Affirmation

I, **Mario Müller**, born on March 27th 1981, in Wiener Neustadt, declare,

1. that I composed my master's thesis independently, have not used other references than stipulated and have not used any illegitimate support,

2. that I have not presented my master's thesis in any form or part of an exam neither domestically nor abroad,

3. that I, if the work concerns my company or employer, obtained agreement from them regarding title, form and content of my master's thesis.

Wiener Neustadt, October 2017

The Role of Human Resources in Lean Transformations

Master's thesis for obtaining the academic degree

Master of Business Administration (MBA)

in the study program

Professional MBA Industrial Management

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Submitted by

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“It seems that perfection is attained not when there is nothing more to add, but when there is nothing more to remove.”

Antoine de Saint Exupéry (1900-1944)

in *Terre des Hommes* (1939)

For my daughter Luisa

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List of Abbreviations

A3	A3 Paper Format for Structured Problem Solving
CAQDAS	Computer Aided Qualitative Data Analysis
DNA	Deoxyribonucleic Acid
IMVP	International Motor Vehicle Programme
JIT	Just in Time
KPI	Key Performance Indicator
HR	Human Resources
HRM	Human Resource Management
LAN	Local Area Network
LPI	Leadership Practices Inventory
MIT	Massachusetts Institute of Technology
NVA(A)	Non-Value Adding (Activity)
OEE	Overall Equipment Effectiveness
PDCA	Plan – Do – Check – Act
QM	Quality Management
SBU	Strategic Business Unit
SOP	Standard Operation Procedure
SMED	Single-Minute Exchange of Die
TPM	Total Productive Maintenance
TPS	Toyota Production System
VSM	Value Stream Mapping
VA(A)	Value Adding (Activity)
WCM	World Class Manufacturing
WIP	Work in Progress

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Executive Summary

The following master's thesis examines the role of HR systems and practices during Lean transformations. The terms "Lean manufacturing" and "Lean management" were first coined by Womack et al. (2007), in their 1990's publication "*The Machine that Changed the World*" . They researched on the performance gaps between Japanese and US auto manufacturers and found several practices, which made the Japanese firms significantly more productive. Those practices were partially known before, such as "Just in Time" production, but partially new and tailored to the specific needs of Lean companies. A company that received a lot of attention since the release of the book was Toyota, which was at the forefront of developing these innovative practices, which became known as the Toyota Production System (TPS). Latest with the publication of "*The Machine that Changed the World*" companies and scholars got fascinated by the supremacy of Lean and many tried to adopt it. However, most of the endeavors to transform companies fail. It seems not to be effective enough trying to emulate the visible parts of the Lean system (tools, practices and principles). Rather, it needs a holistic approach that also takes the invisible parts into account, such as routines and culture. Both of the latter are heavily influenced by people. Since HR is closely associated with managing people, I focused my research on the role of HR in Lean transformations. My research question therefore is: **"Which HR systems and practices can contribute to the success of sustainable Lean transformations and how do they have to be designed?"**

To provide answers, I decided to conduct a qualitative study amongst eight industrial companies, which have transformed successfully from traditional towards Lean manufacturing. To get a rich data set, I had to get well-informed interview partners, who not only were familiar with Lean practices, but ideally have experienced the transformation first hand and are also involved in certain HR matters. Ultimately, eight knowledgeable managers, who shared detailed information openly, were interviewed. Before conducting the interviews however, I carefully designed the research process, paying special attention to avoiding biases and to gather reliable and valid data. Before acquiring the first datasets (coming mostly from interview transcripts and supplementary material for triangulation), it was important to select a methodical framework, which would allow for a flexible, meaningful qualitative approach. Having in mind that this would be an exploratory, inductive research, I evaluated qualitative content analysis methods and the Grounded Theory framework. It turned out that the Grounded Theory approach was much more suitable for my research design and need, since it builds theory from data and takes context very much into consideration – as opposed to qualitative content analysis, which aims to reduce material and is theory driven. As an inexperienced scientific researcher, I decided to use a computer program to aid me with the qualitative analysis of the gathered data. In order to use the software in line with the

Grounded Theory framework, I needed some one-on-one consulting, which turned out to be very valuable for the entire research process.

After a thorough evaluation of the material, I was able to code important concepts and I also visualized my findings in the form of networks. The codes were developed on the basis of quotations from the interviews and reflect a certain statement or fact. Those codes were then put into relation with another and finally, patterns emerged. The patterns, also called categories, comprise a number of underlaying codes and thus make the category easier to grasp. Overall, I identified 11 categories, which I divided into two sections: (1) key drivers and (2) facilitators.

The "key drivers" segment holds seven concepts, which are: (1) Career, (2) HR Processes, (3) Leadership, (4) Pay Systems, (5) People, (6) Recruitment and Selection, (7) Training. In the further course of the thesis, I focused on explaining what characterizes the seven key drivers and how they can be used in Lean transformations.

In the last step, I checked if my findings had any equivalent in scientific literature. I found that High-Performance Work Systems (HWPS) cover six out of my seven identified categories. The only aspect, which was not addressed by HWPS was leadership. The High-Performance paradigm is fragmented and also the different terms can be confusing. Therefore, I present the most widely used terms and try to describe them, so it gets more transparent, what they really entail. In essence, all HWPS use some kind of bundling, which means that they bundle practices in a way that the sum of the measures is greater than each individual part. The difficult part is, however, to select and bundle practices which indeed have an impact on the firm's performance. There are two lines of thought: The universalist and the contingency approach. The universalists claim that a certain bundle works in any setting (vehemence and intensity with which HR practices are deployed are more important than organizational fit), whereas the contingency approach says that only a distinct combination will work under specific conditions (internal contingency). I provide extensive lists, which help understanding both viewpoints and the corresponding practices. To provide a holistic perspective, I also included a short section about strategic approaches which emphasize the people-centric view of both HPWS and Lean. Most notably, I discuss the Resource Based View (RBV) framework. Another central element is the question of leadership, where I highlight one particularly suitable leadership style – the transformational leadership.

I end the paper with a discussion on the findings and its implications, especially for HR departments. One would expect that they play an integral part in Lean transformations, but as my research and other literature reveals, HR is mostly playing an administrative role and not the expected strategic role. If HR managers understand the need of Lean firms and change their architecture and offerings, they can be a true catalyst of Lean transformations. This paper provides a lot of practical and academic advice, how the repositioning can be successful.

Abstract

In this master's thesis, I present findings on the role that Human Resource systems and practices play, when companies transform from traditional manufacturing to Lean manufacturing. Lean is a very well documented management system, but often described in a purely technical manner, as if only by the simple application of various tools, a transformation could be achieved. Practice however shows that the majority of Lean transformations fail. I was therefore researching on the "human element" of Lean transformations and how it can be managed successfully. A profound qualitative study delivered valuable insights regarding "key drivers" of Lean transformations. The findings are then compared to existing literature, where conclusions are drawn and recommendations for actions are provided. Three dominant themes span across the research: people, bundles and continuous improvement. Measures must be carefully selected and combined in order to achieve a successful Lean transformation and sustained superior firm performance.

Keywords:

Lean Management, Lean Manufacturing, Human Resources, HR, HRM, High-Performance, HPWS, HR Bundles, Lean Bundles, Grounded Theory

1. Chapter – LEAN

1.1. Introduction and Motivation

In times with increased competition and diminishing margins, companies are looking for ways to improve their business performance and to gain or maintain a competitive advantage. One of these ways can be found in Lean.

Yet, it is not an easy undertaking to transform a company from traditional production to Lean production[1]. Bhasin and Burcher (2006) found ample research, which suggests that less than 10% of Lean transformations are successful. To become Lean, it is not enough to exclusively apply an extensive number of Lean tools, or as they put it: "not only is it necessary to implement most of the technical tools, but an organisation's culture needs transforming too" (Bhasin and Burcher, 2006, p. 56) Further indications as to where the key for successful transformations can be found is provided when they assert: "Human skills such as communication, problem solving, teamwork and leadership debates (Philips, 2002), are vital for success and is resolute that people and cultural change are predominant reasons for lean failures" (Bhasin and Burcher, 2006, p. 65) Art Byrne, the author of "*The Lean Turnaround*" also states that "At the heart of a lean turnaround, you are really trying to transform your people" (Byrne, 2012, p. 62)

Lean is a generic term that was coined by Massachusetts Institute of Technology's (MIT) research program titled the „International Motor Vehicle Programme" (IMVP) which was launched in 1979 and delivered groundbreaking results 11 years later when James P. Womack et al. published their findings in "*The Machine that Changed the World*" (Womack et al., 2007)[2]. Their research focused on the performance gap between Japanese automotive industries and Western ones. The basis of their data was an analysis of 52 assembly plants in 14 countries. The five-year, five-million-dollar program found that Japanese plants were significantly more productive, because of their production and management style, which the authors called "Lean". Most notably, still today, the car manufacturer Toyota was at the center of attention, as they have, arguably, contributed the most to what we know today as Lean.

Initially, Lean only referred to the manufacturing part, but later the term Lean also included the management style. Today, there is a multitude of Lean derivatives, such as Lean Leadership, Lean Logistics, Lean Production, Lean Organization, Lean Thinking, Lean Service, Lean Planning,

[1] Lean is not limited to be applied in a production setting, but can also be applied in other sectors
[2] First published in April 1990

Lean Reporting and so on. During this master's thesis, I use Lean as a summary for all those areas, if I do not mention a specific aspect of the Lean approach.

There is also criticism around "*The Machine that Changed the World*". Womack et al. claimed that the cultural and societal context was not the decisive factor for the superior performance of Japanese manufacturers:

> Thus we devote our attention in the pages ahead to a careful explanation of the logic and techniques of Lean production. We pay little attention to the special features of Japanese society – the high savings rate, near universal literacy, a homogenous population, the often alleged inclination to subordinate personal desires to group needs, and the willingness, even the desire, to work long hours – which some observers credit for Japanese success, but which we believe are of secondary importance. (Womack et al., 2007, p. 7)

This is thought-provoking, as the researchers already knew about Taiichi Ohno's book, who is said to be the co-inventor of the Toyota Production System (which stands for Lean production more than any other system), where he stresses that everything depends on the will and wanting of the employees (Zollondz, 2013, pp. 91-92)

On the other hand, it is understandable that it is a lot easier to research on and describe the hard facts, than it is to grasp the complex human aspect. Mike Rother (2009) boiled it down to the essence:

> In the ongoing effort to understand and describe what Toyota is doing, most books provide lists of the organization's practices or principles. The individual points may all be correct, yet making lists circumvents explaining how Toyota manages people, as our now 20 years of unsuccessfully trying emulate Toyota's success shows, such lists are not actionable. This is because an organization's collection of practices and principles at any point in time is an *outcome* that springs from its members' routines of thinking and behavior. Any organization's competitiveness, ability to adapt, and culture arise from the routines and habits by which the people in the organization conduct themselves every day. It is an issue of human behavior. (Rother, 2009, p. XVI)

Lean is a collection of best practices, which a lot of companies worldwide have adopted, even before they were called "Lean". Without a doubt, Toyota was a trailblazer and to this day is one of the most looked-at companies when it comes to a holistic Lean approach. They mastered the adaption and execute the tools with great vehemence. Additionally, Toyota has invented methods that were needed for their exact business case, like SMED. But the vacuous application of tools is not enough – it requires a thinking and learning organization, a sort of general mindset and culture. Those are the parts, which are harder to grasp but seem to make all the difference. Mike Rother spent years studying Toyota and has published some outstanding books about the invisible parts, as displayed in Figure 1.

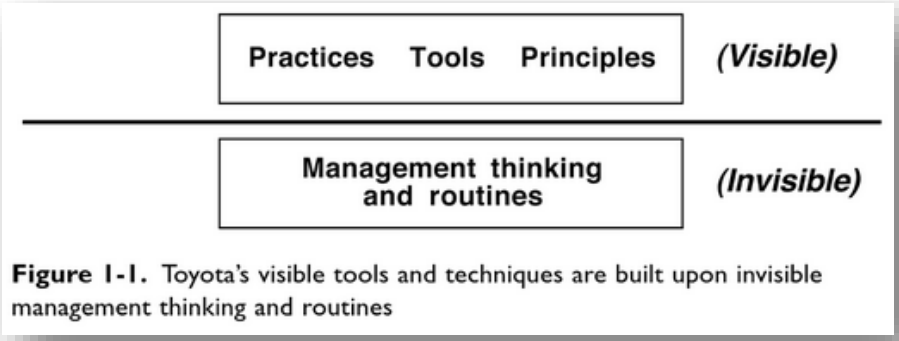

Figure 1-1. Toyota's visible tools and techniques are built upon invisible management thinking and routines

Figure 1: Visible and invisible parts of Toyotas Lean System. Source: Rother (2009, p. 5)

Although Toyota always practiced an open-door policy and did not hide their practices, other companies who followed the Toyota way were not nearly as successful. This is also reflected by Table 1 below, which highlights the enormous differences in the number of suggestions per employee across various plants and countries. This active involvement of all employees, from shop floor workers to top-management is the source of continuous improvement.

Summary of Assembly Plant Characteristics, Volume Producers, 1989 (Averages for Plants in Each Region)

	Japanese in Japan	*Japanese in North America*	*American in North America*	*All Europe*
Performance:				
Productivity (hours/veh.)	16.8	21.2	25.1	36.2
Quality (assembly defects/100 vehicles)	60.0	65.0	82.3	97.0
Layout:				
Space (sq. ft./vehicle/year)	5.7	9.1	7.8	7.8
Size of Repair Area (as % of assembly space)	4.1	4.9	12.9	14.4
Inventories (days for 8 sample parts)	.2	1.6	2.9	2.0
Work Force:				
% of Work Force in Teams	69.3	71.3	17.3	.6
Job Rotation (0 = none, 4 = frequent)	3.0	2.7	.9	1.9
Suggestions/Employee	61.6	1.4	.4	.4
Number of Job Classes	11.9	8.7	67.1	14.8
Training of New Production Workers (hours)	380.3	370.0	46.4	173.3
Absenteeism	5.0	4.8	11.7	12.1
Automation:				
Welding (% of direct steps)	86.2	85.0	76.2	76.6
Painting (% of direct steps)	54.6	40.7	33.6	38.2
Assembly (% of direct steps)	1.7	1.1	1.2	3.1

Source: IMVP World Assembly Plant Survey, 1989, and J. D. Power Initial Quality Survey, 1989

Table 1: Improvement suggestions per employee in different automotive plants. Source: Womack et al. (2007, p. 80)

Womack et al.'s work was certainly a milestone in understanding what Lean as an integrated management style and philosophy really comprises, although the findings and the book itself were not presented in an overly scientific manner and even involves some marketing lingo:

> In this process we've become convinced that the principles of Lean production can be applied equally in every industry across the globe and that the conversion to Lean production will have a profound effect on human society – it will truly change the world. (Womack et al., 2007, p. 6)

It would be counterproductive to selling a book or later a concept (Womack founded the Lean Enterprise Institute), if one would say the system could not be applied somewhere else with the same success. Womack et al. (2007) explained the fact that they wanted to make their findings available to the broader public and not to the scientific community only:

> We therefore decided not to write an academic report on our work, a dry summary of findings by a committee seeking a consensus. Instead, in the pages that follow, the three of us, as leaders of the Program, tell the story of how human society went about making things during the rise, and now the decline of the age of mass production, and how some companies have pioneered a new way of making things in the dawning age of Lean production. (Womack et al., 2007, p. 6)

"*The Machine that Changed the World*" was also not the first literature on Lean – only the first to call it that way. Years before, the term "Just in Time" was already widely used in the manufacturing world and Toyota's very own Taiichi Ohno published his book "*Toyota Production System: Beyond Large-Scale Production*", which entails a lot of details about the tools and methods at Toyota, already in 1988[3].

I believe it is important to critically reflect on the "standard reference" work of Womack et al., since even the authors made some concessions as to the correctness of the study. In the recent edition (year 2007) of "*The Machine that Changed the World*" they have included the original content of the first publication plus numerous pages with rectifications, where they, with hindsight, correct or alter their theories and conclusions in many points, but not with regards to the people aspect.

This is even more surprising as Toyota itself in "*The Toyota Way*", published in 2001, has postulated that their way is based on two key elements: continuous improvement and respect for people – see Figure 2.

[3] In fact the Japanese original under the title "*Toyota seisan hoshiki*" was already published in 1978 (Daiamondo-sha, Tokyo)

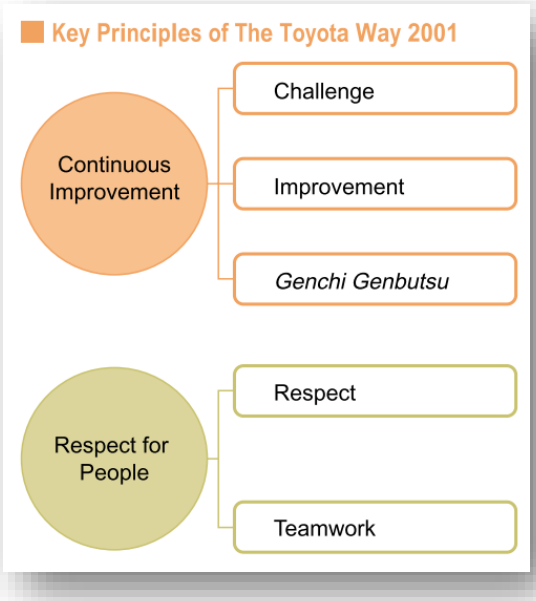

Figure 2: Dual Pillar system in "*The Toyota Way*", as published in the "Environmental & Social Report 2003". Source: Toyota (2003, p. 80)

It is striking that in comparison with the apparent artifacts like tools and techniques, the human element has received a lot less attention. It was because of this underrepresented, but highly relevant human factor, that I decided to pick up the Human Resources aspect as the focal point of this master's thesis.

1.2. Research Question and Structure

There is broad consensus amongst scholars and practitioners alike that people are key in successful Lean transformations, yet surprisingly most attention in literature is paid to Lean methods and the technical aspects but there is little research on the role of HR management during a Lean transformation. This is the research gap, I will address. I will take a holistic approach on the topic by conducting a qualitative study with Lean experts to explore, which work practices they have deployed and what the decisive elements from an HR perspective are. My research question therefore is:

> "**Which HR systems and practices can contribute to the success of sustainable Lean transformations and how do they have to be designed?**"

To be holistic and consistent, I structured this thesis into three chapters. Every chapter lays an important foundation for the following chapter. Thus, the master's thesis should be read in the proposed order. The chapters are structured as follows:

1. Chapter – LEAN
2. Chapter – RESEARCH
3. Chapter – HUMAN RESOURCE MANAGEMENT

1.3. History

To put Lean manufacturing into perspective one must consider the broader history of manufacturing. Before 1850 most manufacturing was craft manufacturing, characterized as "The craft producer uses highly skilled workers and simple but flexible tools to make exactly what the consumer asks for – one at a time." (Womack et al., 2007, p. 11)

Between 1850 and the early 1900's, some standardization evolved, like drawing conventions, tolerances and modern tool development. In 1911, Fredrick W. Taylor published the monograph titled "*The Principles of Scientific Management*" in which he approached work organization scientifically with maximum efficiency in mind and posted his four principals, which include concepts like the division of labor, time and motion studies and standardized work.

After World War I, Henry Ford picked up to those ideas and developed the moving assembly line and most importantly mastered the art of having consistent and interchangeable parts, which were easy to connect. These trailblazing concepts enabled him to be at the vanguard of what was called "mass production". Ford thereby solved to problem of high costs associated with craft manufacturing and was therefore able to provide an affordable car to an ever-growing number of customers. Womack et al. (2007, p. 11) describe this concept as "The mass producer uses narrowly skilled professionals to design products made by unskilled or semiskilled workers tending expensive, single-purpose machines. These churn out standardized products in very high volume." The key was a division of labor taken to the extreme. Work was broken down into smallest pieces that could be performed by unskilled workers – "As a result, the workers on the line were as replaceable as the parts on the car." (Womack et al., 2007, p. 30)

The system of mass production was highly successful in the automotive industry and spread to numerous other industries to this very day.

