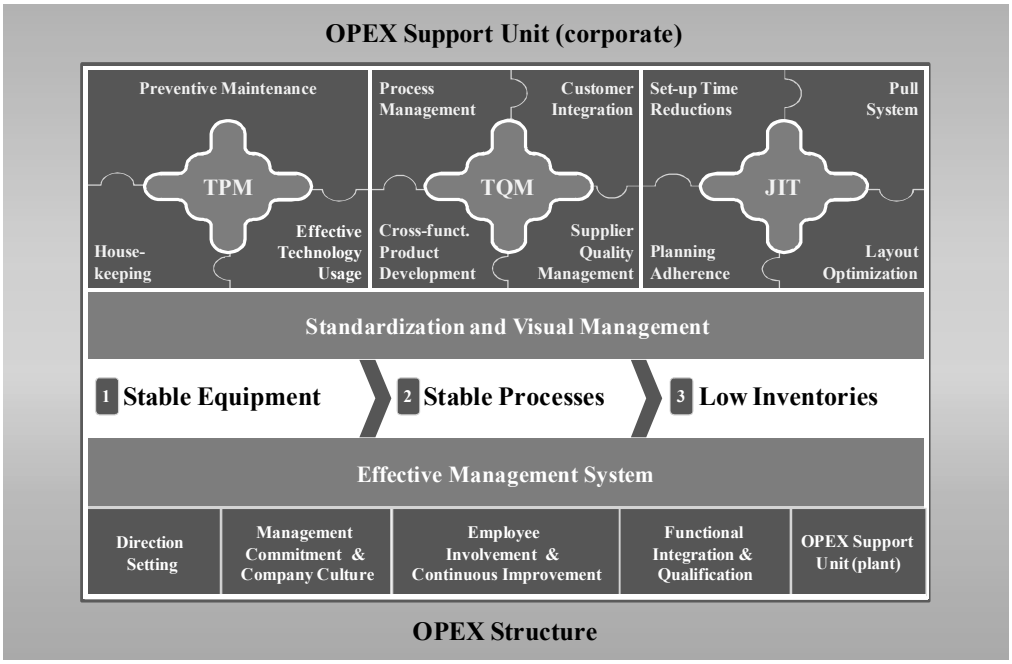


Figure 35. The St.Gallen operational excellence model revised

As the research is based in socio-technical system theory, which states that the design and performance of an organisation can only be understood and improved upon if social and technical aspects are considered together as interdependent parts, the St.Gallen operational excellence model can be said to address both these concerns. With this revised version, the model now serves the pre-existing understanding of operational excellence which comprises structural and behavioural changes in the overall organisation. As operational excellence is understood as corporate initiative in this

dissertation, the existing definition (ref. Section 3.3) of operational excellence, being: *"Operational Excellence constitutes the continuous pursuit of improvement of a production plant in all dimensions. Improvement is measured by balanced performance metrics comprising efficiency and effectiveness, thus providing a mutual basis for an improvement evaluation"* (Friedli et al., 2013, p. 24). Consequently, this definition is based on the insights and the new definitions that have already been provided in this sub-chapter in need of revision and in this thesis defined as:

> *'Operational excellence constitutes the continuous pursuit of improvements initiated from corporate level to implement all production plants in the network so as to increase the competitiveness of the overall organisation.'*

The introduced definitions help operations managers to establish a common understanding of operational excellence and its organisational aspects. This makes the discussion, design, and optimisation of an operational excellence support unit easier and prevents exhausting misinterpretations. As this study strives to provide knowledge on the systematic design of an operational excellence support unit which helps to unlock the potential of operational excellence, a reference organisation is provided in the following section. At this point it needs to be mentioned that the author is aware that there are several other success factors for a sustainable operational excellence implementation. An operational excellence organisation as defined in this thesis is only one lever, but the only analytical focus in this research.

6.2 Reference operational excellence organisation

From a practical point of view it is important to better understand operational excellence initiatives from an organisational perspective and for a sustainable implementation it is important to systematically organise an improvement initiative. Based on the new definition provided in chapter 6.1, the knowledge gained through the cases (see Chapters 4 & 5), and the model for an operational excellence support team on corporate and plant level (see Chapter 4) a reference organisation is provided for pharmaceutical companies which supports continuous improvement. But, the reference organisation is not limited to one industry only. In order to derive the requirements for an operational excellence support unit the drivers in form of potentials, barriers, operational excellence characteristics, and implications from practical interviews were used. These help to derive a reference operational excellence organisation and take a look at its development over time.

6.2.1 Requirements for an operational excellence organisation

The requirements elicitation, meaning the collection of requirements, steams from operations managers, is derived from barriers for the implementation, and some characteristics of operational excellence. Operations managers, who establish an operational excellence support unit or reflect on what they have established provided, some requirements in interviews. The knowledge about barriers helps to derive requirements which help to overcome these barriers. Thus, it is possible to avoid upcoming resistance and better embed operational excellence in the overall organisation. Out of the 20 indicated barriers, based on Jadhav et al. (2014) in Chapter 3.4, several can be addressed by an operational excellence support unit. Additionally, the characteristics of operational excellence itself allow deriving some requirements for an operational excellence support unit. The requirements were gathered, complemented, and verified in numerous interviews with practitioners (see question in Appendix). The verification of the requirements was an iterative process to improve the accuracy and completeness. In the following a focus is set on requirements dealing with organisational aspects. Requirements for competences like leadership skills or expert knowledge as well as technical aspects are excluded in this thesis.

As the thesis deals with dedicated corporate and plant operational excellence support teams and how to set up these teams, the first requirement is obvious when looking at the conducted research: Establishing dedicated operational excellence support teams. Like one of the interview partners said:*"Changes in the behaviour of employees, in the structure, in processes do not happen by accident and somebody needs to drive these"*. Once the decision is made to establish an operational excellence support team resources need to be allocated. As operational excellence is understood as a corporate initiative with a company-wide implementation, resources are needed on both, corporate and plant levels. For example, realising an employee suggestion system needs suitable resources. If suggestions are made in a team, they can be implemented fast and without high investments, there is of course no need for extra resources. If suggestions are collected on plant level they need to be managed. A suggestion committee on plant level collects and decides on the suggestions of different departments. A critical aspect is that there are enough resources available to decide about suggestion and act fast. If people make suggestions and need to wait months for an answer, they get demotivated. Getting to know the best practices, collecting, and distributing them in the production network can be achieved by an operational excellence support team.

Requirement 1) An operational excellence support unit requires resources on corporate and plant levels.

A lack of top/senior management involvement, lack of top management commitment, and lack of top management support is perceived as one of the key barriers for a sustainable operational excellence implementation. This can be drawn back to a missing acceptance of operational excellence throughout the organisation. To tackle this situation, an operational excellence unit needs to be able to convince top managers of the benefits of operational excellence. In order to be able to do this, the team needs to have direct access to the top management on corporate and plant level. In particular in the pharmaceutical industry management must be informed of any abnormality regarding process and product quality as well as changes in procedure (FDA, 2012).

Requirement 2) An operational excellence support unit needs direct access to top management level.

Another major barrier for the sustainable implementation of an improvement programme is a lack of communication between management and workers. Especially in multi-plant companies with a global production network communication and flow of information can be slow. Acting as communication organ with direct links to the sites in order to provide information fast, top down as well as bottom-up with the intended content to the recipient and direct feedback with comments is a key factor to respond fast to changing conditions.

Requirement 3) An operational excellence support unit needs to be able to communicate fast from top management to shop floor.

Operational excellence consists of technical and social aspects. The people orientation is a key aspect as Hall (1987) indicates that employee involvement is a key driver in the long-term sustainability and in the success of a continuous improvement initiative. Moving the decision-making downwards within the organisation is a key aspect in empowerment and employee involvement (Lawler et al., 1998).

Requirement 4) An operational excellence support unit only supports improvement and standardisation activities. Responsible are the people in the line organisation.

Operational excellence is about breaking routines and work together in a globally distributed world. Today´s manufacturing companies are globally distributed and plant have different histories and experiences in the implementation of operational excellence elements. Fostering a knowledge exchange and accessing the knowledge of different experts seems to be necessary to fulfil customer's expectations in today´s fast changing environment.

Requirement 5) An operational excellence support unit should foster knowledge exchange in the company.

Summarising the five requirements allows to derive organisational consequences for an operational excellence support unit (see Figure 36). These characteristics are used to set-up a reference organisation in the next sub-chapter.

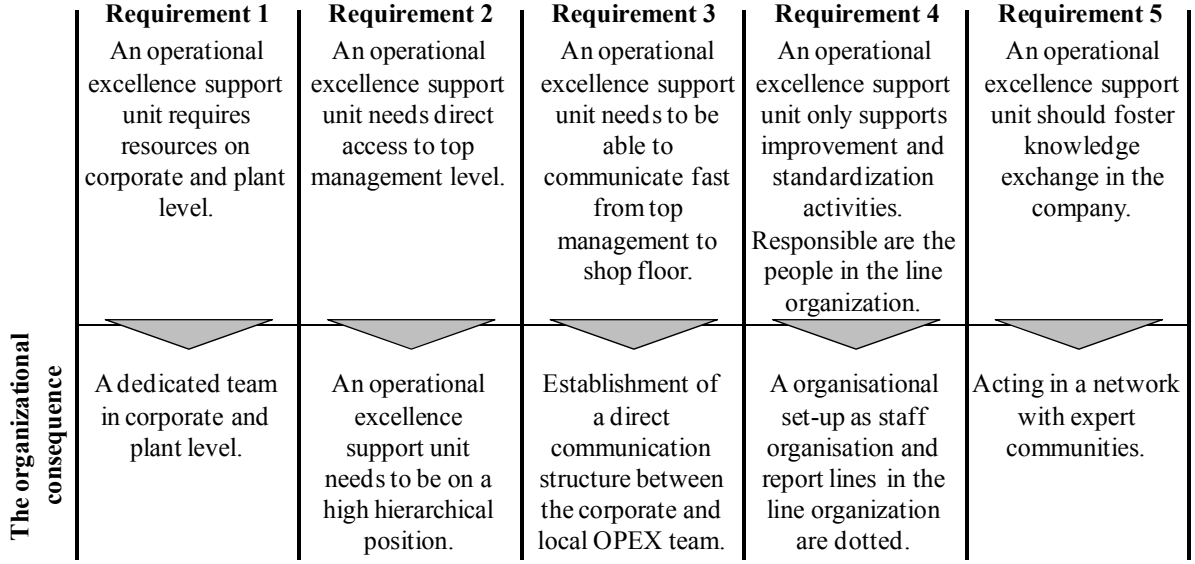


Figure 36. Organisational requirements and resulting consequences for an operational excellence organisation

It needs to be mentioned that barriers like suppliers' resistance or a lack of supplier collaboration are not considered in this research as the focus is on internal aspects. An operational excellence support unit can address these aspects as the example of Toyota and Toyota's OMCD shows (see Section 3.3). From a task perspective this would address the enabling and execution area of the introduced model in Chapter 4. It is also not possible that an operational excellence support unit can address all of the existing barriers to an operational excellence implementation as introduced in Section 3.5. Taking for example 'lack of financial resources': This can hardly be addressed by an operational excellence support unit. Especially as counteractive forces even will find that an operational excellence support unit causes only costs.