It must be said though that both craft manufacturing and mass production have significant drawbacks. In the case of craft production, the major problem is high cost. In the case of mass production, the main problem is a lack of flexibility.

In Japan in the year 1949, a company called Toyota was facing a severe crisis caused by collapsing sales, strikes and the resignation of senior leaders. In that time, Eiji Toyoda, member of Toyotas founding family, travelled to Ford's "Rouge" plant in Detroit to study their manufacturing processes. He returned to Japan three month later and concluded that "[…] there were some possibilities to improve the production system." *Toyota: The First 30 Years*, Tokyo: Toyota Motor Company, 1967, pp. 327-328 (in Japanese) as cited in Womack et al. (2007, p. 48). Together with his production genius, Taiichi Ohno, Eiji Toyoda laid the foundation to the "Toyota Production System" or TPS.

1.4. Prominent Persons and Protagonists

The development of Lean is strongly connected to important protagonists, who either laid a foundation, influenced, actively contributed, documented or studied the Lean phenomenon. The following timeline is an attempt to depict their impact on Lean in relation to time.

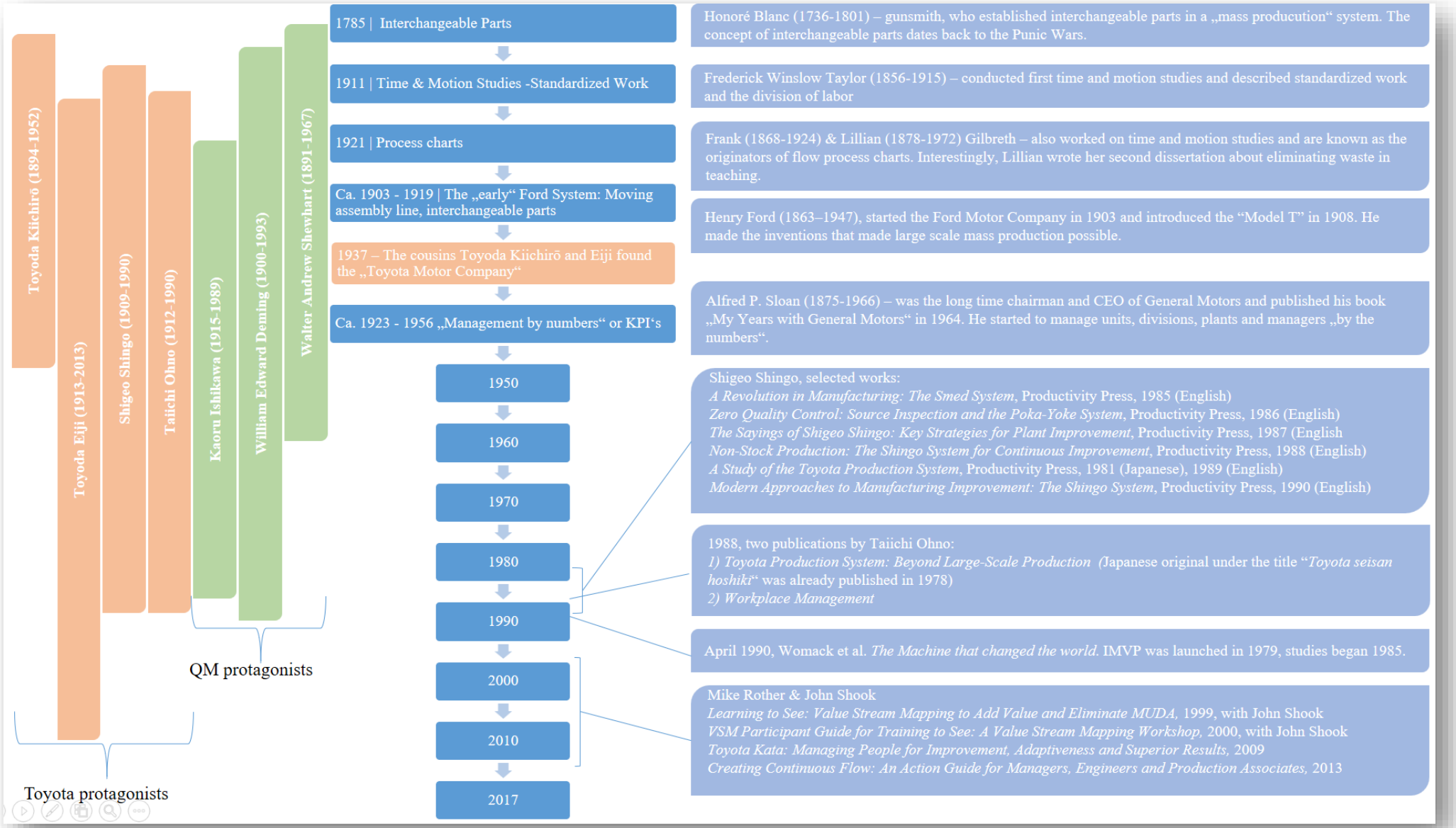

Figure 3: Lean protagonists and some selected works in historical context depicted with a timeline. Source: own creation

1.5. Principles

The very heart of Lean is continuous improvement, or “Kaizen”. The word itself is Japanese and is composed of two words: “Kai”, which means “change” and “Zen” which means “good” – see Figure 4 . Essentially, the meaning is “change for the better”, or continuous improvement. Although the concept of continuous improvement was not new at the time (see Figure 3, QM protagonists, especially Shewhart and Deming) it was embedded and run differently in Japanese companies. This may be explained by the origins of Lean, which are often associated with the Toyota in the 1950’s.

Figure 4: KAI and ZEN in Japanese letters/writing. Source: KaizenInstitute (2016), “What is Kaizen?”, https://www.kaizen.com/about-us/definition-of-kaizen.html, accessed 2016.09.24

Lean companies focus primarily on processes and only later on financial objectives. They know that positive financial outcomes are coming in “through the backdoor”, if the processes are good. If a company turns truly Lean, the typical results that can be expected are shortened lead times, less inventory, productivity gains, reduction in defects (higher first-pass-yield for example), reduction in floor space, improved gross margins, reduced working capital in relation to sales, increased growth and a team culture (Byrne, 2012, p. XiX).

Lean is very process oriented and aims to eliminate waste, or “Muda”. A way to make waste transparent is to perform a **v**alue **s**tream **m**apping (short: VSM) and to critically ask what is necessary and what could be eliminated from the process. In that context, value is often defined as what the

customer is willing to pay for[4]. It is very typical for Lean companies, to have that very customer centric view. So eliminating the waste (Muda), which the customer is not willing to pay for, is essential to be "lean". Waste can be found in every process. To fight Muda, Lean holds a variety of concepts and tools, which are presented in the chapter 1.6 "Lean Glossary".

Figure 5 provides a good visual example of what Lean sees as waste, or non-value adding activity (NVAA). Essentially, every step where a product or service is not processed, is non-value adding. The same logic is also applied to other areas, such as human work – unnecessary walking is also considered as waste, for example.

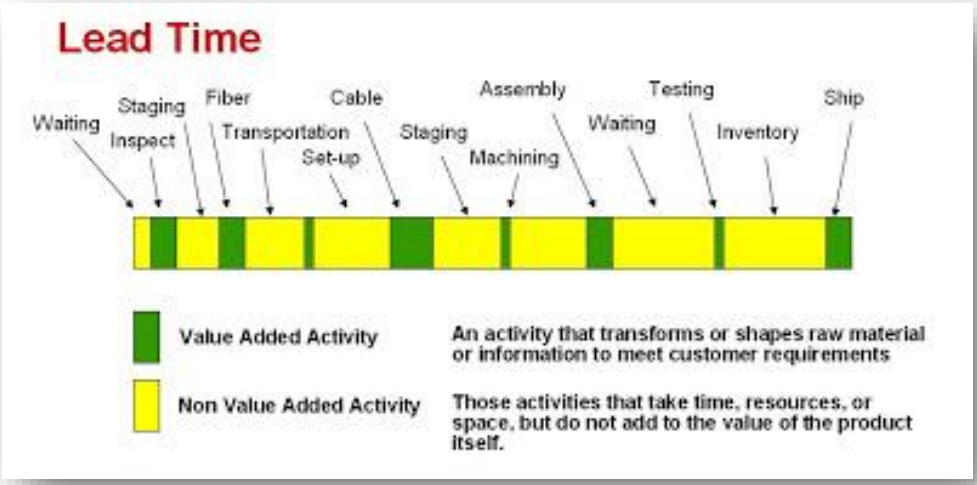

Figure 5: Classic distribution of Value Adding Activities and Non-Value Adding Activities in a Lead Time example. Source: McMahon (2009), "DOWNTIME and the Eight Wastes", http://www.aleanjourney.com/2009/10/downtime-and-eight-wastes.html, accessed 2016.09.25

In a traditional production, with traditional, engineering-driven approaches, one would focus on optimizing the value-added activities. As Figure 6 displays nicely, however, the non-value adding activities are by far the larger share of activities. Any improvement that can be done in that field will lead to a dramatic overall performance improvement, see Figure 6.

[4] See for example http://www.tmac.org/blog/blog/2011/11/03/value/, accessed 2017.10.13

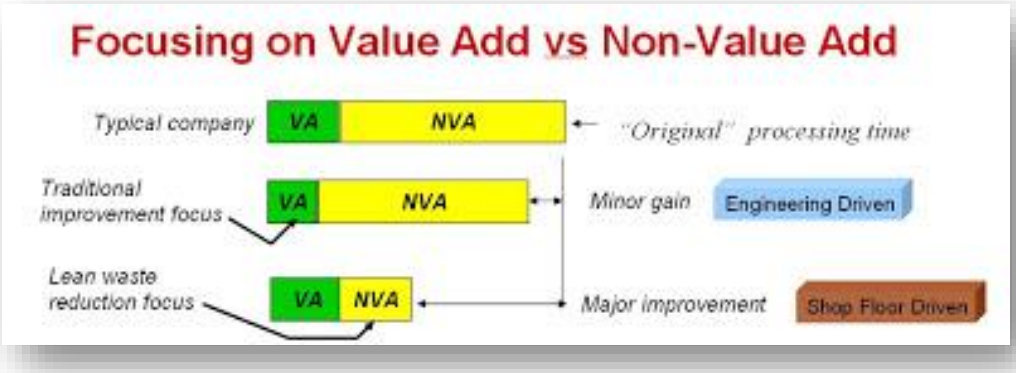

Figure 6: Different focal points between traditional and Lean producers with respect to improving processes. Source: McMahon (2009), "DOWNTIME and the Eight Wastes", http://www.aleanjourney.com/2009/10/downtime-and-eight-wastes.html, accessed 2016.09.25

1.6. Lean Glossary

The origin of Lean is highly visible in the technical terms – a lot of them are Japanese and although there are often translations of those words available, most people will use the Japanese words. In the following section I will introduce the main concepts and tools (in alphabetical order) which are directly relevant or have an impact on the themes discussed throughout this thesis.

1.6.1. Concepts

5S

Stands for **S**ort, **S**et in Order, **S**hine, **S**tandardize and **S**ustain. It is designed to keep workplaces clean and orderly, which is considered the basis for high quality work. Furthermore, things like tools can be found easily and therefore no time is wasted searching for it – consequently eliminating NVAA.

Andon

Is a visual management tool, mostly used on the shop floor to report problems in real time or call for assistance. Andon can be in the shape of a traffic light system (red: problem, yellow: low performance, green: everything okay), electronic displays and such. It is also quite common that workers for example pull a cord, when they detect a deviation from the standard, which stops the process until the desired state is reinstated. The goal is to immediately spot and address problems.

Bottleneck Analysis

Is performed to identify the process step(s) that limit the overall throughput. This analyzes is conducted throughout the entire value stream and not only in the production.

Cellular Manufacturing

Workstations and machines are grouped in close proximity (often in a U- or an S-shape) to produce an entire product or large parts of it in a "cell" following a sequential pattern. Broadly speaking, the raw materials or starting parts enter at one side of the U-cell and the finished products come out at the other end. In a single factory, there are usually several different cells, either producing different products or all the same product. This is in contrast to how Brown and O'Rourke (2007) describe traditional manufacturing:

> In traditional production, factories are divided into various departments (often on separate floors in huge factory buildings), each generating a single part, or set of parts, of the finished product. The semi-finished parts are then sent on to another department for the next stage of processing, traveling from department to department to reach the final assembly and packaging operations. The parts are warehoused between steps in the assembly process. (Brown and O'Rourke, 2007, p. 250)

The aim of a cellular setup is better flow through pull principles and eliminating waste through reduced WIP parts. Furthermore, cellular manufacturing allows for greater production and load-leveling flexibility.

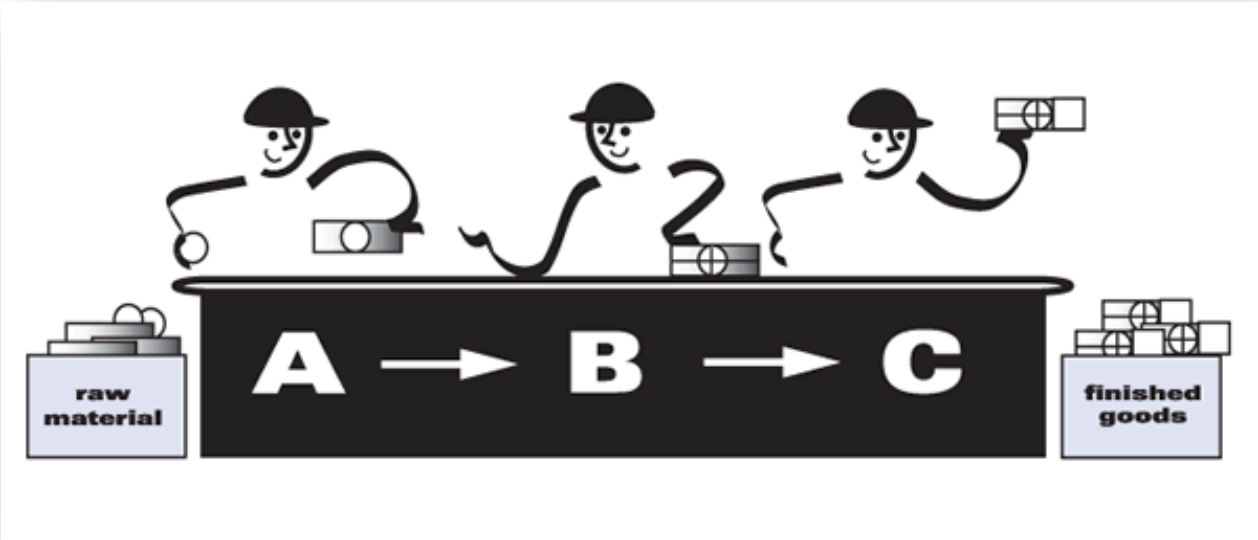

Figure 7: Cellular Manufacturing with Continuous Flow. Source: Lean.org, "Continuous Flow", http://www.Lean.org/lexicon/continuous-flow, accessed 2016.11.01

Flow / One Piece Flow / Continuous Flow

The principles aim is that work, products and information flows smoothly through all elements of the value chain, not only in production. Once Flow is established, it has positive impacts on many forms of NVAA, like inventory, waiting time or transportation. Flow is a quite delicate and complex concept, which requires a lot of other elements working together perfectly. How Flow is linked to other concepts is displayed in Figure 8.

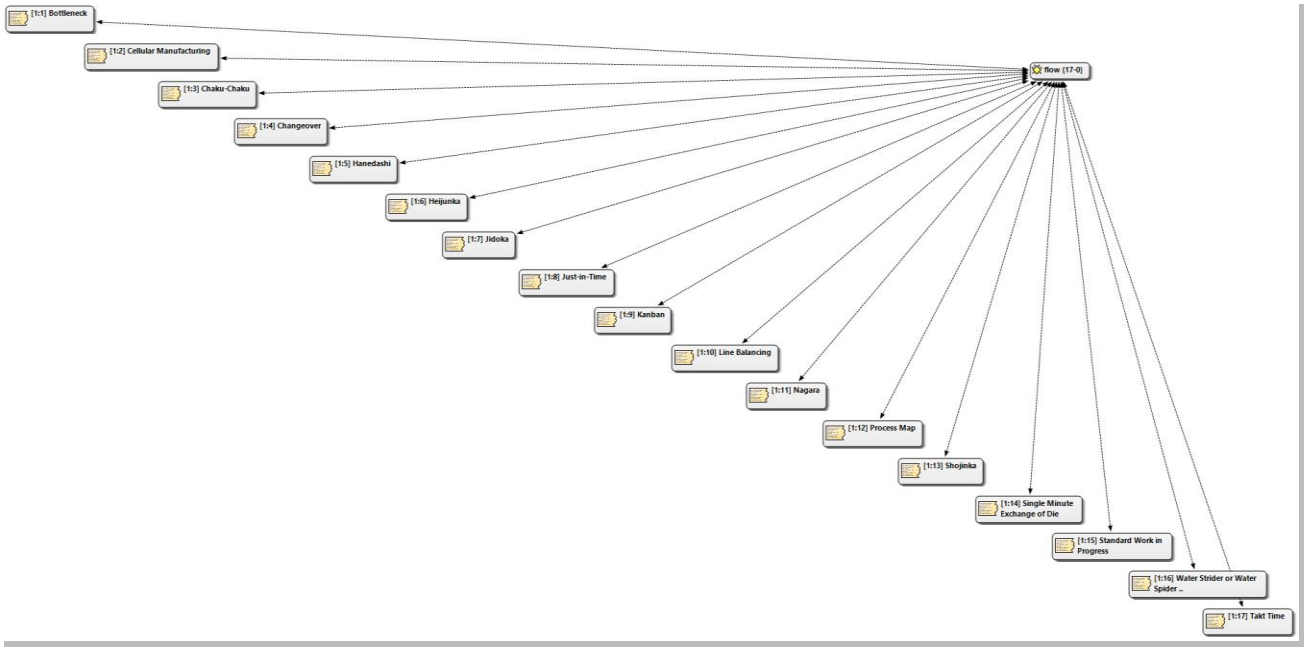

Figure 8: Flow as one the central principles of Lean and how it is connected to other principles, concepts and tools. Source: own creation

For production, Lean.org defines One-Piece Flow or Continuous flow as "Producing and moving one item at a time (or a small and consistent batch of items) through a series of processing steps as continuously as possible, with each step making just what is requested by the next step." (Source: http://www.Lean.org/lexicon/continuous-flow, accessed 2016.11.01). Concept wise, Flow is closely connected to Cellular Manufacturing.

Gemba / Gemba Walk

A direct translation from Japanese would be "actual place". It refers mostly to the shop floor, where value adding activities are performed. Only there, one can see if everything works. Particularly management should go to the Gemba frequently, as this promotes a thorough understanding of the production process and manufacturing issues. The Gemba walk, also often referred to as "genchi genbutsu" (see Figure 2), which translates as "go and see" is also designed to profoundly

understand problems before developing solutions and fosters discussions with different people across the organization.

Hansei

Is a deep personal reflection, typically in connection with continuous improvement and deals with personal shortcomings/mistakes and how they can be improved or avoided.

Heijunka

Is a technique, which is used in production scheduling and would translate as “levelization”. With Heikjunka, a Lean company wants to minimize the impact of customer peaks and valleys by purposely producing in smaller, sequenced batches within the same process. This concept is applicable both for product variety as well as for quantity. A typical example is displayed in Figure 9.