6.2.2 Reference operational excellence organisation

The introduced reference operational excellence organisation is not the one-and-only form, but from the practical and theoretical insights gained in this thesis a promising one for a sustainable implementation of operational excellence. The suggested reference operational excellence organisation consists of two dimensions: the formal structure and a parallel network structure. The formal structure, defined as visible in the organisational chart and the network structure as a parallel set-up of experts from different plant and corporate levels. The employees are not members of the operational excellence support teams, but experts from different functional fields like TPM or

TQM. The characteristic of the network can be constant as a meeting platform of cross-plant operational excellence support team members but also temporary to fulfil improvement tasks in a continuous improvement manner. In the following, both are described in more detail.

Formal operational excellence structure. Following Figure 37 operational excellence needs to be present on different levels of the organisation; from top management, to plant management and the respective operational excellence support teams on corporate and plant levels.

At the top management level the operations board is involved in any strategic operational excellence decision. The operations board member is part of an operational excellence committee that is additionally staffed with plant heads and the head of the corporate operational excellence team. Management support is an essential element and knowledge of operational excellence on management level fosters an operational excellence implementation. Showing commitment to the initiative, e.g. by providing the necessary resources and time is a top management role in the initiative. The top management involvement is in addition expressed in the attendance at operational excellence events; this can be at plant activities.

The central operational excellence support (COS) team is the main point of identification for operational excellence within the organisation. This team is positioned either as a staff organisation or a dedicated team at the same hierarchical level as other disciplines such as marketing or R&D; this is N-1 meaning N is the C-level (see Figure 37). Organised as a staff team allows direct access to top management. This set-up suits an operational excellence support team as the supporting function performed by operational excellence specialist are relevant for the complete organisation. But in this function they do not have the authority over other functional departments (see Section 3.3.4.2). The tasks of the COS team follow the model introduced in Chapter 4 and can be operationalised along the categories communication, enabling, coordination, and execution. These are in line with authors like Chandler (1962) or Collis and Montgomery (1997). Chandler (1962) identifies three tasks of the multidivisional firm's CHQ, namely coordinating and integrating the output of the businesses, providing centralised and specialised shared services, and allocating future use and the appraisal of the present performance of resources. Collis and Montgomery (1997) see a CHQ task in formulating and communicating a company´s strategy, allocation of resources, fulfilment of overhead functions, and setting up the administrative structure, systems, as well as control processes. From a corporate perspective the value-proposition and addition of a CHQ is to influence businesses, which are closely related to corporate strategy and

support functions with special competencies. The plant leader has a crucial role in the implementation of operational excellence at a plant. Without the visible commitment of the plant leader, any initiative is doomed to fail. A plant leader provides the resources (employees and time) to work on operational excellence. Additionally, a plant leader is a role model in applying operational elements and the underlying principles. For example this can be implementation of 5S in his own office and being open to have audits in his office. Changes begin as soon as somebody does something differently. The management has a key role in this process. Smith (2002) identified the main factors affecting successful change as among other strong resources dedicated for the change as well as addressing the needs of employees. The plant management team is marked green in Figure 37, too. They support the operational excellence implementation and maintenance in particular outside the production area. They have to understand the vision and the objectives of the corporate initiative in general and have to translate these into their plant reality.

Successful practice Mechanical Engineering Inc: *The site head plays an exceptional role. New plant employees are trained by the site head personally in the Mechanical Inc production system principles. There is right from the beginning a strong commitment observable, which is demanded by the management team from employees, too.*

The local operational excellence support (LOS) unit is either placed in its own department or as staff team with, in both versions, direct access to the plant leader. Tasks to perform by the LOS team are introduced in Chapter 4 and follow the second dimension of the model; these are coordination, communication, enabling, and execution.

The reporting lines for an operational excellence support unit are solid and doted reporting lines. As we suggest to position the corporate team as a staff team the reporting line is solid to a board member, mostly the chief operating officer. If multi-divisional companies have an operational excellence support unit for each division, they mostly report to the division board. The LOS team directly reports to the plant management via solid reporting lines and via dotted reporting lines to the COS team. In successful companies we could observe that the head of the LOS team is part of the plant managing team. All the relationships are in a direct line reporting, with an objective setting and performance evaluation by the superior hierarchical level. But, there are also indirect line reporting relationships inside the functional operational excellence network (see Figure 37). In particular the exchange between the COS team head and the LOS heads on plant level should be formalised, e.g. by regular operational excellence meetings. With this structure, the operational excellence support unit, as the name already indicates, supports the implementation of operational excellence.

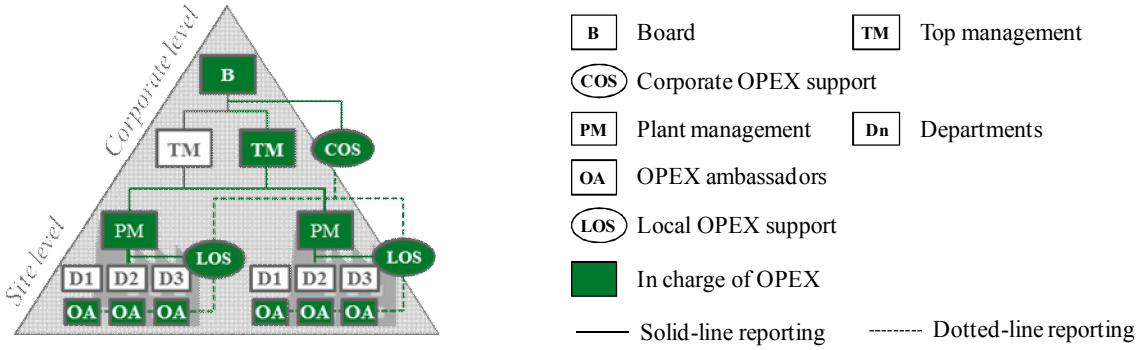


Figure 37. Formal operational excellence support unit at corporate and plant levels

Operational excellence structure. Steering committees and site leadership meetings help the formal institutions were decisions regarding operational excellence are made. The operational excellence steering committee is the highest decision making team regarding strategic and any fundamental decisions in the field of operational excellence. If the corporate and plant operational excellence support teams cannot decide on a topic and have no common direction, the operational excellence committee is the team to take the final decision. In a best possible way, no decisions need to be made by these teams; the operational excellence support teams and the people in the processes decide which action needs to be taken. This formal group of has a cross-functional and cross-hierarchical structure.

Successful example Machine Tool Inc.: *The highest committee is the production system steering group, who directly reports to the COO. This committee is the core team consisting of the head of production system consultant, the plant heads of the big production plant in the manufacturing network, the head of quality management, head of purchasing, and the head of the companies' work council. This is a multi-discipline board with corporate employees enriched by people close to production to incorporate the needs of production plants. Coordination functions and kicks-off new topics relevant for production.*

Another form an exchange on operational excellence relevant topic can take are global operational excellence conferences that are conducted company-internal and are in most cases organised by the COS team.

Successful example Automotive Supplier II: *Once a year a productions system world meeting from both divisions with around 60 people at one production plant is conducted. Best practices are presented at market place, team building activities and regional meetings.*

So far the focus was on dedicated operational excellence support teams on corporate and plant levels. In order to bring operational excellence in the line organisation the LOS team closely works together with appointed operational excellence ambassadors in the line. They can also be named operational excellence coaches or company specific production system experts. These employees help the LOS team to embed op-

erational excellence throughout the plant. By this an essential aspect for a successful operational excellence implementation is addressed: the empowerment and involvement of employees form all hierarchical levels.

The degree of delegation and of participation, Delegation stands for the process of transferring power. The delegation of power enables people to make decisions – especially at lower organisational layers – and thus it is closely linked to empowerment (Malone, 1997). Supervisors are relieved of workload and the people in the process decide what to do and how because they know why based on a good communication by the LOS team. This leads to a higher participation in the improvement initiative whereby participation means the involvement of organisational members in decision-making. With an increasing degree of participation, employees are more involved in decision-making or might even make decisions jointly with supervisors (Tonnessen, 2005). These employees help to embed operational excellence which, over time, should 'infect' all employees working with operational excellence methods and tools. They work in the line organisation and help to embed operational excellence; this can be in the production, engineering or administration area. This means, the responsibility for operational excellence resides in a plant organisation. A well established format is having local teams support the implementation of a company specific production system. A company`s specific production system is the structured and operational expression of an operational excellence initiative programme based on lean principles and the understanding of continuous improvement. The responsibility for results and KPIs need to be in the line with and at the level where people can directly influence the results and the respective KPIs. Self-managed teams, often also named autonomous groups or self-organised groups, are a shift away from traditional group work and moves beyond local environment.

In particular, how problems are solved stays in the decision of a line team. Looking at these teams an additional aspect is the cross-functional staffing with experts needed to solve a problem. As already indicated above, operational excellence is a company-wide initiative. The elements of operational excellence are originated and based in the operations area, but its underlying principles can be applied in administration or research & development. To unlock the potential of operational excellence a whole organisations needs to work according its methods and in particular based on the underlying philosophy of continuous improvement. If these teams work together beyond the own plant boarders as cross-plant teams it results in a network structure.

Operational excellence network. In this network structure the application of Kotter´s (2011) idea of duality of structures is expressed. In its basic thoughts this is not new,

but applied on an operational excellence support unit and its connection it seems to be promising and is not available so far (ref. chapter 3). Following Satell (2015) with his statement *"If it can fit on an org chart, it´s not a network",* a network has rather informal structures with temporary groups of experts working in a global set-up and no cumbersome, formal structure. A network is characterised as nodes connected by links with two characteristics: path length and clustering (Satell, 2015). In the network different communities can operate and work on operational excellence specific topics. A community is a group of people meeting to work on a topic of their particular interest; this can for example be a functional topic like 5S in the production area.

We suggest different set-ups of an operational excellence network. A rather horizontal collaboration of communities on plant or local level, a vertical collaboration between different hierarchies, and third, the combination of both. The last one probably has the most power as it incorporates practical and managerial expertise from different organisational levels and disciplines. In all configurations, the operational excellence support team has a key role: they are the junction to connect people. In this set-up the local operational excellence heads from the LOS teams are acting as operational excellence network managers. Together with the head of the COS team they form the core team of an operational excellence organisation. By this they connect the formal operational excellence organisation with the network operational excellence organisation.