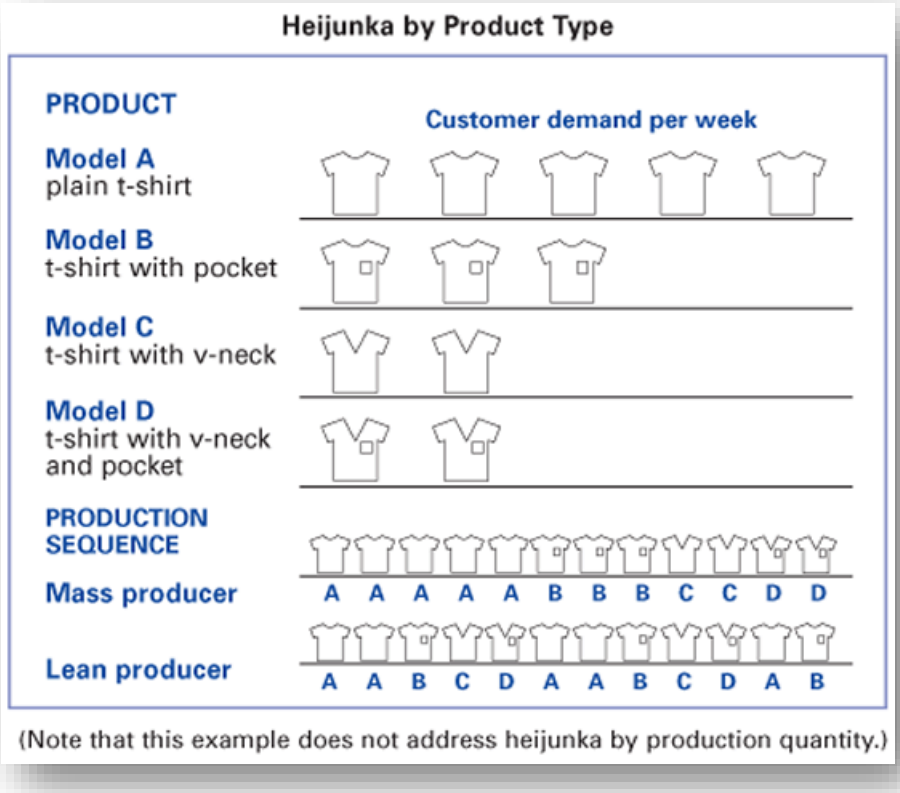

Figure 9: Heijunka example when producing varieties in small, sequenced batches. Source: Lean.org, “Heijunka”, http://www.Lean.org/lexicon/heijunka, accessed 2016.11.01

The advantages are shorter lead times, since each variety is produced more frequently and less inventory, as the batches are smaller. Another benefit is that product defects are detected earlier and can possibly be fixed before the next batch is produced. If a quality problem is detected in the

above example in the “Model A” shirt, the mass producer finds out in the quality control at the end of the batch, when he has produced five faulty shirts and can therefore scrap five shirts. The Lean producer has only produced two shirts before the fault is detected and therefore has substantially smaller losses.

Hoshin Kanri

Means “Policy Deployment” and is a strategic planning method, which aligns the firms functions and activities with its strategic objectives – both horizontally and vertically. The planning process works bi-directional, meaning that goals are worked-out in a top-down and bottom-up approach. This dialogue is known as “catchball” or “nemawashi”.

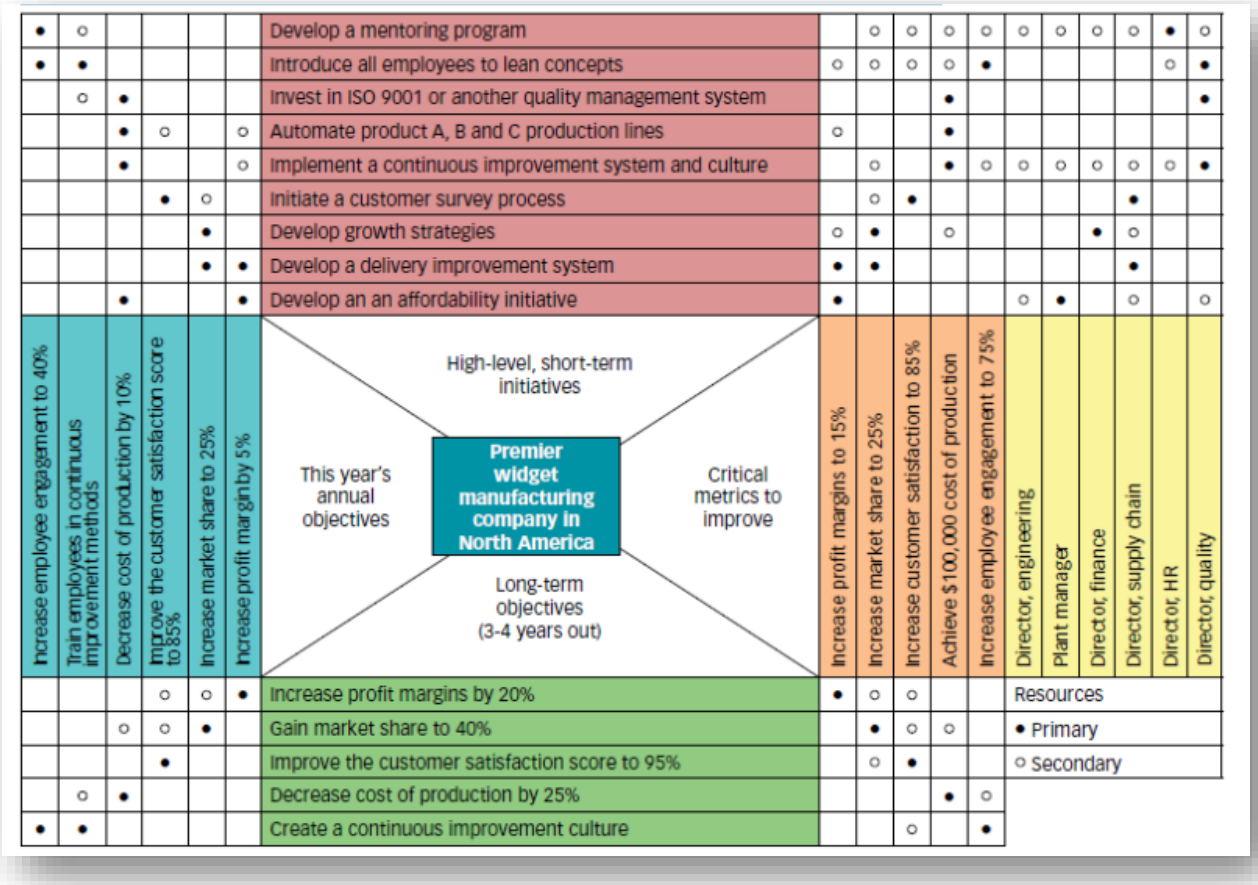

Figure 10: A “X-Matrix” as used in a Hoshin Kanri planning process. Source: https://www.linkedin.com/pulse/boost-your-companys-performance-hoshin-kanri-method-ferhan-bugay/, accessed: 2017.10.29

The planning process is very stringent and incorporates the entire planning process with feedback loops in a structured way, as Figure 11 displays.

Figure 11: The Hoshin Kanri planning process with its "feedback loops". Source: https://kanbanize.com/lean-management/hoshin-kanri/what-is-hoshin-kanri/, accessed: 2017.10.29

Jidoka

Is also called "autonomation" and means that machines are used to automatize certain production steps. The machines have the ability to detect faulty parts and notify an operator, for example via an Andon light. This frees up a lot of human capacity as one operator can monitor and manage several machines at the same time.

Just in Time (JIT)

As the name suggests, Just in Time is a system, which delivers what is needed, when it is needed and just in the amount that is needed. The Lean Enterprise Institute emphasizes:

> JIT relies on Heijunka as a foundation and is comprised of three operating elements: the pull system, takt time, and continuous flow. JIT aims for the total elimination of all waste to achieve the best possible quality, lowest possible cost and use of resources, and the shortest possible production and delivery lead times. Although simple in principle, JIT demands discipline for effective implementation. (Source: http://www.Lean.org/lexicon/just-in-time-production, accessed: 2016.11.01)

Kaizen / Continuous Improvement

As displayed in Figure 4 Kaizen means "change for the better". This concept ideally involves everybody in the organization to continuously improve literally everything. Permanent questioning of the status quo and thinking of new, smarter ways how to improve things should become the DNA of the Lean company. In contrast to traditional firms, where some few managers have the burden to create improvement ideas, which the rest of the employees put to work, Kaizen in a Lean context comes from every single employee, which has an enormous multiplier effect. The individual improvement steps are incremental, but taken together, they make a significant difference. Larger Kaizen projects are usually handled via an A3 or something similar, whilst smaller Kaizen

are implemented by the employee or a team directly and immediately. A further concept for steady improvement is PDCA – see Figure 17 and the respective paragraph below.

Kanban

Is an essential part of the Flow and the Pull concept. Kanban would translate into “cardboard”, but can also be a box, container or something comparable. The purpose of Kanban is to authorize production or to move an item. Only with that card it is possible to get parts, which are necessary to perform a certain step in production. Thus, this method is preventing piles of inventory or WIP and facilitates the orderly flow of goods both within the production as well as externally. Often small parts like screws are placed in Kanban boxes and once the box is emptied, it is replenished by a new box – internally or from outside suppliers. Here is where the Pull comes into play. Once a box is emptied, a new one is pulled into the production system. Traditional manufacturers often buy bulk – Lean manufacturers request smaller batches, ideally Just in Time.

Muda, Muri and Mura

Also known as the “3 M’s”, they stand for wasteful practices, which do not add value from the customers perspective.

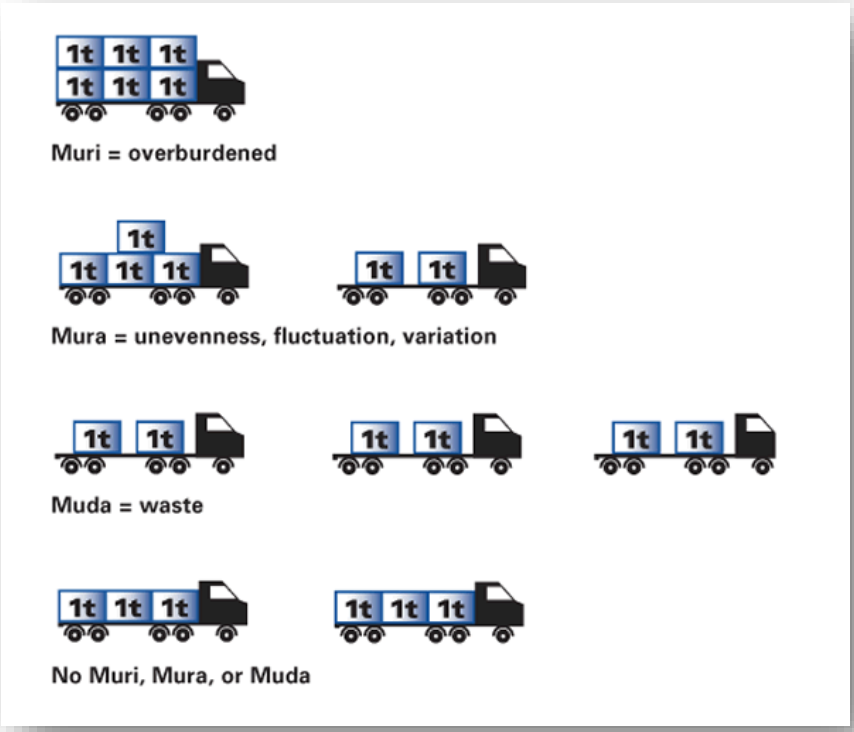

Figure 12: Example of the 3 M’s and how they can be avoided. Source: Lean.org, “Muda, Mura, Muri”, http://www.Lean.org/lexicon/muda-mura-muri , accessed 2016.11.01

The concept may seem obvious, but to effectively eliminate all those wastes, a number of other concepts like Heijunka and Standardization have to be implemented and working properly. Removing waste has a direct, positive impact on profitability.

Poka-Yoke

Is error proofing. Products or parts are designed in a way, that human error in installation or handling is prevented. An example would be a LAN cable, which can only be inserted in one way. In the production environment for example, Poka-Yoke is often part of Jidoka and should help the operator of a machine to insert a part in only one (right) way. The goal in production is to have zero defects and less scrap.

Pull System

Is one of the key concepts of Lean. Traditional manufacturers produce goods according to a forecast or even extrapolate historic figures to predict future demands. Once the products are produced, they sit on stock, waiting to be purchased by customers – this is also known as a push system. Since the customer demand is in the center of Lean companies, they implement a pull system, which means that a customer pulls or requests a product. This is the starting point for all activities. Fundamentally, the Pull System is therefore a manufacturing planning system based on communication and actual real-time needs from downstream operations.

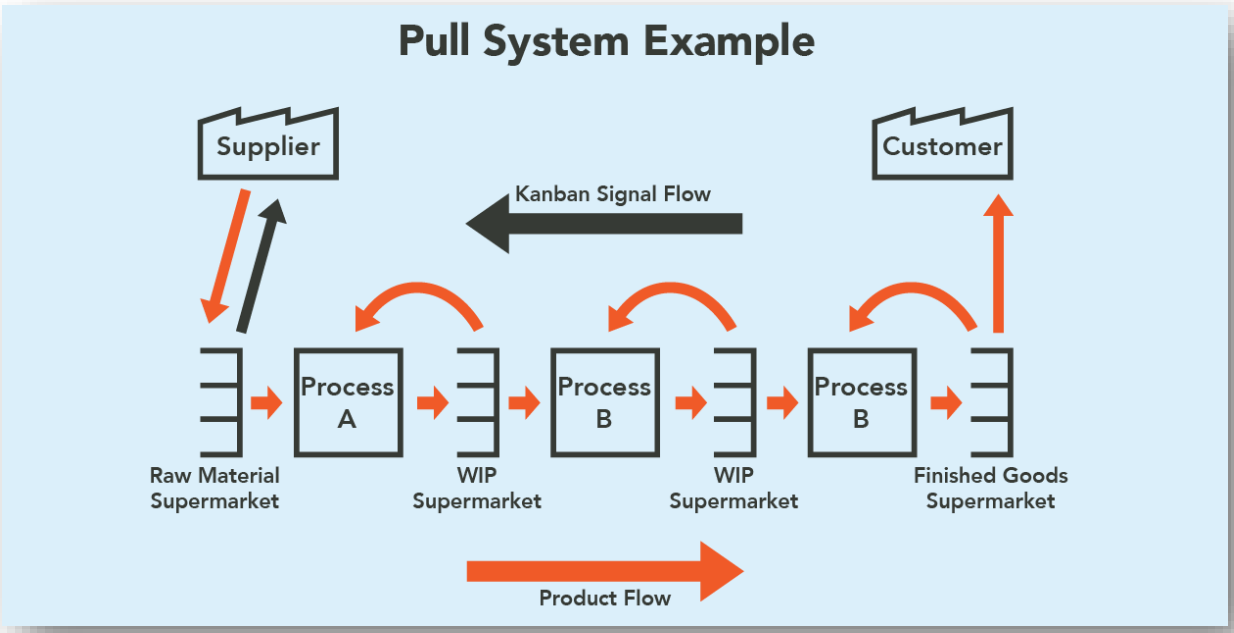

Figure 13: Example of a Pull System incorporating Kanban. Source: VATIVE, "Pull System", http://vative.com.au/wp-content/uploads/2015/03/JIT_VSM.png, accessed 2016.11.01

In the above example, the customer order is translated into a Kanban, which starts the internal production process and simultaneously requests raw material from an external supplier. The example also shows WIP supermarkets[5], which are used for semi-finished products or parts. Similarly, auxiliary material like screws can be stored in those supermarkets – then again in Kanban boxes, which are automatically replenished. The process works backwards, where the last process step (in Figure 12 incorrectly marked with "Process B", whereas is should be "Process C") pulls materials out of the upstream supermarket, which is detected by process step "B" and then replenished. A lot of companies actually have a mix of Push and Pull System, where the customer demand creates a production demand, but then the product is pushed downstream through various process steps to the customer.

SMED (Single-Minute Exchange of Die) / Quick Changeover

Time to set up a machine for producing goods is defined as NVAA, because during that time, nothing can be produced. Hence a quick changeover of tools to switch production from one part to the next one is mandatory to gain productivity. The SMED concept deals with reducing those setup times to a minimum, but a least to less than 10 minutes – therefore "Single-Minute". SMED is important to make concepts like Heijunka work efficiently. To achieve SMED one often has to be inventive. Additively a lot of hands-on procedures and advice can be found in the book "*A Revolution in Manufacturing: The SMED System*" (Dillon and Shingo, 1985), in which Shigeo Shingo, who developed the system for Toyota and who coined the term SMED, explains the principles in detail and provides several application examples. Overall, SMED enables manufacturers to produce smaller lots, reduce inventory and increase customer responsiveness.

Standard Work / Standardized Work

Taiichi Ohno is credited with having said "There can be no improvement where there are no standards", as recorded by Masaaki Imai (Berger, 1997, p. 111). Standardized work is important in two ways: Firstly, it is the starting point of a Kaizen activity, so to say the reference point where improvements are measured upon. Secondly, standardization also marks the end of a Kaizen, by freezing the newly achieved status. Berger (1997) correctly refers to the PDCA methodology in his paper "*Continuous improvement and kaizen: standardization and organizational designs*" when he finds:

[5] Supermarkets in a Lean production work like shelves in a classical supermarket – this is also where Taiichi Ohno drew his inspiration from. Kanban boxes are taken out on the front end of the shelf and the next box slides to the front and automatically generates a purchase an order for replenishment.

> The PDCA-loop seems to work as a standardization of the improvement process, a quite simple framework for using the different quality tools which make the improvement process both visible and measurable while also serving as the main link between improvements and standardized routine work. (Berger, 1997, p. 111)

Standard work is often a living collection of best-practices, documented in standard operating procedures, short SOP's. Another major benefit of standardization is that it serves as the basis for predictable and reliable processes and if it is well documented, it makes onboarding of new employees easier as well. Furthermore, standardization functions as the "wedge" that prohibits the organization from sliding back into old habits and routines – see Figure 17.
However, standardization is not a solution on its own, as Rother (2009) suggests:

> […] it is generally not possible simply to maintain a level of process performance. A process will tend to erode, no matter what, even if the standard is defined, explained to everyone, and posted. This is not because of poor discipline by workers (as many of us may believe), but due to the interaction effects and entropy, which says than [sic!] any organized process naturally tends to decline to a chaotic state if we leave it alone […]. (Rother, 2009, p. 12)

It needs constant practice and training to achieve a routine - Rother calls this "Kata" – the term is listed and explained below in the "Tools" section.

Takt Time

Put simply mathematically, the Takt is the available production time per period, divided by the products requested by customers in that period. If the total available production time is 633 minutes per day and the customer requests 420 products, the Takt Time for one unit is approximately 1 min 30 seconds. This means, that every roughly every 1.5 minutes, one unit must be produced to meet customer demand. Takt is also referred to as the "beat" of the production and is a very central element of Flow.

Total Productive Maintenance (TPM)

As the name suggests, the aim of TPM is to maximize the uptime of equipment, by avoiding the six losses, which are associated with machine operations: (1) downtime, (2) changeover time, (3) minor stops, (4) speed losses, (5) scrap, and (6) rework. Most of those losses can be prevented with timely, scheduled maintenance. The term "total" also indicates, that all employees must engage in TPM and not only the dedicated maintenance team. A lot of daily routine servicing is done by operators, such as inspecting the equipment, lubricating it, or tightening screws. Kumar et al. (2016, p. 43) points out that TPM also "Improved relations among operators and generation of ideas that contribute to enterprise efficiency […]" and had positive effects on production scheduling thanks to better equipment reliability. Increased up-time of machines also impacts the OEE, as we will see later.

1.6.2. Tools

Some of the tools introduced in the section below can also be seen as a concept or approach, specifically if they are used so extensively in a firm, that they become sort of a philosophy or part of its culture. The tools are thus not to be understood as axiomatic - the line between concepts and tools can be fuzzy.

A3

Is a structured problem solving and continuous improvement process tool which is strongly related to the PDCA logic. The name "A3" is derived from the European paper format – Toyota used this format to solve problems on this one sheet of paper. Both the standardized approach and the limited space facilitates effective and efficient problem solving. It can also be used as a simple project management tool, for example in VSM's or Kaizen projects.