In a horizontal network functional experts teams supported by LOS teams collaborate on a specific topic. This can be just a cross-plant collaboration of operational excellence support team members. Horizontal operational excellence communities help to break down functional and local silos. Experts who want to contribute in horizontal communities join a community and provide their expert knowledge. It is important to connect the silos and functional team most efficiently. They contribute with local operational excellence experts for specific improvement topics and care about a network central communication platform, e.g. a company specific document storage, virtual meetings or a company specific social network. Having a local problem and giving this in the networks helps to get answers from different experts with different experience.

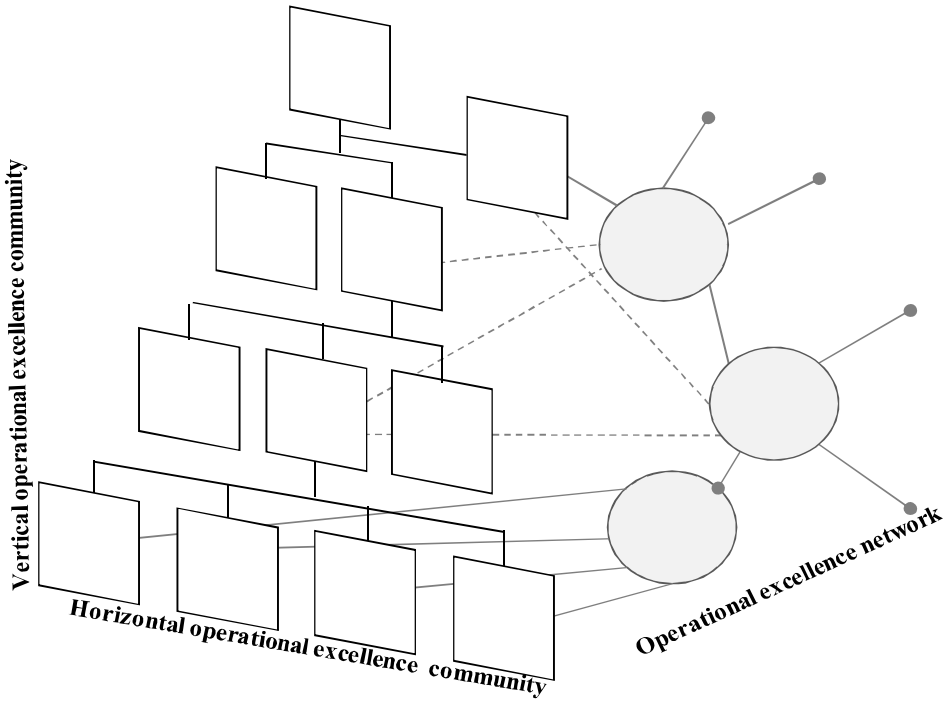


Figure 38. Parallel network operational excellence structure

In the vertical operational excellence communities, the top management does not influence on a functional level. How the problem is solved is in responsibility of operational excellence network. This organisation goes beyond the classical suggestion system know from kaizen or the quality circles. Employees do not give their suggestion to a centralised office and wait for weeks until a decision is made. It even takes more time until the idea is implemented and the employee gets rewarded.

In today´s pharmaceutical industry operational excellence and quality are often organised in different department. Regulations and recommendations from authority may be a reason for that as well as historically grown organisational structures. The networked organisation provides the opportunity to integrate quality expertise from the formal structure into a cross-functionally team. In other industries, we found quality and operational excellence aligned in one organisational unit (see box below).

Successful practice Machine Tool Inc.. *At the site level the lean support department is also responsible for quality issues. So quality is integrated into the lean department. In a pharmaceutical company other approaches can be found to deal with the separation without getting in regulatory troubles. For examples joint teams of quality and operational excellence specialists can work along of identified improvement problems without uniting them under a single head. In a pharmaceutical plant in Ireland the objectives of the quality control labs are directly agreed upon the communication with manufacturing greatly improving the understanding of the overall process flow. There is no doubt that operations, quality assurance and control as well as maintenance departments can each individually establish an operational excellence team that produces results. However, having an aligned team, pharmaceutical companies can unlock the potential of operational excellence much better.*

The operational excellence network organisation does not replace the formal and hierarchical organisation, but complement it with expert communities. This helps to work on small scale project on a local level with the knowledge of a network. Big projects are executed in the formal structure and supported by exactly these smaller network activities. By this, problems get solved in an early contact to the place where they occur; no time is wasted with coordination meetings over different hierarchical levels. The operational excellence plant team than helps to stabilise the achieved status and bring this as current standard in the organisation and connect the knots. An operational excellence organisation with the two dimensions rather follows the 'recipe' mentioned by Hamel and Zanini (2016) *"Revolutionary goals, evolutionary steps"*.

6.2.3 Design recommendation for an operational excellence support unit

The design recommendations result from the reference organisation for the operational excellence support unit and describe a desired state to achieve. The recommendations follow the understanding that organisational design serves the creation of organisational structures and, in turn, that organisational structures are a tool to achieve organisational objectives (Vahs, 2009; Hill et al., 1994). In addition, the design deals with a planned change. These kinds of changes are usually top-down driven. The author is aware that this kind of change is best suited to a stable and predictable environment and those unpredictable changes, which may influence the organisation, are common to the business. However, as operational excellence is a long-term programme, planned and initiated at the corporate level the following recommendations address strategic and by the corporate level planned changes. Consequently, once a decision has been made to start a corporate operational excellence initiative, the operations manager needs to think about the design of the operational excellence support unit and it is here where the introduced model helps as it provides two dimensions of action: the tasks and the organisational structure of the operational excellence support unit. Therefore, this section will provide design recommendations following the organisational structure dimensions of the introduced model in Chapter 4. These are the dimensions centralisation, standardisation, hierarchical level, and span of control. Along these dimensions the organisational design of an operational excellence support unit can be discussed.

In Chapter 4.1, a classification of the organisation of operational excellence support unit on whether it is in place on corporate, plant level, both or not as dedicated team was introduced. In the following design recommendations for these four types

are provided. These recommendations are enriched with successful practice examples for each specific design recommendation. The four types are abbreviated as follows: 1) No operational excellence as NOP; 2) Local Fighter as LF; 3) Centralised theoretics as CT; 4) operational excellence organisation as OEO. These four abbreviations are provided for respective design recommendations at corporate and plant levels and enrich the recommendations following the structure as corporate design recommendations (CDR) and site design recommendations (SDR).

CDR1) Hierarchical position of operational excellence support unit: *Place the head of the operational excellence support team at the highest possible level with direct access to the highest operations manager;* Applicable for: NOP, CT, OEO.

Having the head of operational excellence on a high hierarchical level gives the operational excellence initiative credibility. With the access to diverse management meetings the topic operational excellence can be aligned with other ongoing initiatives and integrated in other functional disciplines out of the production area.

Successful practice CxO Pharma Inc*. The Executive Management Greenbelt. A mandatory and specific designed training for top management with the basics on operational excellence. The head of operational excellence and one person from his team trained the complete top management team. Therefore it was beneficial that the head of operational excellence himself is part of the top management team. In a first step this same hierarchical position gave him a much easier access to the training participants.*

CDR2) Span of control of operational excellence support unit: *Choose the span of control inside your corporate operational excellence support team following the formula "one dedicated operational excellence support FTE on corporate for five large plants";* Applicable for: NOP, CT, OEO.

The critical number of dedicated operational excellence support FTE should follow *formula* "one dedicated operational excellence support FTE on corporate level for five large plant". What means large: in the automobile industry the plants are for sure larger than in other industries. We consider a plant with 2.500 as a large production plant in general[7]. The operational excellence support unit team set-up can be from different functional back ground. In an optimal set-up, the employees are rather senior with high expertise and with a strong network in the organisation.

[7] These data draw back on the plant size of the interview partners.

CDR3) Level of centralisation of the operational excellence support unit: *Establish a low level of centralisation and leave the power at the plants.* Applicable for: NOP, CT, OEO.

The responsibility for operational excellence resides in plant organisation, not in the corporate operational excellence support unit. The operational excellence support unit supports, as the name indicates, the implementation of operational excellence. The responsibility for results and KPIs need to be in the line with and at the level where people can directly influence the results and the respective KPIs.

CDR4) Level of standardisation of operational excellence support unit*: Achieve a high level of standardisation on operational excellence processes.* Applicable for: NOP, CT, OEO.

Standards help to prevent that achieved improvements do not fall back on a lower level as they have been before. Maintaining the current level and having standards in place is essential for operational excellence. In particular on core processes and KPIs as well as training for awareness a high level of standardisation is beneficial. Having a common understanding and language on operational excellence terminology reduces misinterpretations.

Successful practice example Brake Inc.: *In a formal and standardised process an operational excellence audit is conducted on-plant by the corporate excellence team with a standardised questions and KPIs. Best practice is the cross auditor system. Audits are conducted with the central, team in the lead but the auditor consists of a plant head from another plant who acts as a visitor at the three day audit to learn best practices and expand his network. A corporate excellence award is based on the results of these reporting processes.*

The following organisational site recommendations can be given:

SDR1) Hierarchical level of operational excellence support unit*: Choose the head of the operational excellence support unit at the plant level at a high hierarchical level with direct access to the plant head.* Applicable for: NOP, LF, OEO.

Similar to the corporate organisation also at the plant level the operational excellence support unit should be placed on a high hierarchical level. With this direct access to plant management meetings operational excellence relevant topics can be addressed. The escalation of critical activities is not slowed down through hierarchical levels and decisions can be made fast.

SDR2) Span of control of operational excellence support unit*: The span of control at the plant level should follow the criteria "one operational excellence FTE for 150 plant employees"*

The span of control of different companies that perceived their operational excellence initiative at the plant level as successful is "one operational excellence for around 150 FTE". This ratio provides sufficient capacity to work on different operational excellence functions such as enabling, communication, coordinating, and executing.

SDR3) Level of centralisation of operational excellence support unit. *Decisions on operational excellence topics need to be made by the line organisation.*

The level of centralisation means the locus of operational excellence relevant decisions is high. The local operational excellence team supports the sites and translates the overall operational excellence strategy with its objectives to the site environment

SDR4) Level of standardisation of operational excellence support unit. *The level of standardisation needs to be high on plant level*

Improvements need to be conducted on a stable basis. If the basis is not stable, the chance is higher to fall back in previous routines. So, standardisation is key for every upcoming improvement as standards help people to feel comfortable in the daily operations.

The introduced design recommendations help to achieve the reference operational excellence organisation. In general, it is important to achieve standards throughout the organisation that fit local requirements. It is clear that in a production network different plants have a different level of operational excellence maturity. With a high level of standardisation and coordination, efforts relating to the exchange of best practices will require a high level of centralisation.

6.3 Operational excellence organisation over time

So far the focus was on an operational excellence organisation and the operational excellence support units from a stable perspective. The cases in Section 5.3.4 showed the development over time. Based on these insights and the interviews with operation managers as well as the discussion with the focus group participants at two meetings support the provided view and gives insights on the question: how does an operational excellence organisation develop over time?

Let us start with the look at an ideal world. In an ideal word an operational excellence support unit would abolish itself over time as the idea of continuous improvement has reached the whole organisation. But this seems very optimistic. Taking a look in today´s manufacturing organisation with changes of positions, globally distributed plants and subsidiaries in which new employees with knowledge from other companies or no practical experience directly from university join; there is a continual

coming and going. Looking at the empirical data base of this thesis with 24 companies from different industries and the cases companies to whom a collaboration over two years took place: Historical data as well as ideas of the future were discussed with corporate and plant operational excellence managers and no one planned to abolish or reduce the size of his operational excellence support team. But the team can change its tasks and probably its organisational structure. Because in order to be effective organisations must adapt the structures to their specific situation (Kieser, 1995). In this view change moves away from a managed produced under specific circumstances by a number of persons like operational excellence support team employees to a pervasive and invisible change. Tsoukas and Chia (2002) talk about organisational becoming and seeing organisational change not as orchestrated from the top management. We further take a look at the changes over time and see if this development is possible or happened in practice.

Based on the introduced reference operational excellence organisation, we claim that the network structure changes over time and the formal structure stays in a rather stable status from an organisational perspective and set-up. Of course, the employees of the COS and LOC teams may change; employees leave for other positions and others join the team. Based on the model we first look at the tasks and whether organisational dimension change over time. We start with the content that is transported. From a singular focus on a functional perspective, the content of the tasks is changing over time. Following the implementation sequence of the elements of the St.Gallen operational excellence model; TPM first, followed by TQM and then JIT on plant level, while all steps are supported by standardisation and visualisation activities. Why is this sequence reasonable? TPM first leads to stable equipment. Further improvement, e.g. in quality aspects like process optimisation, are more beneficial if they are based on stable equipment. Based on stable equipment and stable processes inventory reduction can be done. These are the most desired optimisations for a management team as the promise a high financial improvement. Performing JIT activities first holds a high risk; imagine if inventory is reduced but instable equipments or variable processes result in a production stop. This can easily result in being unable to deliver the products a customer ordered. In particular in the pharmaceutical industry this is absolutely to avoid. So we argued the change over time from a functional perspective based on Kickuth (2006) which results in the first insight: the content of the tasks is changing over time.

In a second step, we look at the tasks themselves – communication, enabling, execution, and coordination – and if these change over time? We use the initiate-standardise-maintenance-standardise-maintenance process which is underpinning a

continuous improvement process and understanding (see Figure 39). The basic idea is that an *"organization first comes into being when an initial group of influencers join together to pursue a common mission"* (Mintzberg, 1983, p. 22). Operational excellence implementation starts with a management sensitisation and training, best practice visits, a communication concept, and customised training concepts. Establishing a team of operational excellence specialists is a first and obvious change in the formal organisational structure. These specialists have the mandate to provide on-going support for the operational excellence programme. Communicating the new set-up and changes is a necessary step right from the beginning to take away the fear of the unknown from the employees. Changes cause uncertainty and people can react with rejection or resistance and therewith hindering the achievement of embracing the full potentials of an operational excellence initiative. Practitioners said in the conducted interviews as well as the focus group are of the opinion to start an operational excellence implementation with enabling - meaning training people on the topic of operational excellence. This can be management training, awareness training or an intensive expert training. The elements that are trained depend on the maturity level and experiences in operational excellence. What we already know from previous research on operational excellence is to start to work on stable equipment; meaning implementing TPM which comprises according to the St.Gallen operational excellence understanding the practices preventive maintenance, housekeeping and effective technology usage. These activities need to be conducted on site level. So, in the initial phase communication and enabling are the most important tasks to be performed by the operational excellence support team. In the first improvement phase the application of value stream mapping, A3 problem solving or 5S turned out as a suitable approach. In the initial phase there is a focus on methods and tools followed by a focus on building up competence. In the maintenance phase coordinating and executing are the most important tasks to stabilise the achieved improvements. This is a critical phase because the chance to fall back into old routines is high. Going to the shop floor and conducting improvements projects with the employees shows the benefits of operational excellence and ensures credibility of the operational excellence support team and the initiative itself. If a stable level is achieved the next level of improvement needs to be triggered. In the next improvement phase again enabling and communication are key to achieve the next level. So over time and following the continuous improvement sequence a change in important activities seems reasonable and necessary. Rolling out operational excellence in different waves – this may be in regional clusters of factories or based on their importance – results in repeating activities, enriched with best practices from previous waves.

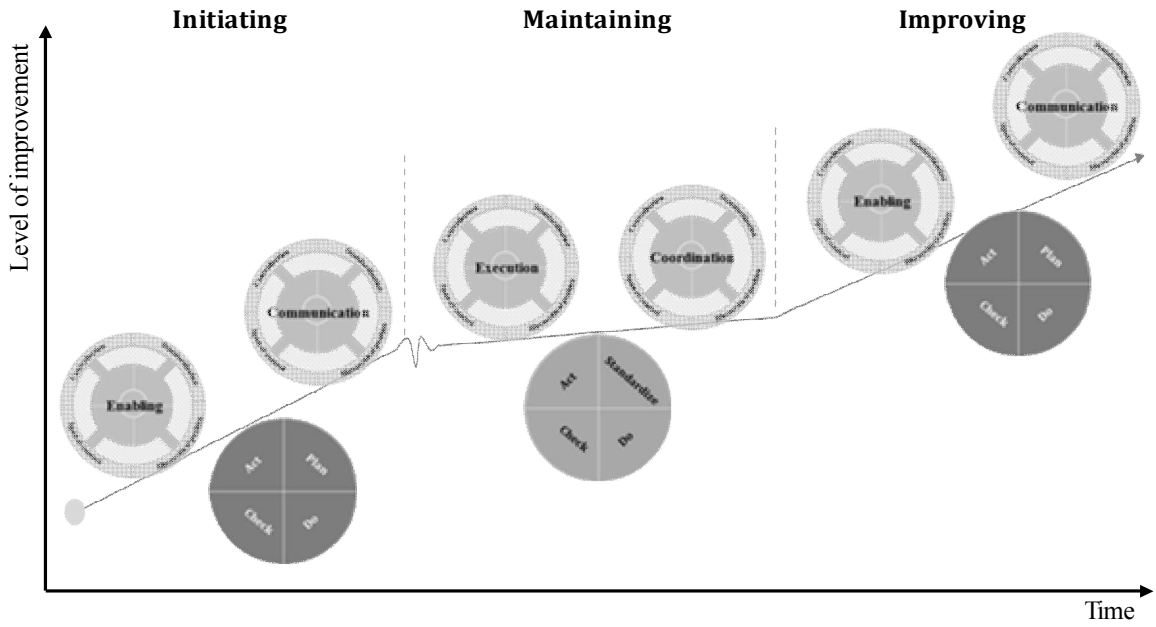


Figure 39. Tasks of an operational excellence support unit over time

How does the organisational set-up change over time? We see operational excellence as a corporate initiative whereby changes are planned at the beginning. This planned organisational change is consciously organised with controlled measures and specific goals. This is achieved by planned interventions in the processes by using behavioural-science knowledge. Organisation design enables organisations to execute a strategy predictably (Beeson, 2014) (see Section 3.3.6). The absence of a sound strategic action is a problem for an operational excellence initiative as operational excellence is a strategic programme with long-term aspects. Having no strategic action leads to an uncoordinated multitude of practices, events and activities without a goal-orientated work as the objectives are missing. Bessant et al. (1994) indicate six success factors for the successful organisation of continuous improvement needs a clear strategic framework and continuous improvement needs managing strategically. As in particular the operational excellence support unit on a corporate level works on strategic actions and its communication and knowing that strategies change over time, it becomes obvious to have an operational excellence support unit in place to work on strategic issues. Operational excellence is based on the continuous improvement understanding and the changing sequence of improvement and standards is important to continually achieve a higher performance. We take the four elements of the third dimension of the introduced operational excellence support unit model: centralisation, standardisation, span of control, and hierarchical position of the operational excellence support unit. Once the recommended ratio of operational excellence FTE on COS and LOS teams is achieved it seems reasonable to leave this number stable. Whether employees change from corporate to plant to gain experience is not directly linked to or-

ganisational changes and respective changes in the introduced model. But this is for sure beneficial and can be observed in practice regularly. As the span of control seems stable, the hierarchical position of operational excellence support units may change over time. In particular dimension 0 – the organisational form – can change over time. Most companies start their initiative with a staff team. A reasonable change and move towards the professionalisation of operational excellence support unit can be the change from staff to a functional department on the same level as other departments. In 'pushing operational excellence', top management has a crucial role especially in the initial phases. Several examples of successful operational excellence initiatives have shown that, in the initial phase, the operational excellence support unit is organised as a staff team with direct access to the operations board member.

The level of centralisation of operational excellence support units changes from high at the beginning to rather low after a certain period. After the decision is made by top management and the initiative runs for a certain time successfully, it is important to delegate decisions to the line organisation more and more. Nevertheless the operational excellence support unit still exists as giving away power does not abolish the team. The level of standardisation is getting higher over time. Starting new improvement from a stable level requires achieving this stable level after every improvement phase. The standardisation requires discipline and needs time. If nobody cares about achieving and holding the standard as a basis for the next improvement, people too often fall back into old routines.

Some supportive arguments. An operational excellence initiative strives for a company-wide implementation. It is not restricted to a special organisational level. The backsliding in previous ways of working is a critical factor as it hinders to establish a culture of continuous improvements. Slogans like "we did it like this in the past and it was good" show the unwillingness to change. To prevent the backsliding consistently or lack of perseverance a presence and the availability of operational excellence support unit employees shows the support in critical situations. Different authors stated the following success factors: a stated vision and goals for the change of direction, leadership guidance or commitment in involvement, defined roles of employees involved in change, training employees and having strong human resources to measure and evaluate performance (Griffith-Cooper & King, 2007; Kenny, 2006; LaMarsh, 1995; Al Haddad & Kotnour, 2015). With regard to resources involved in changes a clear strategy, clear roles and aligning processes, resources and workforce are necessary to accomplish a major change in an organisation. Large-scale change requires

high levels of organisational resources. All these facts support the existence of an operational excellence support unit.