Kata

The concept of Kata in a Lean context was popularized by Mike Rother. Particularly his book "*Toyota Kata: Managing People for Improvement, Adaptiveness and Superior Results*" (Rother, 2009) made the practices accessible to a broad audience. The term Kata itself is well known amongst practitioners of Japanese martial arts and in a Lean environment, the meaning is analogous:

> Kata are small, structured practice routines or protocols. Through physical practice their pattern becomes second nature, done with little conscious attention. Kata are typically for learning fundamentals to build on. The goal is not the Kata themselves, which get used less as you grow more proficient, but the habits of thinking and acting that practicing them leaves behind. (Rother, 2016, p. 2)

He distinguishes two types of Kata – one for the learner and one for the coach. Every part has certain tasks and responsibilities, as displayed in Figure 14.

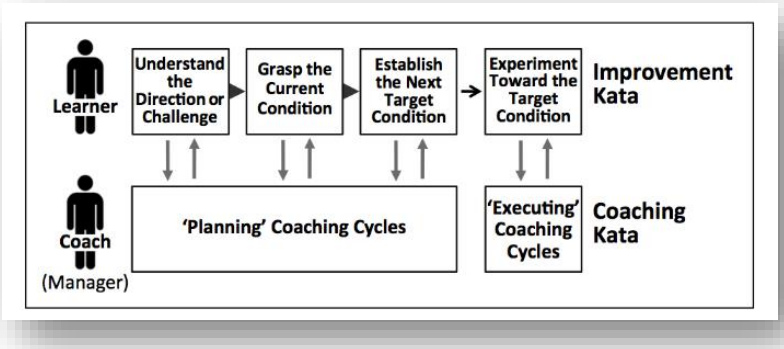

Figure 14: Improvement and Coaching Kata as a management system. Source: Rother and Arbor (2014, p. 3)

It has to be noted, that a lot of those thinking patters and routines are usually hidden and therefore hard to copy (see Figure 1).

Key Performance Indicators (KPI's)

KPI's are a vital element in any Lean system. They have to meet a lot of different requirements. One of those is the issue of transparency. To make improvements possible, firms must know where they stand and they must measure, which impact a certain activity had on their performance. Consequently, it is crucial to carefully define and select meaningful indicators – as the name suggests, key indicators, which are truly significant to processes or the entire business. KPI's are basically metrics, which track and encourage progress. Especially in connection with making KPI's visible – see Visual Management below – they can be a powerful driver of behavior. That is particularly true for leading KPI's, which display for example real-time production progress and goals for the day, as opposed to lagging KPI's which display past performance. Lagging KPI's are important to detect shortcomings against a planned performance and may trigger a Kaizen activity.

KPI's are often grouped according to their field of application, for example business KPI's, quality KPI's, supply chain KPI's as well as process efficiency KPI's. In the latter category, there is one KPI, which is frequently used and deserves special attention, the **O**verall **E**quipment **E**ffectiveness.

Overall Equipment Effectiveness (OEE)

OEE is a combined metric, which measures how effectively equipment is being used. It is calculated as follows:

Availability Rate x Performance Rate x Quality Rate = OEE

What this KPI displays are losses related to TPM's six losses, for example downtime and changeover time (=Availability Rate), slow cycles and minor stops (=Performance Rate) and scrap and rework (=Quality Rate). Since all three indicators are multiplied it gets obvious, that all three are of equal importance and that if only one indicator is not working properly, the overall OEE will suffer.

The example of the OEE demonstrates, how important solid data gathering is. If the data source is flawed or unprecise, there will be no meaningful KPI. For that reason, Lean companies often invest

significant amounts in computer systems, such as production- or machine- data acquisition systems. In parallel, they frequently deploy people, who manually measure time with a stopwatch for example to determine cycle times.

Attention must be paid that people are not overloaded with KPI's. It is not feasible to follow 50 KPI's – this would mean a lack of goal clarity and information overload. One to five meaningful KPI's should be enough. Very focused KPI's have the drawback however, that people tend to focus only on that and neglect other, maybe equally or more important, indicators. This effect is amplified, if performance pay is attached to reaching certain KPI's. To put it simply: what gets measured, gets done. In conclusion, key performance indicators are necessary, but must be cautiously selected.

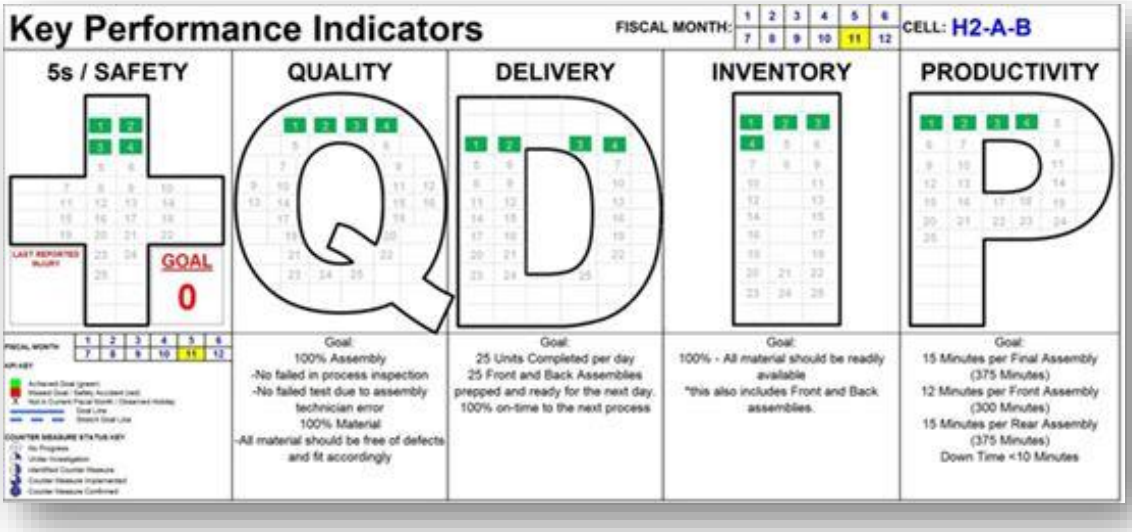

Figure 15: Good example of a Lean KPI board, tracking five indicators and goals across different areas on a daily and monthly basis in a graphic way with color coding. Source: Pinterest, "KPI's", https://www.pinterest.at/pin/396598310911533552/, accessed 2017.08.22

Plan – Do – Check – Act (PDCA)

The PDCA logic is a true cornerstone of the Lean philosophy as it stands for continuous improvement like no other concept. PDCA or parts of it can be found in countless Lean tools and concepts and also in traditional manufacturing companies. For a rough historic sketch, it is necessary to mention that the systems origin dates back to work of Francis Bacon in 1620, was further developed by Walter Andrew Shewhart (Shewhart Cycle - 1939) and finally made popular in the 1950's by William Edwards Deming (Deming Wheel - 1950), who is deemed the father of modern quality management (QM). Deming's teachings in Japan fell on fertile ground and where eagerly integrated by the Japanese industry, which later perfectioned its application and called it PDCA – most

notable contributor at that time was Dr. Ishikawa (Moen, 2009, p. 5). Deming himself continued to refer to the method as Shewhart Cycle and later as PDSA, where the "S" stands for "study". Details of the historic evolution and ramifications are displayed in Figure 16.

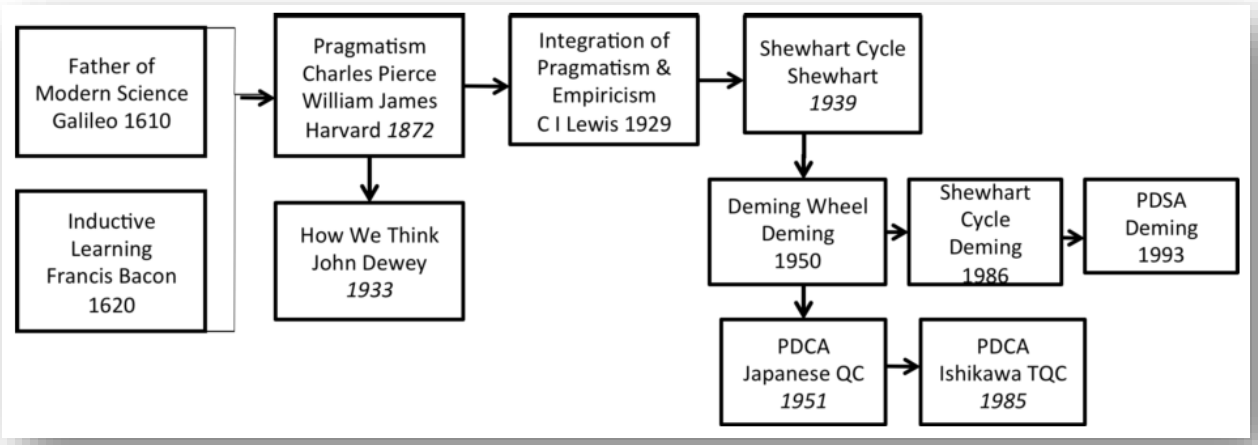

Figure 16: Evolution of the Scientific Method and the PDSA Cycle. Source: Moen (2009, p. 2)

The PDCA logic is a scientific model based on four iterative steps which lead to improvement of a system or process. This uphill running wheel of PDCA is depicted in Figure 17.

Plan This phase creates a vision of the new state, defines what needs to be changed and provides expected results of the change

Do Tests what was planned in phase one on a small scale, for example in a pilot area under controlled conditions

Check This part examines, if the "Do" phase delivered the results, which were anticipated in the "Plan". If it delivered the planned improvements, the final phase (Act) is launched. If it brought unexpected or unwanted results, the process goes back one or two steps. Check serves as a "gate" to the final step

Act If the results of the trials were satisfying, the "Act" phase is designed to make the new, elevated level the new standard. Here, processes are stabilized again, before a new PDCA cycle begins. In this step, the learning(s) from the pilot area are rolled out for example to other workstations, other units or other factories.

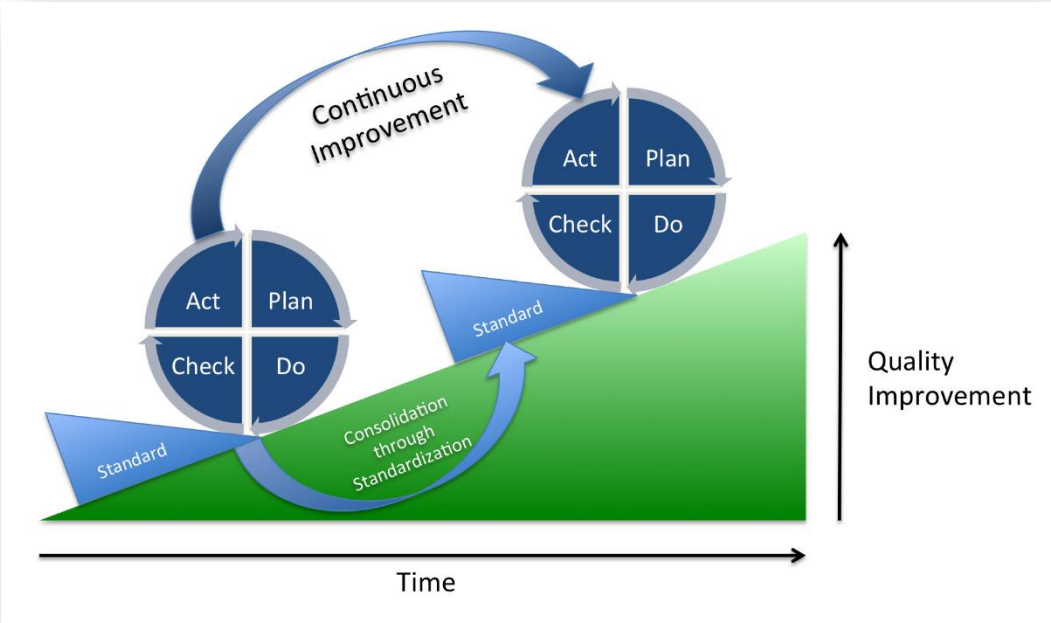

Figure 17: Depiction of the PDCA cycle (or Deming cycle). Continuous (quality) improvement is achieved by iterating through the cycle and consolidating achieved progress through standardization. Source: Wikipedia, "PDCA", https://commons.wikimedia.org/w/index.php?curid=26722308, accessed 2017.08.22

Root Cause Analysis

When a process needs improvement, or when a mistake should be eliminated one can use certain tools to advance to the root cause of the problem. Here I will briefly introduce two simple and common methods which are used to perform a root cause analysis. The "5 Why's" are very easy and fast to apply and universally understood. On the flipside, the method is only good to track down single root causes and it does not point out possible interdependencies. That is when the Ishikawa diagram is used, since it is good for unveiling cause and effects and multiple root causes.

5 Why's

Is an iterative problem detection process, in which "Why?" is asked five times with answers in between, which form the basis of the next "Why?" questioning round. Following this process, the interrogator gets closer to the root cause layer by layer. By experience, the root cause is usually found with five or less iterations.

Ishikawa Diagram / Cause and Effect

The Ishikawa Diagram (also referred to as "Cause and Effect" or "Fishbone" diagram) is named after its inventor, Dr. Kaoru Ishikawa, who developed this simple yet effective method to explore the (root) causes of a specific event or condition. Besides its visual and

structured approach, it also offers the chance to spot associations between variables. The individual causes that lead to the problem can be identified via the above described "5 Why" method or any other creativity technique, for instance with the help of brainstorming.

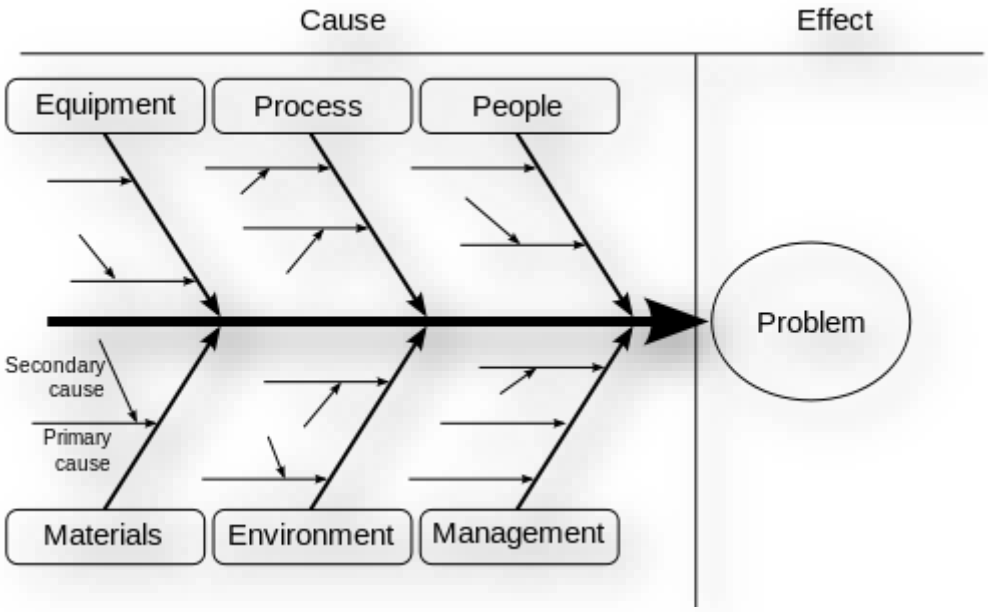

Figure 18: Example of an Ishikawa diagram in fishbone shape, showing factors affecting the overall problem. Smaller arrows connect the sub-causes to major causes. Source: Wikipedia, "Ishikawa Fish-bone Diagram", https://commons.wikimedia.org/wiki/File%3AIshikawa_Fishbone_Diagram.svg, accessed 2018.8.22

After drawing up all causes, the root cause(s) has to be found. Various solution procedures can be used, like histograms, but as a rather simple method, the most likely cause could be analyzed first by gathering data and running a PDCA cycle to see if the problem still persists or if it was solved. It is crucial to always test only one countermeasure or idea at a time and leave other parameters unchanged, so that it can be said with certainty that this changed variable was indeed the root cause. Once the root cause was detected, one can go on using the "5 Why's" again to explore why the root cause appeared.

Value Stream Mapping (VSM)

Is an important technique to visualize a value stream from beginning to its end in order to identify waste and inefficiencies. A VSM can also provide the basis for a re-modeling of a value stream for any kind of reason. A standard reference for VSM in a Lean context is the book "*Learning to See: Value Stream Mapping to Add Value and Eliminate Muda*" by Rother and Shook (2003), where they define:

> A value stream is all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (1) the production flow from raw material into the arms of the customer, and (2) the design flow from concept to launch. (Rother and Shook, 2003, p. 9)

The VSM identifies all the specific activities occurring along the value stream, represented pictorially in a value stream map. An example of a VSM in shown in Figure 19.

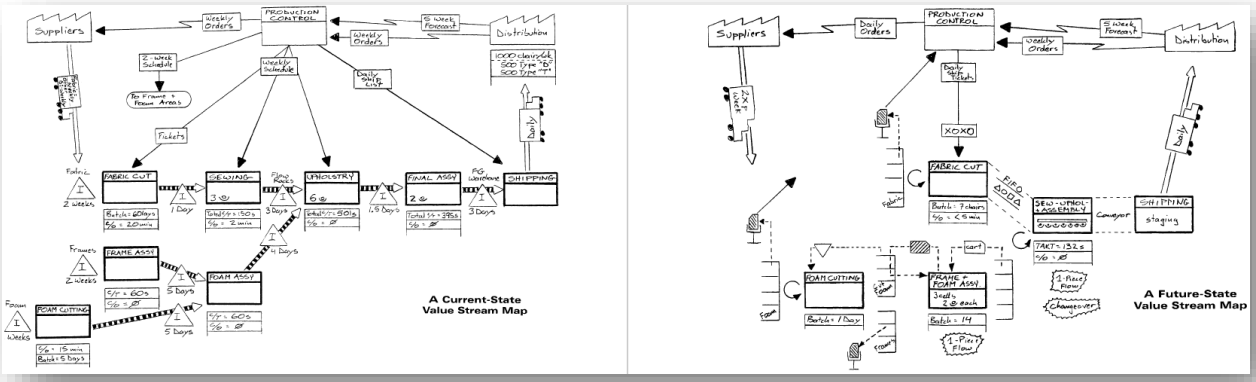

Figure 19: Value Stream Mapping, displaying a re-modeled Value Stream. Source: Rother and Shook (2003, pp. 6-7)

<u>Visual Management / Visual Factory</u>

Making information visible, means making it accessible to all. The idea behind Visual Management is to display relevant information at the right spot to direct behavior or create awareness. Visual indicators also enhance communication. Lean enterprises us this tool wherever they can – for an outside visitor, this is a striking and obvious difference between a traditional manufacturer and a Lean manufacturer. As mentioned above, KPI's and goals are often displayed on screens. Also, Andon lights are a form of Visual Management. With the help of visual controls, deviations from the standard are immediately recognized and can be corrected. Furthermore, progress in project management or the production scheduling is also displayed graphically. Visual Management tries to speak directly to the senses of a human being, for example via color coding. Examples are provided in Figure 20.

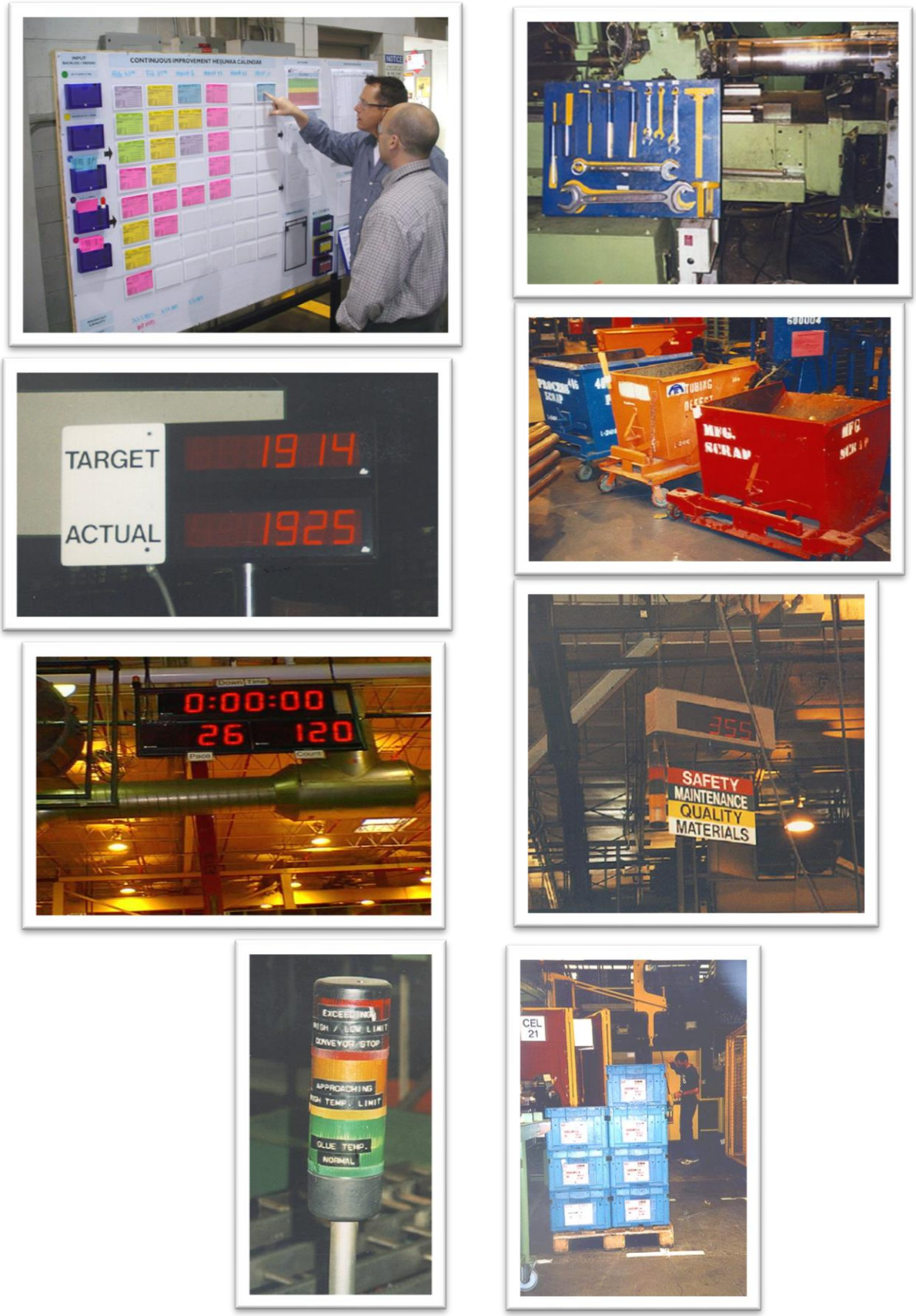

Figure 20: Examples of Visual Management. Note that the palette with the blue boxes in the last photo is not properly placed. Source: Slideshare/Zeeshan Syed, "Visual management & 5S", http://www.slideshare.net/zeeshan_agri/visual-management-5s-in-Lean-tps-workshop-slides, accessed 2017.08.22

1.7. Traditional versus Lean Manufacturing

There are features both in traditional and in Lean manufacturers which are mutually exclusive, whilst others can be found in both. Some of the more distinct features of those two types are listed in Table 2.

Feature	Traditional Manufacturing	Lean Manufacturing
Production Mix	• High volume production of identical products (Low variety/high volume) • Long lead times	• Low volume production of many variants. (High variety/low volume) • Short lead times and cycle times
Labor Costs	• High direct labor costs	• Direct labor is a small percentage of total labor costs. • Difficult to distinguish between direct and indirect labor
Production Practices	• Production for inventory (Just In Case) • Production dictated for all steps by an MRP or other production scheduling system. • Production organized around large batches to maximize machine utilization • High inventory levels (raw, WIP, finished) • Assembly-line flow; each worker does one function • Infrequent changeovers; long set up times • Messy, cluttered and dirty shop floor	• Production on demand (Just In Time) • Manufacturing schedule sets the initial order volumes only; all other production is driven by "pull" signals (Kanban) • One-piece flow • Inventory levels are radically reduced • Cell production; each worker performs multiple operations • Frequent product changeovers; short set up times • Spotless shop floor with visual management
Continuous Improvement	• Management of quality through inspection and rework • Infrequent changes in production practices	• Management of quality through prevention • Continuous changes to improve efficiency and productivity
Measurement	• Management by reports done by outsiders • Focus on individual labor and machine efficiency • Setting of arbitrary improvement targets	• Visual management and shop floor indicators • Focus on process availability and throughput • Data used to improve system stability and capability
Supplier Relationships	• Large volume of direct suppliers • Suppliers deliver in frequent large batches based on volume discounts • Frequent supplier changes based on price differences.	• Reduced number of suppliers • Supplier responsibilities for maintaining inventory levels • Long term supplier relationships
Management Structure	• Many layers of management • Strong functional organizations and clear separation between functions ("silos") • Top-down monitoring of performance	• Fewer layers of management • Strong team-based structure • High levels of team autonomy • Disciplined team-based measurement systems • Visual control systems

Table 2: Comparison of Traditional versus Lean Manufacturing. Source: Cleveland (2009, p. 28)

Of course, this list is never comprehensive. The differences between a Lean and a traditional manufacturer can concern hundreds or even thousands of aspects and details. Likewise, two Lean enterprises are never the same. Nevertheless, there are some core characteristics which are predominantly found in Lean or traditional manufacturers.

One very significant aspect, which is getting more attention nowadays, is the fluctuation in customer demand, the call for "Lot Size 1" and shortened lead-times. Corporations are encountering greater amplified demand curves and must react accordingly. Lean companies are designed to deal with demand swings, thanks to concepts and tools like Heijunka, JIT, One-Piece-Flow, SMED and the Pull philosophy. Brown et al. (2006) characterized both types laconic:

> Traditional batch manufacturing focuses on one main theme or production philosophy—run as large a batch as is economically feasible in order to avoid changing over equipment. Many times, however, this philosophy is contrary to what the customer actually wants, needs, or is willing to hold in inventory. (Brown et al., 2006, pp. 3-4)

And about Lean:

> In contrast to traditional batch manufacturing, lean systems have an entirely different focus. Lean systems focus on providing the customer exactly what product he or she wants, at the price they are willing to pay, and at the time they want it. In other words, the voice of the customer is the controlling factor in determining the production system. Regardless of whether or not the production quantities benefit the manufacturing process, lean philosophy expects that the process should adapt and be flexible to meet the needs of the customer. (Brown et al., 2006, pp. 3-4)

Simply by looking at Table 2 and by comparing the characterizations of Brown et al. (2006), one could see how profoundly different those concepts are and what tremendous effort it takes to transform a business.

1.8. Summary

Looking at the origins and history of Lean, it becomes apparent that Lean practices were developed over a considerable period in time – depending on where you start, hundreds of years ago. However, the practices which are summarized under the term Lean, were first named in such a way by the seminal publication of "*The Machine that Changed the World*" by Womack et al, first published in 1990. It was this book which also closely associated Lean manufacturing with the history of Toyota – which still is a Lean flagship firm. Lean as a concept, or even management philosophy, is very present in today's corporate world, particularly within companies that focus on gaining a

competitive advantage through operational excellence. Adopting a Lean culture, requires a profound change in most organizations, which come from a more traditional manufacturing setting. Research has shown that in the center of Lean transformations, there has to be an effort to transform people. It is thus not sufficient, to just apply a range of tools and concepts, but it is necessary to align all corporate functions according to the new strategy. This sort of profound change bears a lot of potential to fail - records show that the vast majority of Lean transformation are indeed not successful. My particular interest is that of Human Resource Management before, during and after Lean transformations – a very specific area, where little research was performed before. In order to gain more insight in HR's role, I designed a research project, where I examine HR architecture and practices of companies which have transformed successfully.

2. Chapter – RESEARCH

2.1. Introduction

This chapter is designed to form the transition from the background and analyzes of chapter one to the conclusions and recommendations of chapter three. I establish the link between Lean with all its facets and HR by an exploratory study in which I am interviewing experts in their respective field. Within this chapter, I try to show how successful Lean companies organize their workforce and how they executed the transition from traditional manufacturing to being a Lean manufacturer (as said before, Lean is not limited to manufacturing firms only). The interviews brought up some major themes, which HR managers and/or Lean managers should address when transforming a company. Based on the emergent themes, I analyzed recent and classic HR concepts in order to answer the second part of my research question, which deals with the design of those HR systems. The first part of my research question "Which HR systems and practices can contribute to the success of a sustainable Lean transformation" is subject to be explored through the interviews. Because my research question is in a rather unexplored field and shall answer the "what and how" questions, also referred to as exploratory research (Saunders et al., 2015, pp. 174-175), I decided to conduct a qualitative study. Since there are a number of methods with regards to qualitative studies and the succeeding qualitative data analysis, I had to research and finally choose a method, which fitted most adequately to my research project. The following sections will first explore different research methodologies, will explain my methodological choice and finally be applied to my specific research. In the last part of this chapter, I will share the outcomes and insights of the research.

2.2. Research Methodology

The nature and design of my research project requires a qualitative approach to interpreting and sense-making of the gathered data to potentially deriving/developing a theory. The underlying question in the search for an appropriate methodological framework was, if the framework would allow some flexibility when it came to new discoveries in the research process. Whereas all qualitative data analysis methods allow for some flexibility some are more suitable to grasp the whole picture when building a theory.

Essentially, two lines of thinking seemed to work in the first place: qualitative content analysis such as Philipp Mayring's "Qualitative Content Analysis" - German original title: "*Qualitative Inhaltsanalyse. Grundlagen & Techniken*" (Mayring, 2015) - and the so called "Grounded Theory"[6] as defined by Corbin and Strauss (2015).

The two frameworks have a lot in common, however in areas critical to my research, they deviate considerably. In the following paragraphs, I will outline some of the more significant differences and will constitute, which framework is more suitable for my research project and why it is more apposite.

2.2.1. Context

One point of difference is the attention, which is given to contextual data. Qualitative content analyses uses context mostly to interpret uncertain or unclear parts of text. Grounded Theory however treats context as part of the creative process of building codes and categories. To conduct semi-structured interviews as I did it in my research, one needs to have a quite deep level of knowledge in the interview subject. It is however critical for the researcher not to influence the interview by his knowledge, so that no ex-ante categories are defined. I paid special attention to this issue by directing the interview mostly with open questions and short, non-directive interventions. Furthermore, I collected data for triangulation and therefore validity, wherever possible. I gathered that information through presentations or other materials provided by the interviewee and sometimes I got to visit the manufacturing site myself, which enabled me to research on the discussed concepts directly at the source. Table 4 below indicates, where I was able to get supplementary data for triangulation and when I was able to see the plant and shop floor myself.

2.2.2. Data Analysis Process

Within the qualitative data analysis process, selecting the unit(s) of analysis is an important initial step in reducing the amount of text, according to Cho and Lee (2014). They highlight that this data reduction is necessary to focus on selected aspects. Also, the process is done in a pre-defined and rather rigid way. In sharp contrast, the data analysis process in Grounded Theory runs parallel, meaning that data is collected and analyzed immediately and new findings are incorporated before the next data collection. The procedure is neither linear, nor sequential.

[6] In fact, Grounded Theory is not only to be used in a qualitative way as Barney Glaser, one of the founders of the methodology, expressed: "Grounded Theory is an inductive methodology. Although many call Grounded Theory a qualitative method, it is not. It is a general method. It is the systematic generation of theory from systematic research. It is a set of rigorous research procedures leading to the emergence of conceptual categories. . . . Grounded Theory can be used with either qualitative or quantitative data. (Grounded Theory Institute, 2013)" as cited in CHO, J. Y. & LEE, E.-H. 2014. Reducing confusion about grounded theory and qualitative content analysis: Similarities and differences. *The Qualitative Report,* 19 (64)**,** 1-20.

2.2.3. Text Reduction versus Text Amplification

In Grounded Theory, the initial material, in my case the transcripts of the audio-interview files, serve as the basis for analysis. Moreover, one important aspect of Grounded Theory is memo writing to support theory building. The researcher is writing notes at every stage of the research process to achieve a better data set and understanding of the matter. Through those memos and drawing conclusions from them, the research process may be (and in most cases, is) altered. It is an iterative process, best displayed in Figure 21 below.

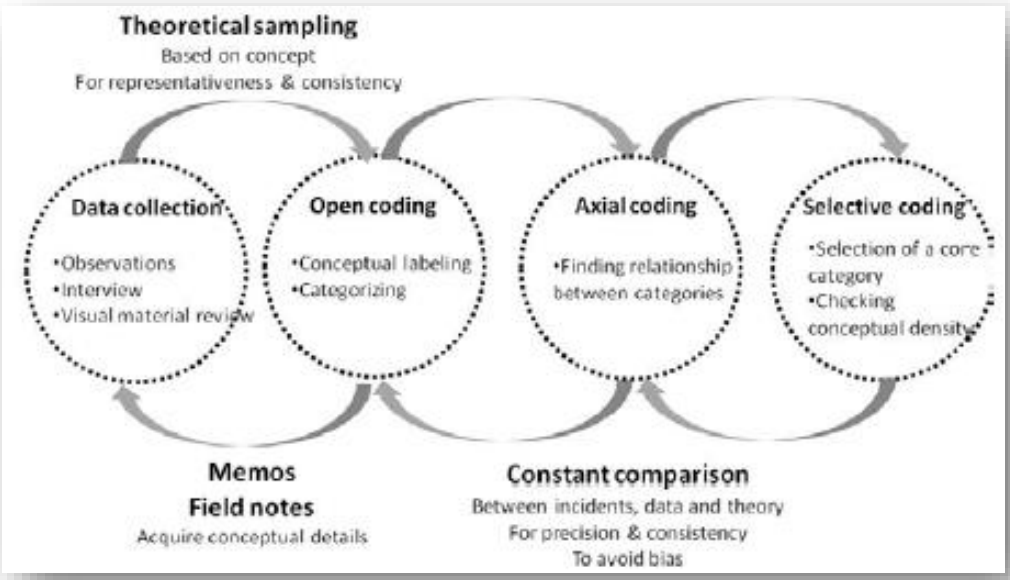

Figure 21: Grounded Theory research and coding process. Source: Cho and Lee (2014, p. 9)

As mentioned in the "Context" paragraph above, I was also using other data sources for the research, which produced and even greater amount of data.

In contrast, content analysis aims to reduce text by paraphrasing and consequently constructing categories. This framework typically looks at passages which are relevant to answer the research question or to support the initial underlying theory or hypothesis. Other aspects of the text are largely disregarded.

2.2.4. Goal, Rationale and Outcome of Research Process

While qualitative content analysis can be used in both an inductive and a deductive way, it often builds upon a theory or hypothesis (theory guided approach, deductive) to construct certain categories which are later used to dissect and structure the unit of analysis. In contrast, Grounded Theory is putting the emphasis on patterns, which emerge through the study and coding of the text,

which is a purely inductive approach. Grounded theory develops those categories, whereas deductive qualitative data analysis searches for theory-guided categories within a text. The process of developing codes is a critical step in both methodologies. Grounded Theory uses open coding (see Figure 21), which means that codes are derived from gathered data and are not generated from theory or literature. In contrast, deductive qualitative content analysis uses an approach as displayed in Figure 22.

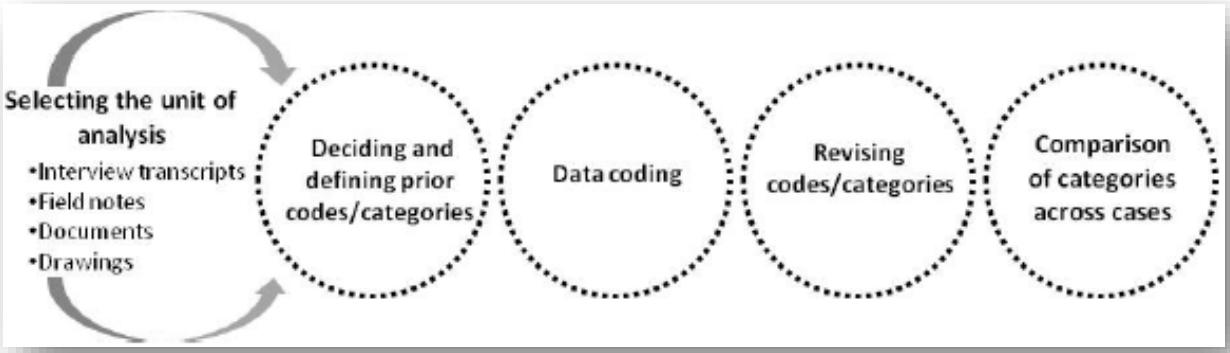

Figure 22: Deductive coding process in content data analysis. Source: Cho and Lee (2014, p. 11)

Therefore, qualitative data analysis is more confined then Grounded Theory with respect to new findings. The risk with Grounded Theory is however, that too many subjects and patterns evolve – in that sense, Mayring is easier to use with large data-sets where the researcher is only looking for specific characteristics. In my research project, I gathered about 112 pages of transcript plus some supplementary material, which is still a manageable amount for the Grounded Theory, particularly as I was using a qualitative data analysis software[7].

2.3. Computer Aided Qualitative Data Analysis (CAQDAS)

One of the founding fathers of Grounded Theory, Anselm Strauss (born in 1916), used a manual approach to coding and memo-writing all his life long. Many of the later Grounded Theory users and developers also adhered to his manual approach. In my research however, as an inexperienced researcher, I thought I would have difficulties coping with the masses of documents, repeatedly manually sorting and organizing them and still keeping the overall picture in mind. Hence, I was looking for a computer program, which could aid me in doing the qualitative analysis. Swiftly I

[7] Fully licensed Version 8 of atlas.ti, available at http://atlasti.com/

discovered a vivid controversy about using computers in connection with Grounded Theory. One of my starting points in figuring out whether CAQDAS was suitable and legitimate for my research project was Chapter 11 of Corbin and Strauss (2015, pp. 203-213) book on qualitative research. It is documented that Strauss did experiment with computer programs, most notably with ATLAS.ti and NVivo. While Strauss used the computer to write memos, he never used a software for the analysis. Corbin speculates though that if Strauss would live and work today, things would be different. Corbin and Strauss emphasize that it is the creative individual who makes the discoveries and not a computer program.

My quest for suitable software led me to ATLAS.ti, which I originally started to explore on my own. Quickly I discovered limitations in using the extensive program. If I would not be able to use the software correctly in the context of Grounded Theory, I might end up drawing wrong conclusions and thus jeopardizing my entire research. Hence, I decided to get a one-on-one tutorial with Dr. Susanne Friese[8], a renowned qualitative researcher, author and teacher, who is both well acquainted with ATLAS.ti from its very origins and with Grounded Theory. She not only counselled me on the application of ATLAS.ti, but also on the qualitative approach to my research – which was an invaluable contribution. In the process, Dr. Friese also shared her working paper "*CAQDAS and Grounded Theory Analysis*" (Friese, 2016) with me, where she critically reflects on application of computers in GT and provides some examples on the correct application. Friese writes:

> As the Grounded Theory approach was developed before the event of CAQDAS, the various steps and procedures have been described for manual ways of analysis. In newer books one finds references that this can of course also be accomplished in CAQDAS, but little detail is provided how this can be done, as if it would be self-explanatory. Based on my experience, this is not the case. Learning the various tools and features in a software, does not automatically teach the user which tool is the best fit for a particular process given a particular methodological framework. In writing this paper, I wanted to show how the various steps and procedures of the Strauss and Corbin approach to Grounded Theory can be translated for use in ATLAS.ti. (Friese, 2016 , p. 1)

After the training and some exercises, I felt confident in using the software as an aid, while still fully controlling the GT research process. Finally, I used ATALS.ti for coding (Friese prefers to call this tagging in a computer environment), sorting the data, making quantitative analysis, visualizing my findings and generating lists for codes and quotations. Although the software would also allow to write memos directly there, I took my memos on paper – which also worked well.