Due to a faster changing environment, demographic changes in the workforce the operational excellence support unit is not a temporary department or team but rather a permanent team with changing team members. The idea is not to build up a large corporate and local bureaucracy organisation. For making operational excellence part of the daily work still the employees in the process or the shop floor are responsible. The dedicated teams do not disconnect the rest of the employees from engaging in the operational excellence initiative but rather motivating line organisation on plant level and management on top corporate level. Working in an operational excellence initiative requires the commitment to compromises. Trusting people often lead to positive results. People in the line organisation know their processes and often can improve these in the best way. This is important for operational excellence leaders. In the understanding of Hirano (2016) an ideal leader is not simply a guardian of a stable state nor an initiator of changes. Rather, a person who identifies the need for a phase switch based on the conducted observation. The leader then facilitates the switching process between the organisational evolution and revolution as required, with the purpose to move the organisation towards an ideal viability.

It is too often forgotten, that the journey of Toyota or Gore took more than 50 years. Enthusing employees for operational excellence is not easy and requires long term effort. In particular in fast changing times, persistence and continuance are required. Lean as understood by Womack et al. (1990) is more than 25 years old; and companies are still struggling with the implementation. However to date there has been no practical evidence to indicate that an operational excellence support unit as defined in this thesis, has been downsized as a result of organisational learning with employees managing to work in new routines according to the understanding of continuous improvement. We see operational excellence as a never-ending journey of innovative and incremental continuous improvement activities with a dedicated team driving these activities. Dedicated and company-internal operational excellence experts play an important role in the implementation and in a consequent application of operational excellence to achieve a continuous improvement culture. Once started with a dedicated operational excellence team a complete dissolution of the formal operational excellence support team and pass of every operational excellence activity to line employees is a nice thought, but not observed in practice so fare.

If there is no one responsible for the improvement initiative, people too often fall back into old routines. A quote out of an interview the author had with an global op-

erational excellence manager describes the topic pretty well *"There is a need for people who care about that other people can do their job in a best way"*. Having discussed this, a professionalisation and consequently institutionalisation of operational excellence as own discipline and a consequently a permanent operational excellence support unit with changing tasks and changing organisational structure is advised in this thesis.

6.4 Summary

This chapter provided a definition of the term operational excellence support unit, a revised definition of the St.Gallen operational excellence model, a reference operational excellence organisation and design recommendations based on four operational excellence organisation types (see Section 4.1). Therefore we draw on the introduced model (see Section 4.4) and its dimensions.

The definitions of the terms operational excellence support unit and operational excellence structure presented, help to achieve a better and common understanding of operational excellence from an organisational perspective. By this, the St.Gallen understanding of operational excellence could be enriched by organisational aspects in form of the operational excellence support unit at plant level, the operational excellence support structure and the corporate operational excellence support unit. By adding the corporate perspective the model now serves as a basis for discussion about operational excellence as a corporate initiative in the form of a multi-plant improvement programme. This is an important aspect which bolsters the institutionalisation of operational excellence and its support unit in practice. These aspects help to institutionalise operational excellence and its organisational aspect by understanding an operational excellence support unit as supporter of an organisation in every task related to the conception, design, implementation, and maintenance of an operational excellence initiative. In being active on corporate and local levels the corporate operational excellence and local operational excellence support unit form an operational excellence organisation which acts in an operational excellence structure and network. Doing this operational excellence support units become actively involved in corporate rather strategic activities and locally in rather operative activities supporting the employees at different levels to think, act, and lead following defined operational excellence principles and actively design and enlarge the operational excellence structure. By this operational excellence is spread into the organisation like roots into a soil which makes it stable.

The suggested reference operational excellence organisation consists of a formal structure and a parallel network structure. The formal structure is part of the organisational chart and a permanent element of the organisation. In contrast, the network structure is a parallel set-up of experts from different plant and corporate levels, who form a team for a purpose; to solve a problem and to continuously improve. The design recommendations for an operational excellence support unit at the corporate and plant levels are provided for in this chapter. These recommendations help to achieve the reference operational excellence organisation as introduced earlier. The recommendations follow the dimensions of the introduced model. While the recommendations do not have universal applicability, common practices are available and these are promising as far as achieving a more sustainable operational excellence implementation is concerned.

Overall and seen over time, the idea is not to build up a large corporate and local formal operational excellence organisation. For the implementation of operational excellence the employees in the process are responsible. But, an abolishment of operational excellence support teams on corporate and plant level with the complete transfer of operational excellence activities to line employees is a nice thought, but not observed in any of the cases used in this thesis. If there is no one responsible for the improvement initiative, people too often fall back into old routines. Consequently we rather advice for an institutionalisation of operational excellence as a own discipline.

7 Summary and outlook

Success is not final,
failure is not fatal:
it is the courage to
continue that counts.
Winston Churchill

The final chapter concludes the thesis by summarising its results and contribution made but also by providing critical reflection on the entire research. Section 7.1 provides a summary of research conducted and Section 7.2 outlines the study's contributions to theory and practice. Section 7.3 presents a critical reflection on the main results as these relate to the stated RQ. Finally, Section 7.4 completes the thesis with an eye to the limitations of the research, as well as a view towards possible future research in this area.

7.1 Summary and conclusion

Implementing and maintaining a corporate operational excellence initiative organisation-wide requires extensive organisational changes. Yet among manufacturing companies there is a general lack of knowledge with regard to the systematic organisation of an operational excellence support unit on the corporate and plant levels. This is without a doubt a difficult task; however, research has thus far provided little assistance. Facing this challenge, the thesis provides a structured and effective method to organise an operational excellence support unit which helps to unlock the potential of an operational excellence initiative and make it more sustainable. The study is based on literature from operations management, notably operational excellence, lean production and continuous improvement, enhanced with literature from organisational theory, organisational design, and organisational change in particular. The research field centres on corporate improvement initiatives, derived from the St.Gallen understanding of an operational excellence initiative with continuous improvement as an underlying philosophy. The analytical unit is a dedicated operational excellence organisational unit, named operational excellence support unit, which supports the company-wide implementation of operational excellence in the long-term. The relevance of better understanding the professional organisation of an operational excellence initiative is reflected in the fact that numerous companies from different industries now run corporate improvement programmes. In production areas the initiatives often find their expression in specific company-wide production systems. However, these initia-

tives can often be seen to be lacking with regard to a sustainable implementation. In order to embed operational excellence a dedicated operational excellence support team to lead the improvement initiative on a corporate level in manifold shapes is needed. This can either be as an independent organisational unit in the form of a staff department, or as a part of the production function. Infusing the whole organisation with a continuous improvement DNA is achieved by establishing an operational excellence structure with the aid of operational excellence support units, which are organisationally 'mirrored' from the corporate to the plant level. With suitably formal vertical and lateral coordination instruments, an operational excellence structure can be established over time.

The thesis was structured in seven chapters to answer the RQ "How should an operational excellence support unit in the pharmaceutical industry be designed to support continuous improvement?" The first chapter provided a general overview of the research motivation, its theoretical and practical research relevance, the central RQ with its four sub-questions, expected objectives, and the structure of the dissertation. The second chapter presented the theoretical and conceptual background, the research framework the research design and methodology as well as the empirical data base. Chapter 2 described the research foundation. The thesis is grounded in contingency theory, structuration theory, and embedded in an understanding based upon socio-technical theory. Moreover, the research is based on the practical approach of Ulrich's (1984) understanding of research. Following this, the practical problem is answered and solutions provided for management practice. The research is conducted with a strong focus on qualitative data. The definitions of any terminology used were provided at the end of Chapter 2 so as to aid a common understanding, and to underline the author's perspective on the research field. Chapter 3 provided a discussion on the basics in the research field as well as a literature analysis on the operational excellence and continuous improvement literature, which was enriched with organisational literature. The third chapter also established the fact that operational excellence has evolved over years. Of particular influence were the 1980s' research results on the superior performance of Japanese companies, with particular regard to Toyota as well as publications of the MIT (Womack et al., 1990) on lean production (Krafcik, 1988) and continuous improvement (Imai, 2012). Lean production is of specific help in doing the right things (effectiveness), while continuous improvement helps towards doing these things right (efficiency). The company specific production systems serve as a framework in terms of communication and provide a structure for the methods and tools used for the comprehensive optimisation. Operational excellence can be summarised

as a consolidation of different approaches that have evolved over the last 50 years and have shown themselves to be beneficial. In all approaches the underlying basis of any improvement activity is based on the continuous improvement understanding. Increasingly, recent operational excellence initiatives are initiated from the corporate level (Netland, 2013), which brings with it an ever-growing coordination effort. Barriers in implementing improvement initiatives, like the lack of resources to invest or the lack of top management commitment provide potential field of actions for an operational excellence support unit. Chapter 4 presented a model used to understand and describe an operational excellence support unit over time. The model is derived from results of the theoretical research and complemented by the qualitative research data. The outcome here is a model with three design dimensions. These relate to different tasks of an operational excellence support unit and different organisational structure dimensions. The focus is not on individual people and their capabilities, but on the organisation of the operational excellence support unit itself. Decisions along the dimensions of the introduced operational excellence support unit model allow a focus on organisational aspects at different times of the operational excellence journey in a structured way. In Chapter 5, cases were used to demonstrate the practical application of the model. The empirical context was the pharmaceutical industry. In chapter 6, it was possible to enrich an existing management model and develop guidelines for organising operational excellence on corporate and plant level in manufacturing companies. Finally, the seventh and current chapter concludes the dissertation with a summary and discussion of the results as well as the study's contributions to theory and practice. Limitations of the research and a view to future research are provided at the end of this thesis.

In sum, the main results are insights and a framework to better understand the organisation of an operational excellence support unit and its task in creating an operational excellence structure in the organisation. The developed artefact is integrated as a descriptive artefact in the EMS sub-system of the St.Gallen operational excellence model, which exists and is applied in the industry since several years. This adds to the institutionalisation of operational excellence and continuous improvement in the operations management literature in terms of shaping an understanding to a broad accepted terminus and differentiation of continuous improvement, lean and other improvement concepts which are too often used synonymously in practice. This supports practitioners in the establishment of operational excellence as a discipline and business function in its own right on both corporate and plant level in manufacturing companies.

7.2 Contribution to theory and practice

In order to achieve a culture of excellence, many manufacturing companies have established corporate improvement initiatives represented by company-specific production systems. For the organisation of dedicated operational excellence resources, this thesis develops a descriptive model for an operational excellence support unit. The model is divided into three dimensions: the organisational form, the tasks, and the organisational structure of an operational excellence support unit. The model serves as a basis for the development of general management guidelines on how to deal with the organisational set-up of the operational excellence support unit over time. By answering the RQ the thesis provides both an academic and practical contribution to this specific research field. A certain level of theoretical advancement is desirable to achieve a pragmatic and practical research results. In the following, the theoretical contributions are shown first, followed by the practical contributions.