A particularly adjuvant feature of ATLAS.ti is its ability to visualize findings by creating networks. The software allows the user to drag all sort of information, such as codes or memos into the network and link them if they have a certain connection. The user can freely choose the direction of the influence and label them accordingly. I found this option very helpful in drawing up the

[8] http://www.quarc.de/ueber-quarc, accessed 2017.10.29

main categories out of the codes and to check on links, interdependencies and other connections between the various items. Drawing up networks is also an iterative process since every new unit of analysis (interviews, supplementary material, etc.) might add new viewpoints on the subject and therefore makes adaptions in the network necessary. I used this feature to visualize my categories and codes in connection with their relation to other objects. An example of such a visualization can be found in Figure 29.

To summarize, using CAQDAS is not self-explanatory and in order to generate a valid and scientific comprehensible output, it requires a solid understanding of the software used as well as a sound understanding of the methodological framework. Furthermore, it is helpful to reflect about the limitations of CAQDAS and to refrain from using apparently helpful options like "auto coding" as this would distort the research completely.

2.4. Methodological Choice

Wollny (2009) in her paper "*Qualitative Social Research - Origins and Approaches for Research in Family Medicine*" summarized felicitously:

> We show that content analysis is particularly suitable to gain descriptions of social circumstances and facts, which makes this method appropriate for the theory-led analysis of large quantities of text. Grounded Theory is most suitable for a research-approach without a pre-set theoretical framework and results in the development of an empirically [sic!] theory. (Wollny, 2009, p. 467)

Similar to Wollny and for the reasons elaborated in 2.2 "Research Methodology", throughout my research project, I was following a Grounded Theory approach as suggested and described by Corbin and Strauss (2015). I did not only apply it as a tool or technique, but rather tried to apply it as a research style.

Ultimately, I did not develop a theory out of the data, but that was not my research objective. Using the well-defined and clearly structured Grounded Theory approach up until the formation of core categories fulfilled my research need perfectly. I then went on and used those emerged core categories as a basis for further analysis and conclusions in chapter three.

2.5. Specifics and Design of the Research Project

To get reliable and valid data, I first had to identify companies who operate on a wide range of Lean principles and who adopted an extensive Lean philosophy. During my research on Lean, I established contact to a renowned Austrian Lean coach, who I met for some consultations on my research project. He referred me to an Austrian journal for best practices, called "TechnoKontakte". In this journal, there are numerous Austrian and international companies who open their doors for external visitors in the form of so called "best practice days". The presentations of the hosting companies are headlined with categories, such as "Lean Management" or provide information about Lean practices in their description. I identified the most suitable companies and contacted the responsible manager(s). To get a rich data set which was capable of answering my research question, I was aiming to interview managers who were responsible for Lean within their companies or for HR matters. In the case of HR Managers, they had to be well acquainted with their company's Lean program. I also tapped into other resources for interview partners, such as visiting best practice days or congresses myself and asking for volunteers there. Also, I asked Lean experts, if they knew suitable interview partners as part of my snowball sampling strategy.

I made my need for cases/interview partners public by inviting those prospective interview partners to take part in my research project and some of them volunteered to do so – Saunders et al. (2015, p. 303) refer to such a process as self-selection . During my contact with those prospects, I asked them to refer other Lean and/or HR experts to me. This was part of my snowball-sampling strategy which is commonly used, "[…]when it is difficult to identify members of the desired population[…]" Saunders et al. (2015, p. 303). Also, Lean experts are much more capable than me in identifying other Lean experts, which leads to high quality interview partners. According to Raymond M. Lee (1993) this sampling process could also pose a problem, as snowball-sampling may lead to a very homogenous sample. I tried to counter that problem by having a good balance between self-selected leads and snowball-sampled leads.

I was developing a rough interview guideline for my semi-structured interviews based on the research question and on themes and bullets that emerged from literature studies, practical experience and recommendations from Lean experts. Furthermore, I introduced new themes to the interview guideline, once found. This was the case for example in the very first interview, when the issue of "transparency" surfaced. The term "transparency", which later even became a category,

also serves as an example of "in-vivo coding"[9] in the open coding process of GT. Since the term seemed to be interesting, I added the bullet "transparency" after the first interview and the first round of coding. And indeed, it proved to emerge in almost every subsequent interview, thus helping me to define the category better. As said above, I followed a GT approach, where category building is an inductive and iterative process; elaborating categories further is referred to as "Theoretical Sampling" – this is done until saturation is achieved, see Corbin and Strauss (2015, pp. 139-140). This methodology was also applied to the interview guideline. The main purpose of the guideline was however, to provide a certain focus on HR and Lean during the interview, whilst not limiting the conversation in terms of depth. In a model case, I would not use the guideline at all, because the interview partner would stick to the research area by himself and touch upon relevant issues autonomously. Occasionally I asked open questions related to some themes to keep the conversation going and/or going deeper into evolving themes. The final interview guideline can be found in Appendix 4: Themes and Bullets for the Semi-Structured Interviews.
A complete overview of my research approach is summarized in Table 3.

Research Parameter	Approach in Master's Thesis	Notes
Data Collection	Semi-Structured Interviews	Non-standardized, one-to-one. Either face-to-face, internet mediated (video conferencing) or telephone. Contrived data (e.g. from interview, not observation)
Data Analysis	Qualitative	Computer aided
Time Horizon	Cross-Sectional	
Strategy	Grounded Theory	
Methodological Choice	Mono-Method Qualitative	
Theory Development	Induction / Abduction	
Philosophy	Interpretivism	

Table 3: Summary of research methods. Source: own creation

2.6. Description of the Data Gathering Process and Characteristics of the Data Set

According to Saunders et al. (2015, p. 297), the minimum sample size for semi-structured interviews should be between 5 and 25. Overall, I identified and contacted 22 potential interview partners, out of which eight were actually interviewed. The drop outs did not want or could not conduct

[9] Details see http://guides.library.illinois.edu/c.php?g=347981&p=2345709, accessed 2017.10.20

the interview in English, turned out not to be in the position to converse about my research question profoundly enough (for example, because they were not involved of the transformation), were not allowed to give that information out of the company or cancelled a scheduled interview appointment.

Data collection was done with semi-structured interviews. They were non-standardized, one-to-one with a variation of face-to-face, telephone and interned-mediated interviews. Overall, the data can be summarized as contrived as defined by Susan Speer in "*The SAGE handbook of social research methods"* (Alasuutari et al., 2008, pp. 290-312) in a sense that I could not observe the phenomena myself, but studied it through the authentic accounts of my interviewees.

To avoid translation errors and ambiguity, all interviews were conducted in English language. Whenever a respondent could not name the appropriate English term, I encouraged them to either describe it or to use the German term. After transcribing the interviews, I inserted the appropriate English term and marked it using yellow color for those passages or words.

My principal strategy was to get face-to-face interviews, followed by internet-mediated interviews via Skype™ and by telephone interviews. I chose this order, as research suggest that establishing rapport is an important factor with semi-structured, in-depth interviews (Saunders et al., 2015, pp. 394, 421). However, since no sensitive or personal information was conveyed (where rapport would play a major role), even telephone interviews delivered very detailed and rich data sets.

Because of the special, multidisciplinary nature of my research (covering both technical and social aspects) I sent out e-mail briefings (Appendix 3: Briefing of Interview Participants) to my interview partners way in advance, so that they had ample time to prepare for the interview. Saunders et al. (2015, p. 406) suggest that sending out those briefings may both help promote validity and reliability. I also requested in the briefing and the interview itself that the interviewees shall provide supplementary documents, such as charts, graphs, presentations, etc. If they brought such data with them or provided it later through an e-mail, I used it for triangulation, as this makes the interview even more comprehensible, allows me to check for inconsistencies and thus strengthens my research overall.

After the interview was conducted, transcribed and eventually improved with triangulated data, I sent out this document, which I referred to as "factual account" to my interview partners. I asked them to doublecheck, if the factual account correctly represents their opinions and the information that they wanted to convey. They had the chance to add or alter the factual account, so that everything was clear, precise and correct. Only those approved factual accounts made it into the qualitative data analysis and thus served as the basis for the study.

In total, I conducted eight interviews in the period from September to December 2016, out of which six came from self-selection and two came through snowball-sampling. I used this combined method (snowball-sampling and self-selection sampling), because it allows for maximum reach of the target audience. The interview partners could choose freely, if they want to be mentioned personally or by the company name or if they preferred to provide the information confidentially. In the latter case, I used codes to guarantee anonymity and non-traceability. Since there is no gain in information through releasing the company names, I ultimately decided to used codes for all conducted interviews and the subsequent analysis. In the succeeding Table 4, I provide an overview of the interviews conducted and their respective codes.

#	location / method	CODE	Data for triangulation?	Plant visited?
1	telephone	BKN	no	no
2	face-to-face	WMP	yes	yes
3	face-to-face	KSE	yes	yes
4	telephone	AKC	yes	yes
5	Skype	CEA	yes	no
6	telephone	MWK	yes	no
7	telephone	RGW	yes	no
8	telephone	LST	yes	yes

Table 4: Overview of interviews, methods, plant visits and triangulation data. All companies were encoded to guarantee confidentiality – see column CODE. Source: own creation

For added validity, I asked people how long they were employed in their company and how long they served in their function. Additionally, I asked them how long they deal with Lean practices and some more information about the company size and organizational structure – see Table 5 with detailed statistical analysis.

						company turnover [Mill. EUR]		number of employees			
title	position	gender	years dealing with LEAN	years in company	years in function	plant	group	plant	group	headquarter in	plant location
	CEO	Male	13	10	10		70		600	Switzerland	Switzerland
Dr.	Head of HR-Management	Male	14	9	6	380	1.000	1.280	8.050	Austria	Austria
Ing.	CEO	Male	4	22	1		55		1.250	Austria	Czech Republic
DI	Plant Manager / CPO	Male	10	9	3	600	26.500	600	64.500	United Kingdom	Austria
MA, MA	Lean Manufacturing & Project Manager	Male	8	6	6	150	2.500	700	8.000	Finland	Austria
DI	Manager Manufacturing Process Improvement	Male	16	6	2		2.200		12.000	Germany	Germany
DI (FH)	Corporate Lean Manager	Male	6	3	2	360	1.300	800	4.500	Germany	Austria
MSc	Assistant Plant Manager / Lean Manager	Female	1,5	1,5	1,5		2.700	500	11.000	Germany	Austria
	arithmetic mean	**-->**	**9,1**	**8,3**	**3,9**	**373**	**4.541**	**776**	**13.738**		

Table 5: Overview of statistical data regarding the researched companies and the interviewees. Source: own creation

Although I pointed out in the beginning of this thesis, that Lean can be applied in many different sectors (services, trade, etc.) all the companies I researched have a manufacturing background. I deliberately chose to have a homogenic population, but within the population I was aiming to cover a wide range of different industries to ensure optimal generalizability.

The interviews lasted between 25 minutes and 75 minutes and produced a total of 112 DIN A4 pages of transcript data. The transcriptions were made based on the audio-taped interviews by a web-service called "TranscribeMe Inc"[10] in a near-verbatim way with 99+% accuracy and delivered in an edited transcript format.

2.7. Coding, Concepts and Categories

Following the Grounded Theory method, I developed a total of 82 codes, where each of them stands for a lower-level concept. As expected, there was a wide variation in the frequency of codes. While some codes were unique, others occurred very frequently. However, it would be misleading to conclude that the more frequent codes are more important. A better measure of importance is provided, when those lower-level concepts are put in relation with each other. Then the dimension of "density" comes into the equation. Density is pointing towards the number of referrals between the concepts. The denser the network around a concept, the more central the topic seems to be. Also density varied greatly, but still provided a clearer understanding of the data and its implications. For increased comprehension of the data, codes, categories and concepts, I performed nu-

[10] http://transcribeme.com/

merous analysis, both quantitative as well as qualitative. One aspect which helped me understanding the importance of some concepts, was the visualization in a matrix, where I could identify which codes appeared in every single interview, as Table 6 displays.

I highlighted those codes green, which could be found in every single unit of analysis and light orange, when I did not find them in every interview, but when they still appeared frequently in the research.

	Interview _BKN	Interview _WMP	Interview _CEA	Interview _RGW	Interview _AKC	Interview _KSE	Interview _MWK	Interview _LST	Totals
training / workshops	4	4	3	10	3	3	6	1	**34**
communication / information	3	4	3	3	3	5	4	2	**27**
Implementation	6	3	1	1	2	1	11	2	**27**
organization	2	10	4	4	5	0	0	2	**27**
change	3	6	1	3	3	3	3	2	**24**
transparency	2	3	2	10	1	2	2	2	**24**
pay & salary system	2	8	2	2	1	1	5	2	**23**
career planning / path	1	8	1	3	5	0	1	1	**20**
Involve people	2	2	2	4	2	3	4	1	**20**
KPI's	3	2	0	7	2	2	1	3	**20**
Management	4	4	0	8	2	0	0	2	**20**
performance management	2	2	2	6	5	1	1	1	**20**
leadership / leading	0	3	3	2	2	5	1	3	**19**
performance pay	1	5	3	3	2	2	2	1	**19**

Table 6: Matrix display of code frequency per interview. Green codes/concepts can be found in every interview, whilst orange code/concepts are significant, but do not appear in every interview. Source: own creation.

In a subsequent step, categories were built on the base of the lower-level concepts. The categories need to be sufficiently defined and explained by the lower-level concepts. Categories represent the major themes of the research and the subcategories must have elements in them, which point to the category, see Figure 23.

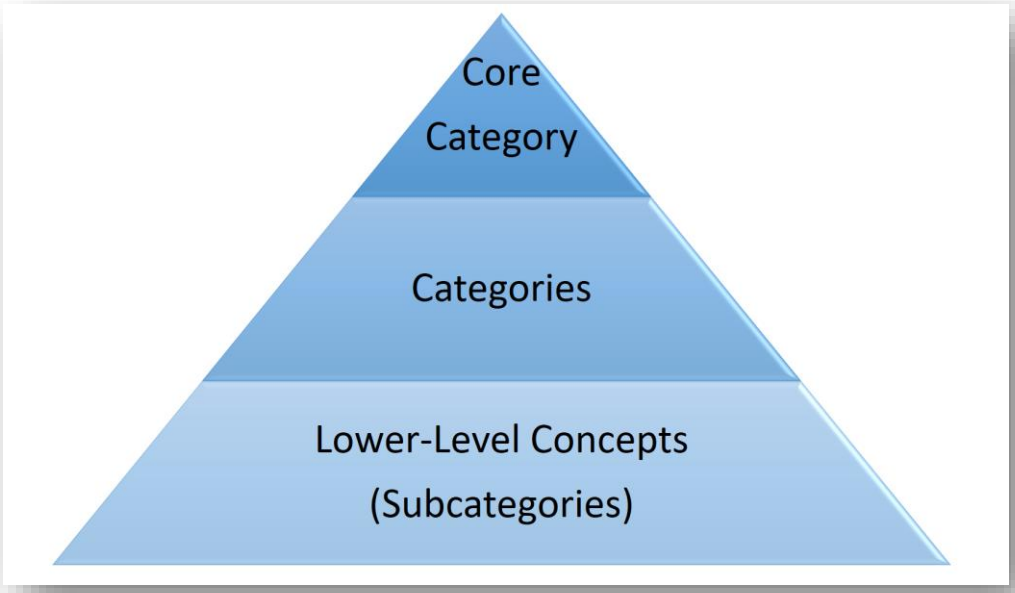

Figure 23: Category development pyramid. Each higher level summarizes lower-level concepts and categories. Source: own creation, based on Diagram 4.1 of "*Basics of Qualitative Research*", Corbin and Strauss (2015, p. 77)

Furthermore, it must be noted that the link between concept and categories can be, but very often is not mono-directional. The relation is indeed often bi-directional, meaning that they influence each other and/or are interdependent. The same is true for the relations between categories and the relations between concepts. Wherever possible and feasible I depicted those interdependencies in the forthcoming graphics.

I coded many concepts in the process of getting acquainted with the data, but after critically reviewing their relevance with respect to answering my research question, I discarded many of them. The discarded codes might still be relevant, but not to an extent to include them into this particular research project.

Ultimately, I discovered a total of 11 categories which are directly or indirectly relevant to my research question. Those are (in alphabetical order):

- Career
- Change Management
- HR Processes
- Leadership
- Organizational Design
- Pay Systems

- People
- Recruiting & Selection
- Training
- Transparency
- Trial & Pilot

I also extracted and defined a core category, which is “Working with People”. For my research, the core category has limited meaning, since I want to analyze the critical elements of a Lean transformation, which emerged in the form of categories. Nevertheless, working with people is the overall bracket of the qualitative research process. A word cloud derived of all interview answers coincidentally supports the core category also from a quantitative perspective, see Figure 24.

Figure 24: Word cloud with a medium sensitivity setting encompassing all words from the answers of the interviewees, providing a quantitative image of frequent words and themes. Source: own creation

The evolution of the codes, concepts, categories and finally the core category is depicted in Figure 25. There, I also listed all 82 individual codes, which later formed the 11 categories.

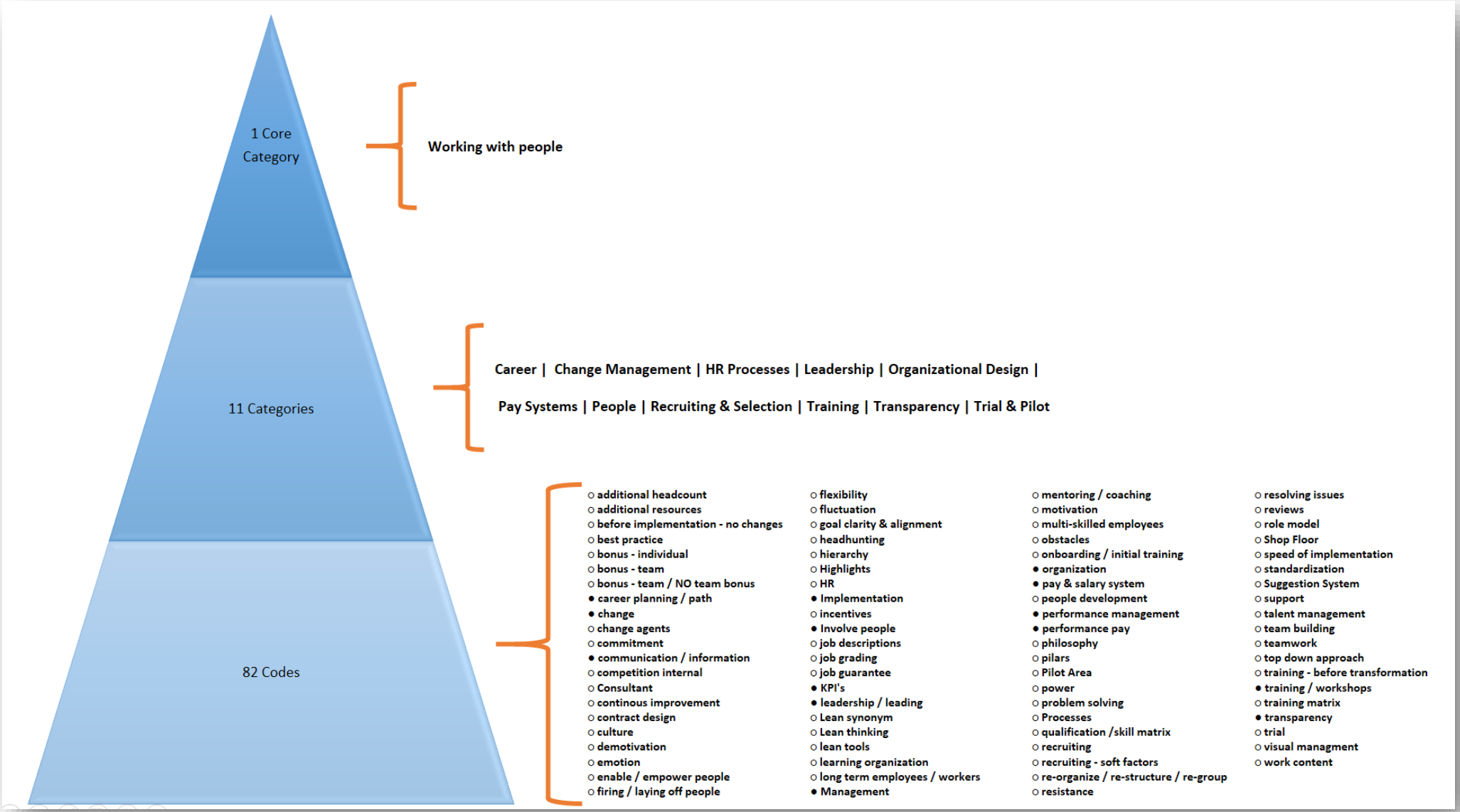

Figure 25: Codes and categories developed out of the qualitative research, following the Grounded Theory approach, aided by atlas.ti. Source: own creation

As indicated above, some categories have a direct and strong link to answering the research questions, while others are still important in the general context, but not specifically for my research question. Hence, I differentiated two streams: one with the "key drivers", which are directly linked to my research question and others I termed "facilitators", which enhance the transformation and are important from a holistic change perspective. In the subsequent analysis, I will focus exclusively on the key drivers. A diagram of the facilitators can be found in Appendix 1: Facilitators of Lean Transformations. Figure 26 below highlights the different streams and elements of the transformation.