Theoretical contributions. Conceptual and descriptive statements constitute the main theoretical contributions. The conceptual, fundamental knowledge on continuous improvement and operational excellence as well as organisational design is the basis for the development of the model. In Chapter 4 the organisation and functions of an operational excellence support unit are discussed and visualised in a descriptive model. The previous focus in research was dominated by single factory improvements and how improvement initiatives affect performance as well as relating to the effect of isolated improvement initiatives. Viewing operational excellence from an organisational perspective leads to aspects which add to the literature of improvement initiatives but have, to date, been rather lacking in basis. Additionally knowledge in CHQ's staff(ing) and its functions in context of operational excellence is gained. The theoretical knowledge with operational excellence characteristics, drivers for operational excellence, and barriers to operational excellence help describe and explain the phenomenon of an operational excellence support unit. The model introduced here is based on the St.Gallen understanding of operational excellence and suggests a set of organisation dimensions for an effective operational excellence support unit. The linkage of organisational design and functions adds to the operations management and organisational theory literature. In addition, the model makes an academic contribution in terms of addressing organisational aspects in the context of an operational excellence initiative over time. The dynamic time aspect allows for an improved understanding of operational excellence. So far, no other approach has demonstrated such a holistic, company-wide character as operational excellence and continuous improvement have in an economic sense. By comparison, logistics established itself as a separate discipline in

the 70s, but logistics did not influence the normative level in companies. In contrast operational excellence addresses precisely this normative level and attempts to achieve a culture of continuous improvement. Based on the St.Gallen operational excellence understanding, operational excellence is defined as "*Operational Excellence (which) constitutes the continuous pursuit of improvement of a production plant in all dimensions. Improvement is measured by balanced performance metrics comprising efficiency and effectiveness, thus providing a mutual basis for an improvement evaluation"* (Friedli et al., 2013, p. 24). With the institutionalisation of the subject of an operational excellence support unit, organisational aspects replace a missing part in a generic operational excellence management. The operational excellence support unit is first defined in this thesis as a "Dedicated operational excellence team responsible for all operational excellence relevant activities including execution, enabling, coordination, and communication". The integration of organisational aspects, in particular the organisation of an operational excellence support unit into the St.Gallen operational excellence helps further develop the well-established understanding of operational excellence and support the infrastructural discussion in literature.

Practical contributions. In practice the organisation of an operational excellence support unit seems to be intuitive but when it came to using this actively, in the past at least this was often associated with a certain lack of knowledge from a systematic and effective perspective. Given the fact that single approaches were known to be lacking in sustainable implementation it is highly relevant from an industry perspective that corporate operational excellence initiatives are better understood. A compendium, based on the St.Gallen understanding of operational excellence and a guideline for setting up, adapting, and optimising an operational excellence support unit over time helps operation managers to overcome that challenge. The model developed supports managers and helps them take the relationship of continuous improvement and organisational structures into consideration when understanding, designing and adapting the operational excellence organisational structure over time. In consequence, the model is applicable at different stages of an operational excellence initiative. Overall, the model visualises and maps the organisational structure of an operational excellence support unit in different specifications and in its corresponding activities. The consolidation of successful practices, the theoretical knowledge gained and the generic management model developed all allow for final conclusions to be drawn on how to direct an organisation towards continuous improvement and how to embed operational excellence in an organisation. The developed management guidelines should prove to be an enabling factor for practitioners therefore, and provide operations managers with a lever at

hand to ensure the success of an operational excellence initiative. In practice, the value of the descriptive model in particular, is to structure the discussion in companies and to promote a comprehensive view of an operational excellence support organisation and an operational excellence structure in the long-term. The relevance of providing structured knowledge on operational excellence with adaption over time is based on the dynamic understanding of continuous improvement. It is thought that practitioners will benefit from using the results of this research in planning their operational excellence initiative from an organisational perspective with insights for the tasks of a newly established operational excellence support unit. Having a kind of reference organisation of the operational excellence support unit serves as an orientation. This approach needs to be understood as a conceptual development by raising the operations managers' awareness for the professionalising of operational excellence. The model has a certain level of for the first time view on the operational excellence support unit, as well as providing confirmation of the practical reality. If the potential of operational excellence is to be unlocked, information on different set-ups in practice with regard to both the operational excellence organisation and an operational excellence structure is essential, which is why they find their presentation in this thesis.

7.3 Critical reflection

The following section attempts to reflect on the results of the thesis according to the RQ initially stated in Chapter 1. The RQs were answered to the best of the author's knowledge and with the available resources; however this is not to say that the results do not demand critical reflection attention.

The main RQ was "How should an operational excellence support unit in the pharmaceutical industry be designed to support Continuous Improvement?" This was answered by introducing the model and providing guidance for management. The application in the pharmaceutical industry was shown with the three cases. A differentiation as to whether the organisation form of the company implementing an operational excellence initiative is a functional, geographical or matrix organisation was not made.

RQ a) "What are the drivers for and barriers to continuous improvement?" This was answered in Chapter 3 and 4 following extensive research of the literature on barriers in change processes and of TPM, TQM, JIT, and continuous improvement change initiatives in particular. The results were enriched with practical insights from interviews as well as existing data from the St.Gallen operational excellence database. The summarised implications draw on existing theoretical knowledge and practical problems of managers dealing with operational excellence. Here it is critical to emphasise that

drivers and barriers are always individual and so depend on the specific situation a company faces at the very moment it decides upon an operational excellence initiative.

RQ b) "What functions should an intra-organisational operational excellence support unit have to fulfil?" This research question was addressed in Chapter 4 by introducing a model and in Chapter 5 in light of the insights gleaned from the cases. The question's starting was the general management function based in organisational literature from Chapter 3. Empirical data from the focus group, several on-plant tours and interviews with operational excellence managers, and cross-industry interviews delimited the number of functions to a critical and relevant Figure as well as guaranteeing their validation in real industry settings. Key here was the differentiation in practice between the functions of in-house consultants, guidedance and line managers, as well as the influence of external consultants who support an operational excellence implementation. Which function each role is responsible for conducting is company-specific.

RQ c) "How are intra-organisational structural mechanisms shaped to support continuous improvement?" Findings here were based on interviews, case studies and from other, general fieldwork, all of which helped establishing a descriptive approach for the management of the operational excellence support unit. In this case it is important to remember that many structural mechanisms exist in the organisational literature and that the operationalisation of the design parameters of an operational excellence support unit can be performed according to different specifications. In this thesis, specifications were selected on a best fit with the characteristics of an operational excellence initiative, including empirical data from interviews with operations managers to reflect the chosen dimension and its development over time.

RQ d) "How should the Operational Excellence support unit be adapted over time?" This was also answered in Chapters 4, 5, and 6. The theoretical argument was made in Chapter 3. In this case it is key to point out that the future cannot be predicted and is often influenced by external aspects that cannot be considered in advance. The knowledge required to provide a satisfactory answer to this question was generated using retro-perspective analysis.

In addition, the author acknowledges the fact that different schools of operations management have evolved, each with their own view on improvement initiatives and their own well-defined principles, definitions, and ideas as to how best to run an organisation. For example, TQM research claims that TQM is a holistic management philosophy, kaizen researchers that their studies consist of different elements while lean production researchers claim to have holistic characteristics. Same can be found

in organisation theory where theorists from a school cite each other's works commonly, but usually ignore the work from other schools or even mention them in a negative manner only (Shafritz, Ott, & Jang, 2011). It is clear that everybody will find arguments to justify their own approach just as it is obvious that researchers on kaizen will not abandon their particular views thereby 'destroying' their life's work. Essentially, consideration always needs to be given to the perspective or school researchers are using as their unit of analysis. The St.Gallen operational excellence understanding and the author assume that Toyota contribute and is a forerunner of the lean paradigm, that lean production and WCM contributed to the evolution of modern improvement approaches of operational excellence, whereby the underlying philosophy is always to continuous improvement of existing standards. The evolution in operations research shows the actual trend leans towards researching corporate improvement initiatives. These have a continual character and consist of lean production principles, methods and tools with continuous improvement as the underlying fundament. This view represents that improvements need to be conducted in a continuous way. There is no black or white: grey is the colour of choice. It is important that practitioners are aware of these circumstances and do not simply copy a system. "*In Japan, or anywhere, kaizen – or continuous improvement – means whatever the speaker wants it to mean. Almost any effort to improve processes can be labelled kaizen, and antecedent's practices have a long history"* (Laraia et al., 1999, p. 25). In the end an improvement initiative with its organisation, principles, methods, and tools needs to fit the company's environment, existing terminology, and gained experiences of the employees in the past.

7.4 Limitations and future activities

This thesis has several limitations in both its theoretical foundations and practical applications.

Methodology. The theoretical foundation has certain limitations as in the contingency theory only the internal fit is considered, and external contingency factors are excluded. A major methodological limitation of the thesis is the focus on qualitative data with three cases and additional interviews. This methodological design makes it difficult to argue for a general validity. In addition, the empirical focus in the cases is only set on the pharmaceutical industry.

Literature. Even in a systematic literature review there is a risk of excluding papers that can be beneficial for the research; in any case, if this occurred in the thesis at hand this was not the author's intention. By following the approach based on vom Brocke et al. (2009), the author made an effort to limit this risk and by making the literature re-

view as transparent as possible. Maybe one reason for the relatively low quantity of research found stems from the underlying St.Gallen understanding of operational excellence and the requirement of corporate improvement initiatives with a multi-plant improvement programme.

Model and practice. The model can be criticised in two aspects. First, the fact that the operationalisation of the operational excellence support unit has only four design parameters. There are, without doubt, additional dimensions available in the literature. Second, an overtime perspective is challenging to demonstrate and the introduced stages suggest an ideal cycle as the model delineates the characteristic of continuous improvement with the successive standardisation and improvement phases. The cases were selected based on approachability, accessibility and subjective judgments of success in continuous improvement as a result of project work collected and existing data access of the research group. The companies in the sample represented the pharmaceutical industry only and an operational excellence deployment in other industries may be different. The author made an effort to counteract this fact by conducting interviews with manufacturing companies from other industries.

These limitations also provide a path to future research possibilities, however. Most notable would be the testing of the model in other industries and by adding external contingency factors. A further contribution to future research would involve a more quantitative setting in order to test the generalisability of the model. This implies analysing the performance of different organisational set-ups and patterns. A further, in depth view could be taken with regard to the capabilities of the operational excellence support unit employees on different hierarchical levels. This is a point with increasing relevance in light of a workforce that is becoming ever more heterogeneous. The thesis already makes a contribution to the institutionalisation of operational excellence and its support unit but there are future research opportunities with an eye to establishing operational excellence by institutionalising support processes according to existing standard processes in supply chains. One thing is clear – the continuous improvement of existing processes and its organisation on corporate and plant level is and will be the core of any operational excellence initiative – now and in the future.