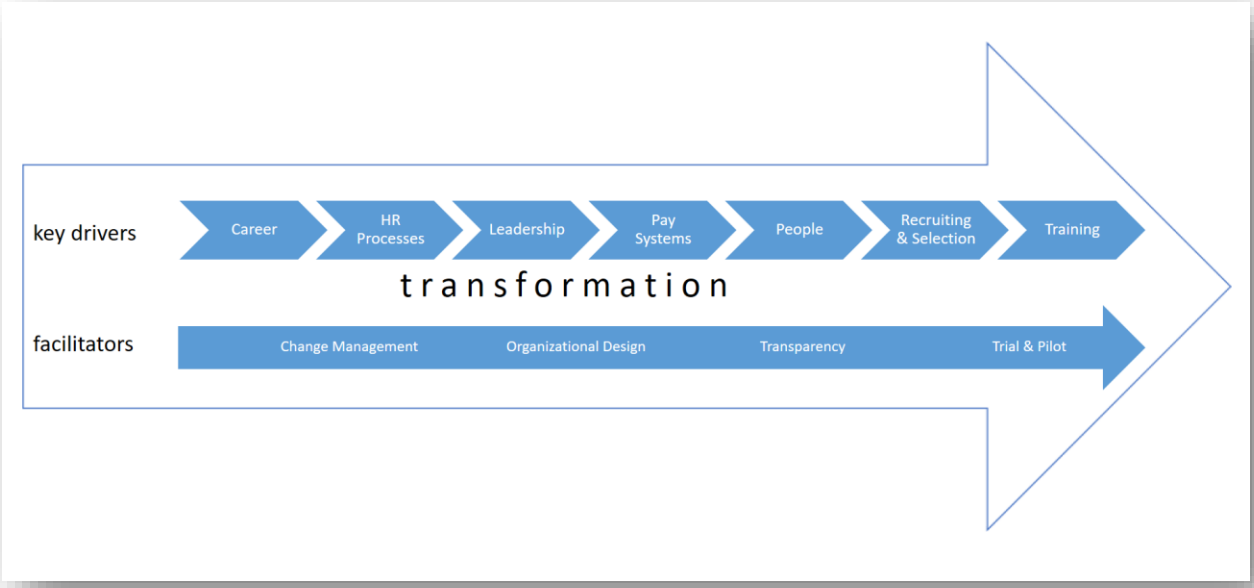

Figure 26: Key drivers and facilitators enabling a Lean transformation. Source: own creation

Out of the overall 82 codes I extracted, 14 codes were not grouped into a category. The remaining 68 codes may occur in one or more categories. It is important to stress, that the codes were developed out of text passages and/or quotations. Most of those passages were coded with more than one code, which explains that ultimately, one code can be found in multiple categories, if the underlaying quotation / information, supports both categories.

The 14 codes, which are not directly linked to a category are still relevant for the transformational context. I attached an overview of these categories and codes in Appendix 2: Codes which were not used in Category Building.

In an effort to bring more structure into the categories, I allocated the sub-categories to the seven key-drivers, as depicted in Figure 27.

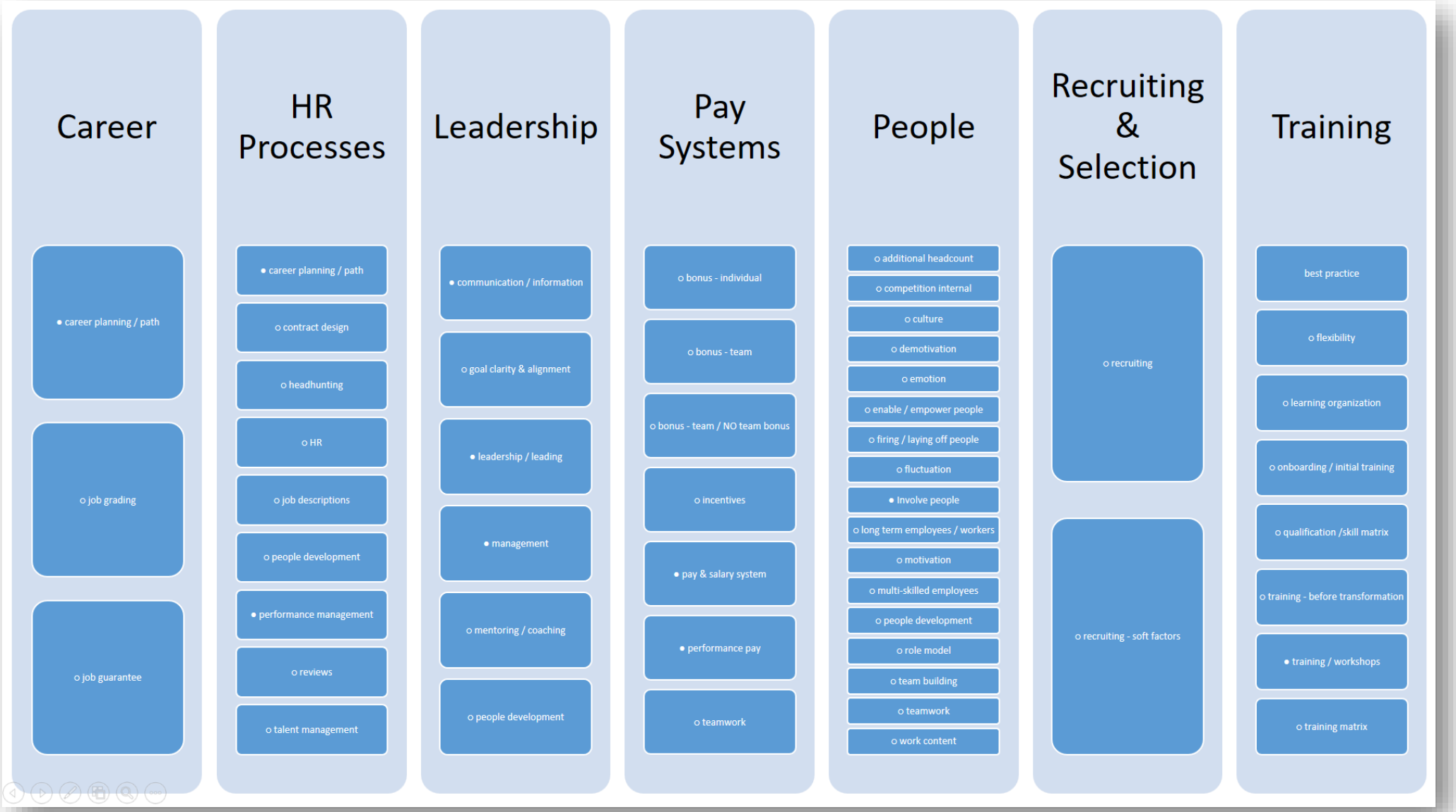

Figure 27: Detailed view of the key drivers categories with its sub-categories. Source: own creation

In the following paragraphs, I will introduce the key drivers of a Lean transformation and highlight, which characteristics make up those concepts. For a more solid understanding of the connection between a concept and the sub-category or code, I will use graphic network displays. Additionally, quotations from the data set will be used to foster a deeper comprehension of the codes' meaning.

2.7.1. Career

The category "Career" was developed out of three recurring codes, with a total of 30 related quotations. Career planning was particularly frequently discussed and is therefore highlighted in orange, as discussed in section 2.7 "Coding, Concepts and Categories".

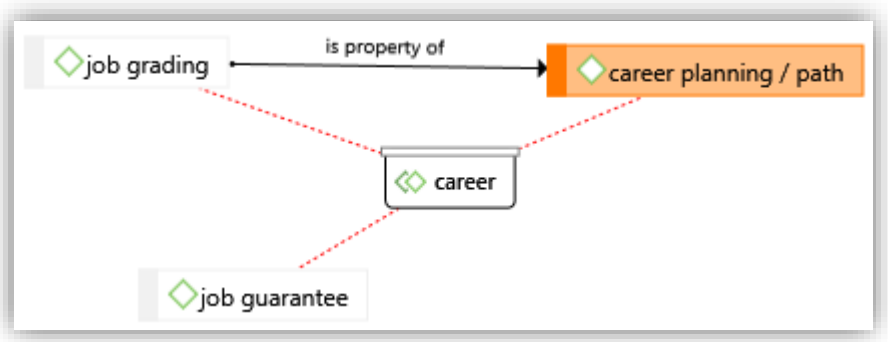

Figure 28: The category "Career" and its sub-categories including linkages. Source: own creation

A vividly discussed issue was, whether to issue a job-guarantee or not. Byrne (2012 p.70) suggests considering a lay-off in excess of 25-40% of the workforce, prior to embarking on a Lean transformation and to issue job-guarantees for the remaining workforce. The reasoning behind that is that efficiency gains will make jobs obsolete. On the other hand, people might block, sabotage or run counter to the efforts of a Lean transformation, if they know their jobs are at stake. A job guarantee should grant maximum buy-in of the workforce. My research showed that there were no written job guarantees, but there were affirmations like "But we said, because of Lean, we won't fire anybody." (MWK) or „Lean does not substitute jobs" (LST). Companies knew they had to take the people with them on the transformation and that they had to deal with concerns and resistance. Then again, one interview also highlighted the danger of job-guarantees "if you tell in advance, 'we'll set nobody free', that means all the lazy guys, they know, 'Why should I do anything [chuckles]? If I improve, that's nice. If I don't improve, they also don't fire me'. This is kind of motivation also." (RGW)

Not a single company laid-off people in advance though. In an ideal scenario, the company would grow their business and leverage their existing workforce better or use voluntary attrition and a reduction in contract workers.

Job grading became important in connection with pay systems, career and training. WMP introduced a job-grading system, that made it possible to compare and evaluate expert versus leadership careers, while CEA employed a workplace grading, which enabled them to define certain skills their people needed to have to successfully operate different workplaces. Furthermore, they also derived a training need from that workplace grading.

Finally, the planning of career paths was a major theme. The common ground was that career planning should play a major role in Lean companies, however, not all companies had such a systematic in place or it did not include all hierarchical levels, like in the case of RGW who states "this is just for the global scale, so on MD level, and some really key positions." AKC as a very advanced Lean company has talent development programs in place, which are tailored towards a special career path and the acquisition of the needed skills and experiences. Also, as requirements or personal focus changes, it is seen as beneficial if employees can switch in between a leadership, expert, or project management career. Tied to that career path are often detailed job descriptions and, once more, a training or qualification matrix. Sometimes the career paths' were not publicized, but somewhat non-formal, as LST stated: „experienced mechanical and electrical workers who have a thorough understanding of the machine can make their way up to be a commissioner."

In summary, career is a blistering category with both controversial and unanimous standpoints, which either way should be considered in Lean transformations. A guiding question can be, whether the career options, processes, job gradings, and other details, fit the new organizational objectives and structures. Particularly the issue of job guarantees and how to deal with it must be considered to warrant the employees buy-in.

2.7.2. HR Processes

HR Processes summarizes several codes, which are related to standard HR operations that can also be found amongst traditional manufactures or that are not significant enough on their own (category- and evidence-wise) to form an own category. This section will highlight particular characteristics which the research surfaced among those Lean companies I surveyed.

A very dense concept is performance management, since it has ties with a lot of other codes, as displayed in Figure 29.

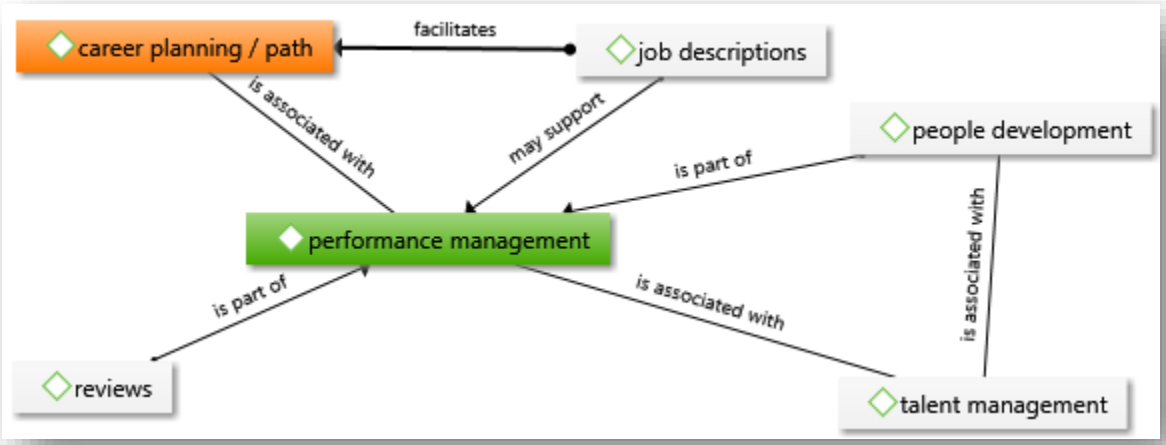

Figure 29: Performance Management as one of the central HR Processes. Displayed here with the connection to its neighboring codes. Source: own creation

Performance management is a topic in all researched companies and the systems are similar in their design with different levels of specialization and sophistication. Most companies have defined specific Lean KPI's, such as the number of Kaizen a manager must complete within a certain timeframe or the number of suggestions, which are filed by workers. Another parallel is that the majority of companies also have behavioral and leadership goals anchored in their performance management system. If there is performance pay, this is typically also tied to the achievement of certain objectives. Some companies have only introduced performance management in the wake of their Lean transformation, as this was the first time, they had accurate and meaningful KPI's in place. Some employees were struggling with this increased transparency and with the stress of being evaluated. Some more advance Lean companies have enhanced their performance management system with a Lean-specific policy deployment method called Hoshin Kanri. This enables excellent and seamless breakdown of goals and easy, transparent controlling of KPI's and objectives.

In that context, job descriptions are important, as they serve as a baseline for the evaluation of people's performance, detecting eventual areas to improve and also as a way to standardize jobs. WMP said that now "we have a description of the function, which is not related to the current owner of the function."

People development is an essential part of the change process in Lean transformations and in fact an ongoing effort. Employees are developed in multiple aspects, so that they can perform tasks, which are of central importance for Lean enterprises. Particularly the breakdown of hierarchical structures (and therefore organizational silos) and the orientation along the value stream bring structural changes to the company and the workforce, thus also creating the need to develop new

skills, for example leadership skills. WMP stated: “And above all, we tried to make it clear that the manager or the department leader is the first person responsible for people's development, and it's not the HR department. The HR department is the biggest supporter but it's one major task of our managers to be the responsible person for people's development“. Another aspect is that not everybody can follow the Lean transformation or at least not in his old role – people development is then also an issue in switching careers, as CNH put it „[…] maybe the leadership path is not the right one for you. There is also the realignment so you are going to the expert path. Those are inside the development plan.“

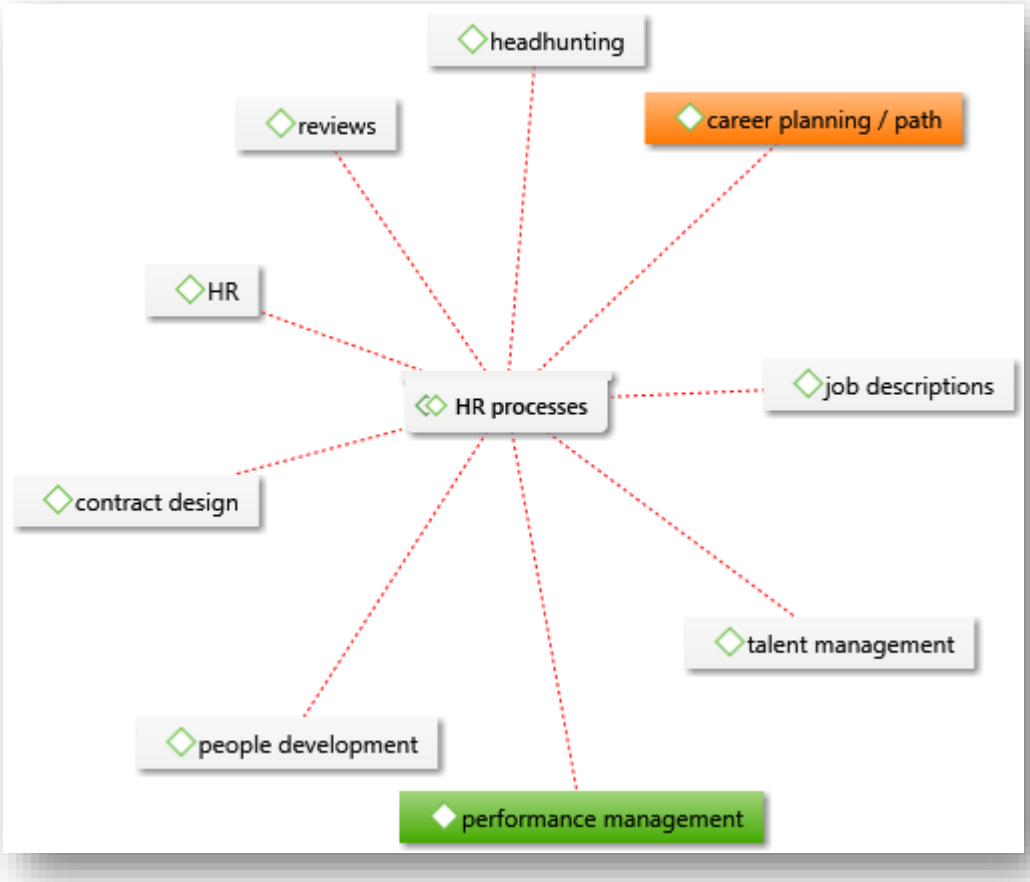

Figure 30: HR processes with the major sub-categories “performance management” and “career planning / path”. Source: own creation

HR is seen by some as the organizer or even driver of qualification and training efforts, tailored to the needs of the focus group. In contrast, talent management is not exclusively the duty of HR, but rather a collaborative effort which is shared with functional leaders, where HR has many coordinative tasks – often across various companies, divisions or units within the same group.

2.7.3. Leadership

Excellent leadership was unanimously seen as a key aspect of Lean transformation and in maintaining the achieved results.