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Appendix

Appendix A: Interview guideline (excerpt).....XXVIII
Appendix B: Interview guideline – Discussion of model (excerpt).....XXXIII
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Appendix A: Interview guideline (excerpt)

Interview Guideline

Unlock the potential of OPEX with a purposeful and structured OPEX support team

Nikolaus Lembke

Institute of Technology Management

University of St.Gallen

St.Gallen, 2014

General Introduction

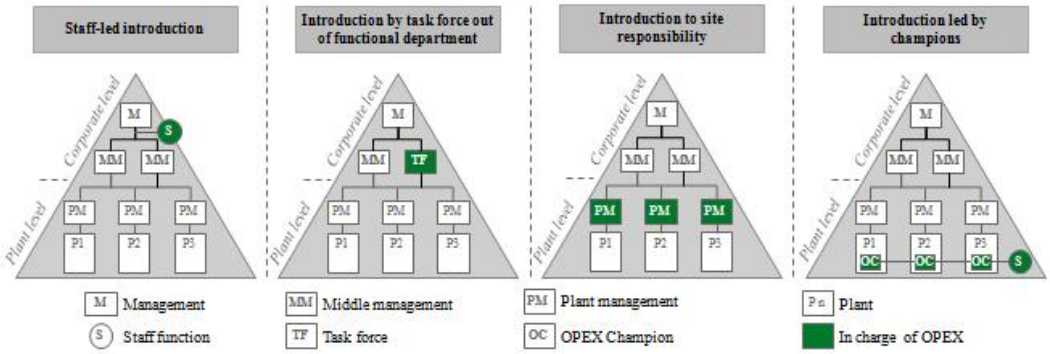
- Introduction of the interviewer and the interview partner
- General Information:
  - Goals, procedure and schedule of interview
  - The number and selection of respondents (overview what is coming)
  - Main topics of conversation
  - Management of the evaluation (especially of: confidentiality)
- Opportunity for questions

OPEX Introduction

1. When did you start to implement OPEX (e.g. also an initiative under the name lean)?

Corporate level _____ *Site level* _____

2. How did your OPEX introduction organization look like?



3. How many FTEs were in charge of OPEX at the introduction? _____

4. How successful would rank your OPEX implementation: *Not successful* ○ ○ ○ ○ ○ ○ ○ *Very successful*

4 ©ITEM-HSG

OPEX Introduction

5. What were the activities of the OPEX support team?

Corporate level and site level

_____

_____

6. What requirements had the corporate OPEX support department to fulfil?

_____

_____

7. What were the most hindering barriers?

_____

_____

8. What are the most promising potentials of OPEX and why did you launch an OPEX initiative?

_____

_____

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Organisational Structure of an OPEX Support Unit

9. What are the most important organisational structure dimensions for design an OPEX support unit?

- ☐ Management span of control
- ☐ Number of hierarchical levels
- ☐ Level of standardization
- ☐ Level of centralization
- ☐ Degree of delegation
- ☐ Degree of participation
- ☐ Degree of self determination
- ☐ _____
- ☐ _____

10 . Do you plan to change the set-up of your OPEX support unit over time? If so, to what extend?

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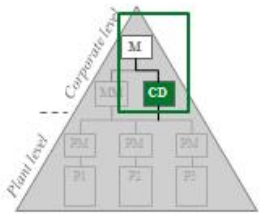
OPEX Support Team today – Corporate Level

11. How does the corporate OPEX set-up look like today?

A) **Staff-led sustaining**

B) **Sustaining led by champions**



C) **Combination** (please indicate)

12. How many FTEs were in charge of OPEX today on corporate level? _____

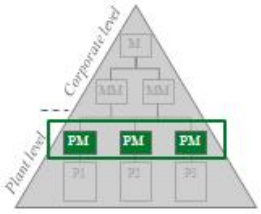
13. What is the task of the OPEX team on corporate level?

7 ©ITEM-HSG

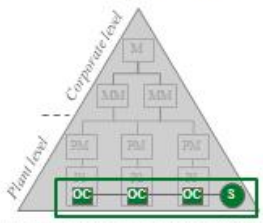
OPEX Support Team today – Plant Level

14. How does the plant OPEX set-up look like today

A) **Staff-led sustaining**



B) **Sustaining by functional department**



C) **Combination** (please indicate)

15. How many FTEs are in charge of OPEX at plant level (average?) _____

16. What is the task of the OPEX team on plant level?

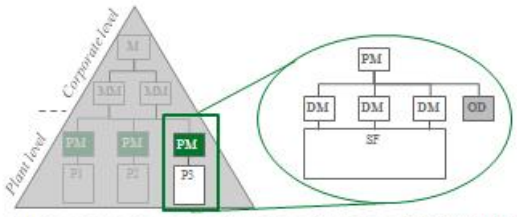
8 ©ITEM-HSG

How does the Plant Organization look like in detail?

17. Do you have a dedicated OPEX team on plant level? ☐ Yes ☐ No

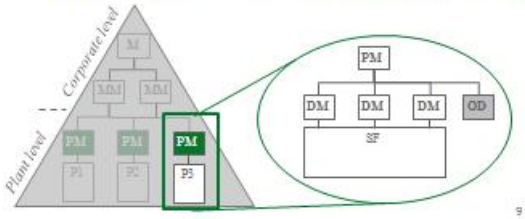
If no, which department is in charge of OPEX? _____

18. What departments deal with OPEX (work with OPEX)?



☐ Production ☐ Maintenance
☐ Quality ☐ Purchasing
☐ Maintenance ☐ Planning
☐ Logistics ☐ Admin
☐ _____

19. In what departments is at least one person placed who is in charge of OPEX?



☐ Production ☐ Maintenance
☐ Quality ☐ Purchasing
☐ Maintenance ☐ Planning
☐ Logistics ☐ Admin
☐ _____

9 ©ITEM-HSG

OPEX Structure

21. In which official committee, regularly meetings is OPEX on the agenda?

22. Is there a established exchange between corporate and plant OPEX team?

Varia and open points to discuss

11 ©ITEM-HSG

Short Appraisals: To what Extend do the Statements apply

The organization has a large number of written rules and policies …

The participation of OPEX managers in strategic planning is …

We have written rules and procedures that guide quality improvement efforts …

We have written rules and procedures that show how workers can make suggestions for changes …

Number of functional areas that are the responsibility of the teams is ….

Our workers have the authority to correct problems when they occur ….

Hierarchical distance between OPEX decision-makers and senior executives who make more global decisions on an organization-wide basis …

What is the position of the top OPEX manager …

The number of subordinates who report to a single superior …

There are many management layers between plant operators and the CEO …

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Appendix B: Interview guideline - Discussion of model (excerpt)

Interview Guideline

Enabling Operational Excellence with organisational Organisation

Nikolaus Lembke

Institute of Technology Management

University of St.Gallen

St.Gallen, 2015

General Introduction

Introduction of the conversation

- Introduction of the interviewer and the interview partner
- General Information:
  - Goals, procedure and schedule of interview
  - The number and selection of respondents (overview what is coming)
  - Main topics of conversation
  - Management of the evaluation (especially of: confidentiality)

Opportunity for questions

General Idea and Key Question

Key question

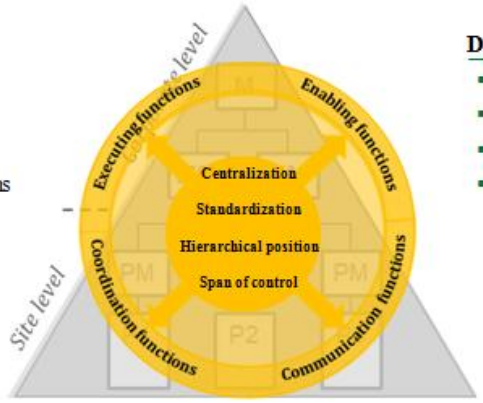
How should an OPEX organisation be designed to support continuous improvement?

General idea

Unlock the potential of OPEX with the right organisation in place!

Necessary functions

- Executing functions
- Coordinating functions
- Enabling functions
- Communicating functions

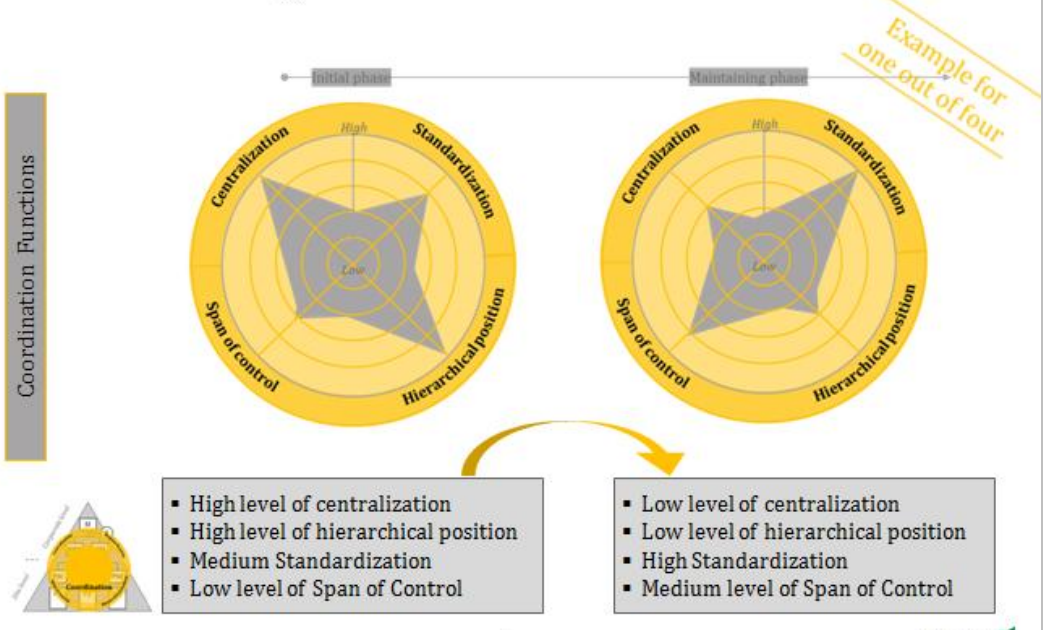


Design variables

- Centralization
- Standardization
- Hierarchical position
- Span of control

3 ©ITEM-HSG

Different Configuration for each Function over Time



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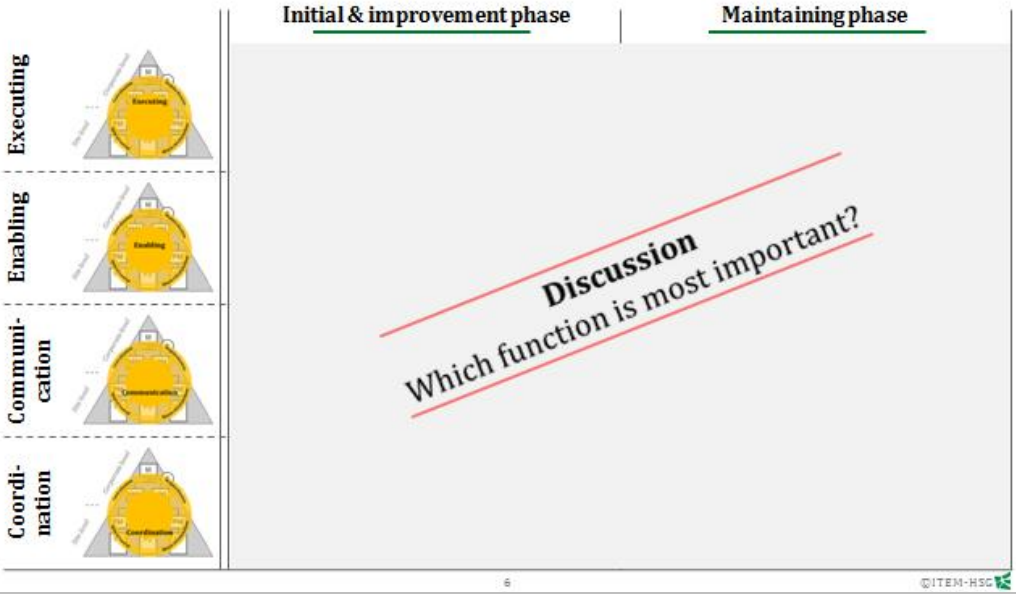
OPEX is based on the CI Understanding

Initiating, maintaining and improving are based on the CI cycle of PDCA and SDCA which contribute to an higher level of improvement over time

5 ©ITEM-HSG

How Focus on Functions could look in different Phases



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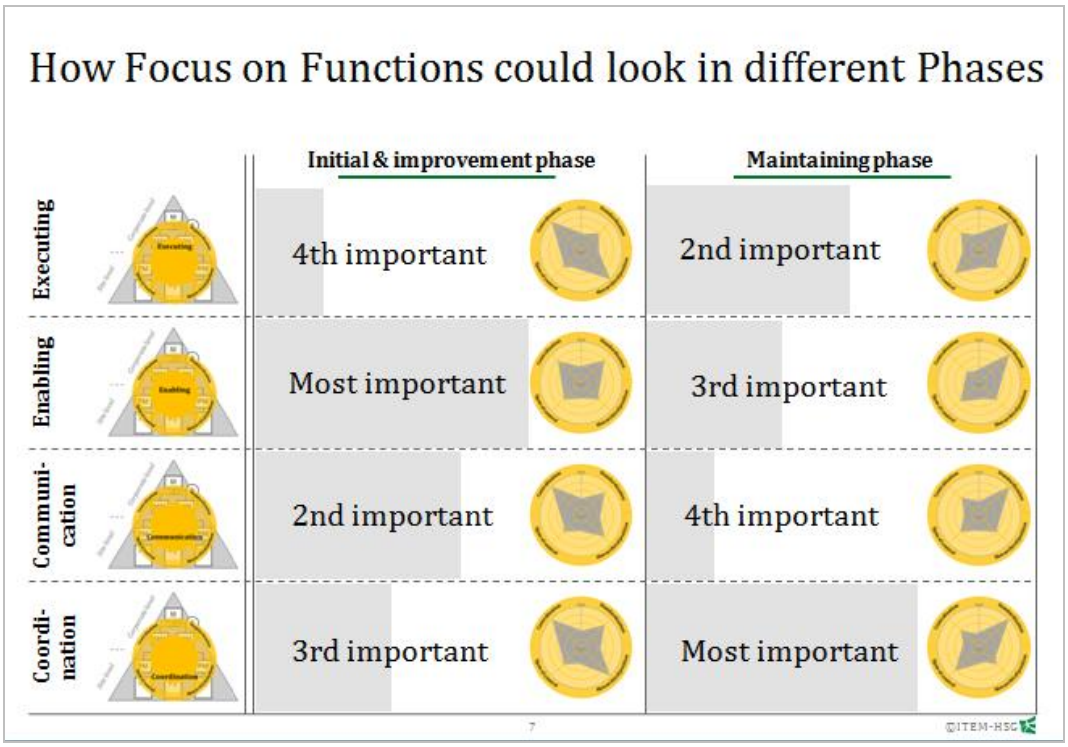
How Focus on Functions could look in different Phases
Initial & improvement phase
Maintaining phase
Executing
4th important
2nd important
Enabling
Most important
3rd important
Communi-cation
2nd important
4th important
Coordi-nation
3rd important
Most important
7
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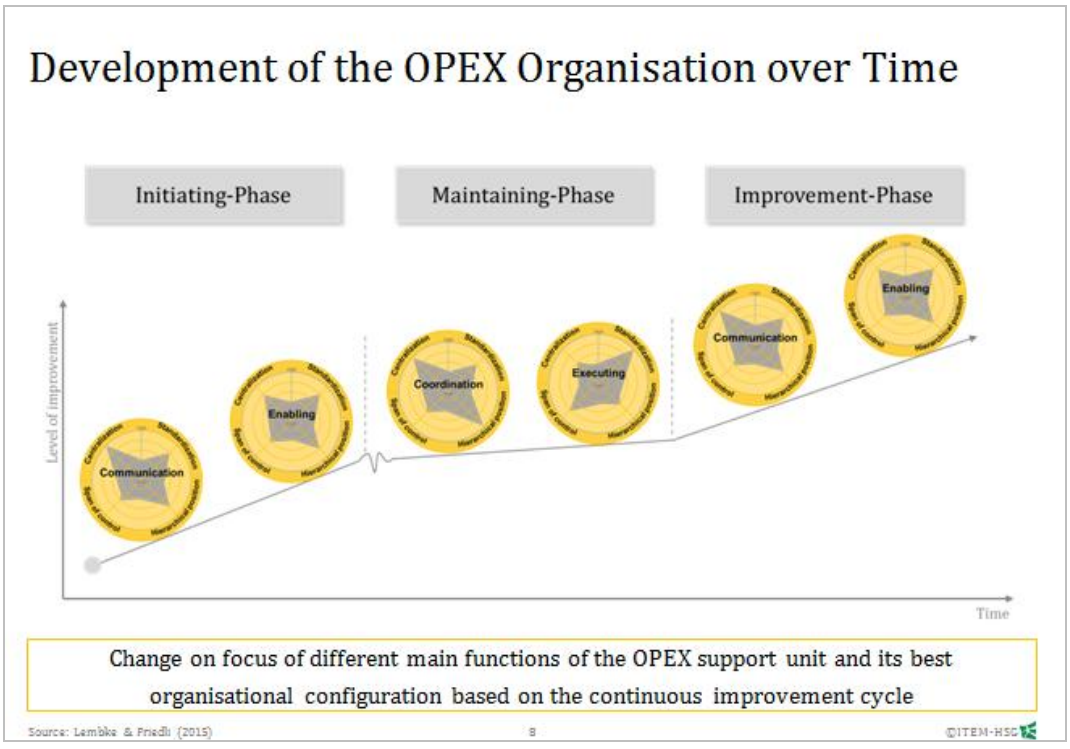
Development of the OPEX Organisation over Time
Initiating-Phase
Maintaining-Phase
Improvement-Phase
Level of improvement
Time
Communication
Enabling
Coordination
Executing
Communication
Enabling
Change on focus of different main functions of the OPEX support unit and its best organisational configuration based on the continuous improvement cycle
Source: Lambka & Friedli (2015)
8
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A holistic OPEX Organisation Model

A model to consciously discuss about the systematic and effective organisation of an OPEX initiative on corporate and site level with 12 different specifications which support the different functions in different phase on an optimal way

Source: Lambka & Friedli (2015) 9 ©ITEM-HSG

Appendix C: Overview empirical data base

Company	Corporate Headquarters	Employees	Revenues in Mio	Number of manufacturing sites
Pharma Company I	Israel	43.000	20,272 $	66
Pharma Company II	United States of America	97.000	49,600 $	55
Pharma Company III	Germany	47.700	13,317 €	20
Pharma Company IV	United States of America	19.000	20,100$	no data
Gx Pharma Inc.	Germany	26.000	9562 $	30
Speciality Pharma Inc.	Japan	2.000	¥1,118.2 billion	10
R & D Asia Inc.	Switzerland	30.000	no data	4
Global pharma company Asia	Japan	31.000	1777,8 bn yen	25
CxO Pharma	Germany	800	75 Mio €	3
Global pharma company Europe	Ireland	21600	23 bn $	40
Aquired Pharma Company	Russia	3200	1,5 bn $	3
Medical Care	Germany	52.000	5.429,60 €	no data
Automotive Assembly	Germany	4.000	3.200 €	21
Automotive Supplier I	Germany	131000	36,600 $	313
Automotive Supplier II	Germany	23.000	5,21 €	no data
Automotive Supplier III	Germany	582	133,6 Mio €	3
Automotive Supplier IV	Germany	290.000	48.951 €	no data
Automotive Supplier V	Germany	82.294	12.124 €	74
Truck Company	Sweden	42.000	92,051 SWED Kronen	10
Mechanical Engineering	Germany	10.000	2.717 €	10
Machine Tool Inc. I	Germany	1800	374 Mio €	2
Machine Tool Inc. II	Liechtenstein	22.000	4,497 Mio CHf	12
Agricultural Company I	Unites States of America	20.000	9723,7 $	17
Agricultural Company II	Germany	11.000	3,823 bn €	9

Appendix D: Curriculum vitae

Name	Nikolaus Lembke
Place of birth	Kaufbeuren (DE)
Date of birth	September 2nd, 1982
Nationality	German

Practical Experience

2011 - 2015	University of St.Gallen (CH) Institute of Technology Management Research associate
2008 - 2011	MBtech Consulting GmbH (DE) Internship, diploma thesis, working student
2007 - 2008	Fraunhofer-Institute for Production Technology & Automation (DE) Student research assistant
2007 - 2008	Fraunhofer-Technologie-Entwicklungsgruppe (DE) Student research assistant

Education

2012 - 2017	University of St.Gallen (CH) PhD program in Business Administration
2003 - 2011	University of Stuttgart (DE) Technology Management studies (Dipl.-Ing.)
2008	Nanyang Technological University (SG) Exchange semester
1993 - 2002	Jakob-Brucker-Gymnasium, Kaufbeuren (DE) Abitur (General qualification for university entrance)