A particular effort of the leaders has to go to communication, starting with the preparation of the Lean transformation. Quite often, companies are accompanied by consultants in their transformation or they develop the knowledge internally. In either case, the management has the ultimate responsibility to communicate, as BKN stated "[…]what's going on and the results and why we are doing it." WMP completes the picture by saying „[…]we recognized that most problems in daily work do not arise from the direct work on our components, on our [*blanked for anonymity*], but the problems arise regularly from missing communication […]" As addressed in the previous paragraph under "People Development" and "Leadership", not everybody was born as a leader or a skilled communicator. Therefore, there is an effort to develop those much-needed skills, such as social skills or communicative skills (WMP). Communication is vital to get people on board and to diminish resistance in the Lean implementation, by explaining the workforce, why certain things are done. MWK explained: „We needed to convince people. And first of all, we didn't want to go somewhere, do a workshop and have to train all those people before. Then we wanted to convince them of the why. Not only of the how, but also of the why. Why did we need to change? Why did we need Lean? And besides monetary benefits, there are a lot of other things we can improve, like ergonomics, the works surrounding and so on. So that's the why." And further: „From my point of view, the one most important point would be to always inform the people what you're doing. Always communicate what's your plan, always involve the workers' union and the people into what you do."

Another central task of leaders is to align goals and to formulate them clearly and precisely. As a helpful instrument, Hoshin Kanri can be used here as well. It is in the responsibility of the leaders to also ensure cooperation along the process steps, which is sometimes done with "interface agreements", where two consecutive process steps agree what they need in order to perform their job. All requirements are put in writing and are signed by all members of both parties. This facilitates high commitment and also serves as an excellent way to further standardize processes whilst actively involving the people.

Especially in times of change, people tend to orient themselves strongly on the behavior of their leaders. With that in mind, it is necessary to also align the leaders goals with the overall objectives of the transformation. RGW brought it to the point by saying "If we want to create leaders, we have to measure them on leading, and not only on EBIT or productivity."

Some leaders were also not up to the task "our leaders, they were hiding behind these regulations, and they did not take all of their responsibility to be a leader and to make decisions." (WMP)

Another aspect which was emphasized by all interviewees, was that the leaders must be brought to the shop floor as often as possible. This can be achieved by regular Gemba walks, meetings or standings[11] on the shop floor or as in the case of LST „The leadership is encouraged to spend a good amount of their time on the shop floor, which is also supported by having their offices directly on site or in close proximity to the production (German: "Führung vor Ort")." WMP for example askes their leaders on every hierarchical level to critically reflect, what exactly their contribution is and why he or she makes a difference in that position.

The different approach to solving problems and in fact to see problems as a chance to improve, required some leaders to adapt their approach. That analytical, structured approach needed to be taught. RGW had a perfect example at hand: "So this was some lessons learnt in the beginning. The management started to, let's call it 'shoot quite fast', against this person. But then, they learned after a few weeks, the person is just the first point where you should go and ask 'why?'. What is the real root cause that you are having inventory in your process? And of course, then we found a lot of different root causes and the organization started to react on this."

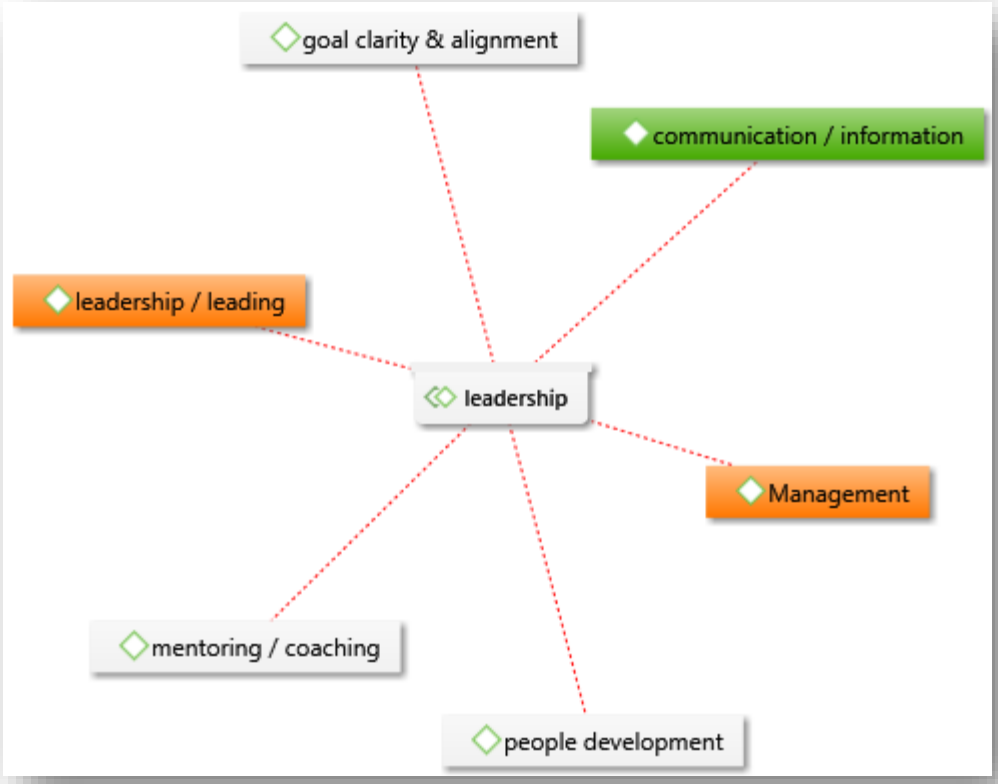

Figure 31: Leadership holds six sub-categories, including three central elements highlighted green and orange. Source: own creation

[11] Also called „stand-up meetings". Read more here: https://en.wikipedia.org/wiki/Stand-up_meeting, accessed 2017.10.13

To develop leaders and their skills, some companies made use of either mentoring or coaching or a combination of the two. Sometimes external coaches are utilized, but very often, the companies own leaders double as coaches and mentors. Those coaching sessions can be done during the daily KPI meetings or in specially devoted time-blocks in the schedule of leaders - a concept which is often incorporated in the so called "Leader Standard Work"[12] regime.

2.7.4. Pay Systems

Pay systems are a vital part of any company and sometimes they are difficult to change – may it be because people are so used to them or that unions have a strong say. Pay systems were also very central in my research and were adapted to the Lean needs during the transformation.

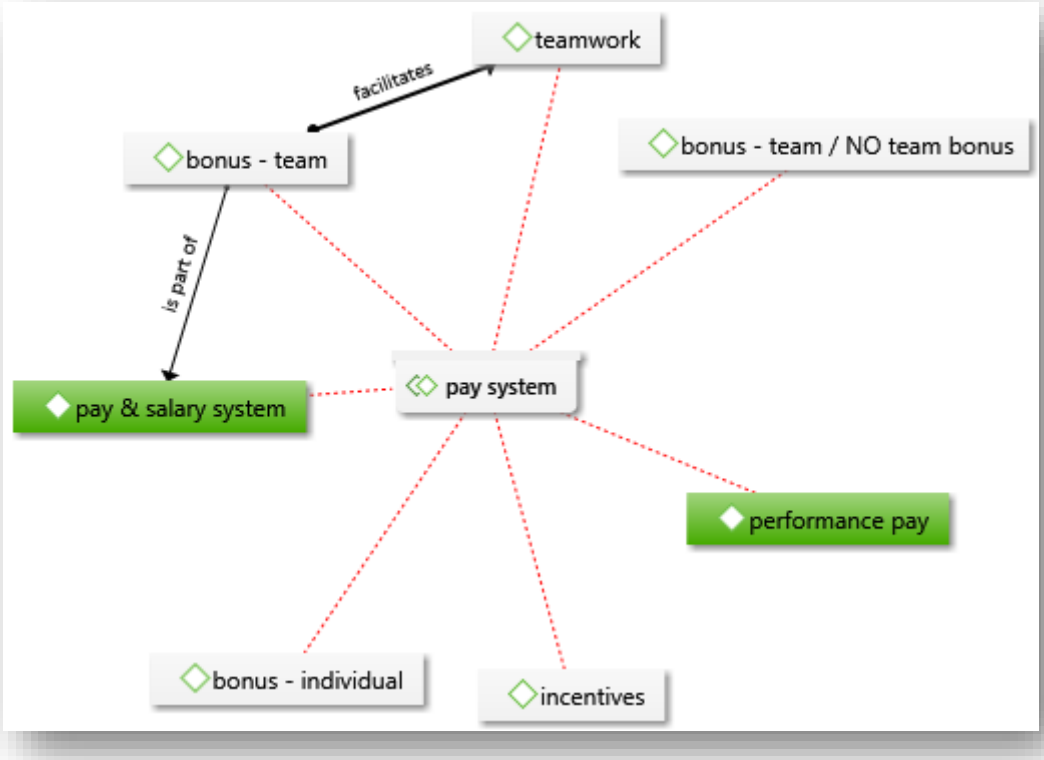

Figure 32: Pay systems. Source: own creation

All companies had fixed salaries and a performance-based variable pay. How the systems were designed varied according to the specific needs of the company and the level of transparency they had reached. To determine individual performance, the companies must have very good master data and KPI's in place. And still, in some cases it was not desired or too effortful to measure

[12] For more information, please see https://www.lean.org/common/display/?o=2493, accessed 2017.10.13

individual performance. Furthermore, Lean relies heavily on team efforts, so pay systems were often tailored to team performance. As another general rule, team-bonuses are more widespread on lower hierarchical levels. Middle and Top Management usually have strong individual targets and are occasionally also participating on the entire companies result. In one case, all the workers also got an equal share of the company's overall financial result. When it comes to team pay, most companies divide the bonus amount through the number of people in the team. Paired with high team autonomy, this can also increase productivity, as in WMP's example: "the team can even, they can even decide the number of team members, plus/minus one or two, because they can say, 'We do it with ten people, then we have to work little bit more. Or we do it with 11, but then we have to divide the premium by 11'."

Typically, any type of bonus, may it be a team bonus or an individual bonus, is attached to classic Lean parameters. On management and leadership level, often the number of successfully run Kaizen projects is part of the performance pay. On workers level, it is often linked to the number of workstations one person can handle, the time which is spent with value adding activities or other KPI's like customer quality or productivity. Pay is also used to facilitate easier transformation. Some say that they found it easier to transform the company and their culture, if the employees also saw a financial benefit in changing their behavior and way of working. One participant stated: „And I think that's the only way of really starting this-- because there needs to be this extrinsic motivation, if there would be an intrinsic motivation already there, then this would already exist, but it's not." (RGW)

However, there is not only monetary rewards in order to guide behavior during and after the transformation. A lot of companies work with incentives like free barbeques, new set of T-Shirts or work apparel. Additionally, companies on the transformation also emphasize non-materialistic benefits for the workers, such as increased flexibility in working hours (applies to some), increased work ergonomics and improved work environments. There is also broad consensus on what not to pay for, and that is for improvement ideas/suggestions. As discussed in pervious chapters, Lean relies on continuous improvement from all individuals within the company. It is seen as counterproductive to pay for individual improvement suggestions, as this steady improvement process should be an integral part of everybody's job. One company has monetary rewards for improvement suggestions in place, but they are dissatisfied with it and are looking for a way to end it. This proves difficult however, because people are stripped from the opportunity to earn some extra cash. Other companies give out non-monetary rewards or have a type of internal competition system in place, where exceptional performance is highlighted. Those great achievements are then often spread as a best practice example on the company's intranet or are celebrated on Lean galas.

Occasionally, there is no elaborate and transparent performance pay system, but interviewees admit, that more highly skilled workers have more bargaining power in salary negotiations. Generally however, the interviewees prefer to have some kind of fair salary system, where equal work is paying the same amounts.

2.7.5. People

Unsurprisingly, the category "People" holds the most sub-categories within the key drivers segment in Lean transformations. Since a Lean transformation is mostly about a change in culture, working with people, which also surfaced as the core category, is crucial. In the following paragraph, I will highlight the most central success factors.

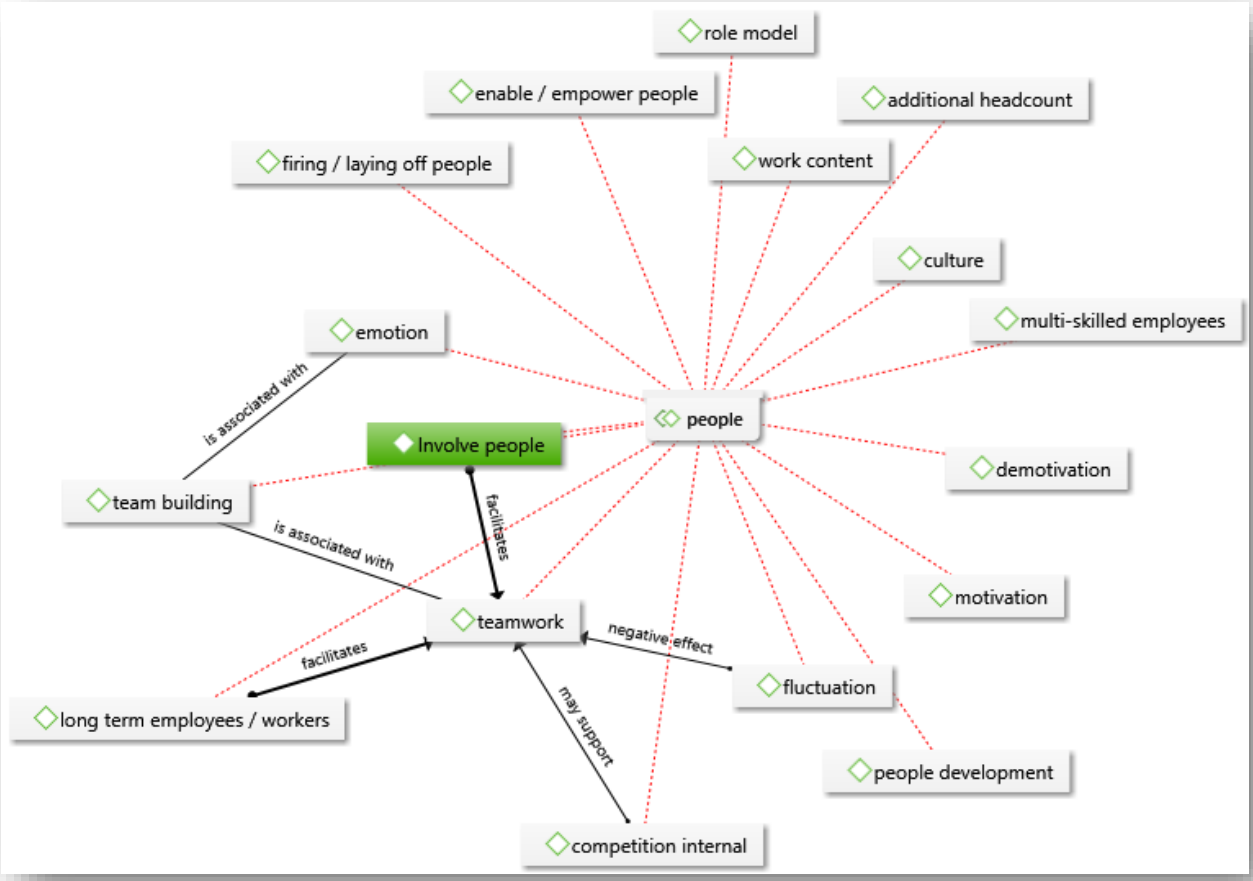

Figure 33: People category with its dense network and the emphasis on teamwork. "Involve people" is highlighted green, as this was a topic in all studied companies. Source: own creation.

My research showed a very dominant theme across all companies to empower people, involve them profoundly, make them more autonomous and increase their personal accountability. This is

very much in line with the findings of Womack et al. (2007 p. 12) which stipulate "[…] a key objective of lean production is to push responsibility far down the organizational ladder." Womack et al. also admit that this can be stressful for the individual. Why the responsibility is being pushed down, has a number of reasons. The most dominant one is probably because people who are performing a process step usually know best, which improvements the processes need. MWK provides a suitable example: "Especially the operators because they know the processes best. They know what they've been doing – sometimes for the decades. So they are the ones who can tell you the best what's wrong with the processes. Then you need a specialist, whether it is an internal Lean person or an external consultant, that knows how to solve those problems with Lean matters."
Furthermore, when you engage the people and encourage them to solve problems on their own, as opposed to work brainlessly and let a quality manager or department leader detect problems, the companies can also flatten out hierarchies and therefore making the organization nimbler. As a side effect, people feel more appreciated, if their advice is being heard. Many companies for example, did not have the need for a foreman any more, as this was organized by the team itself. Alternatively, a sort of foreman is part of the team and acts as a "playing captain", who others can call for help if they need assistance or consult for advice when solving problems.

Having that sort of team structure is also partially founded in the need to manufacture in so called "cells", see "Cellular Manufacturing" under 1.6.1 "Concepts". The teams who are organized in cells do not necessarily have to produce the same product, but are often responsible for performing one particular process step. The next team further downstream takes the product and performs another value adding activity until the finished good is produced. In an effort to coordinate teams and reduce friction, some companies have interface[13] agreements between their teams. In those documents, teams write down what they need from the pervious process step in order to fulfill their work or which parameters they will check, before a product (or service) moves from one section to the next. This ensures a high commitment between the individual process steps and is important in creating flow, whilst also reducing anger between teams (MWP). Lean principles and structures can generally help to keep negative emotions or demotivating events out. Teams are supporting their members to achieve the common goal and if they cannot do it alone, there is a person, who they can attend to. Furthermore, if the production and processes run smoothly, there is not much need for stressful firefighting.

[13] In German the word interface would be „Schnittstelle", symbolizing that something was cut there and is therefore seperated, which is somehow negatively connoted. Some companies therefore call this „Nahtstelle" instead, which means stitching or seaming place, and stands for something that is connected and one piece.

Before transforming the enterprise, it is seen as important to involve people at all levels from day one. As touched in a previous paragraph, information and communication are key – it is important to find a common Lean language and understanding. Equally important is however, to let people decide (where possible) how they want to re-organize their sphere according to Lean principles. They aim is to have a critical mass of people "[…] who are burning for Lean manufacturing, or at the end for improvements, or for changes and involve them because they also can motivate others." (AKC) This movement is supported by training and educating efforts and in most cases by an additional headcount, meaning that either somebody from within the company or an external consultant is working full time to support the Lean transformation. Those Lean experts provide trainig to the staff, like for example how to perform VSM's or to explain the different types of waste and assist in problem solving by providing the appropriate Lean tools.

When embarking on the Lean transformation, keeping the motivation up high is essential. Ways to do this are to highlight the personal advantage people have from the new way of working or can also lay in the pay systems. Some companies launched internal competitions, so that teams would be motivated to outperform others in the transformation - then again, positive examples are highlighted and some teams or individuals developed themselves into role models and thus change agents. Moreover, if other teams or people saw the power of Lean, they had a high ambition to follow the positive example and to reap the same benefits.

In most cases Lean also comes with a shift in priorities or values, which have to be explained and brought to life. There is a big effort to communicate those new values and expectations prior and whilst the transformation – always supported by other systems, such as performance management or incentives. However, not all people are able or willing to work in the altered environment. Some companies therefore experienced a higher fluctuation during the Lean transformation but report lower levels of fluctuation upon successful adopting the Lean culture and principles. An often mentioned factor for either lay-offs or voluntary resignations, is the increased transparency thanks to massive data acquisition and much more precise KPI's which reveal underperformance. Another interesting aspect surfaced, when AKC told me, that once the company was truly Lean and has developed Lean experts, they were in high demand on the market and consequently headhunted away.

Working in teams is nothing very novel nor a unique feature of the Lean companies I interrogated, but as described above, Lean teams typically have different requirements, autonomy, goals, tasks

and modi operandi. It is therefore important to re-group teams along the value stream (often including amending the team size and switching people across teams) and to prepare the teams for their new tasks. Teambuilding efforts are thus also often expanded. BKN, a Lean consultant, who has helped numerous companies transform, stated: “the workshops were also - I would say - the best team building ever. Because, if you work together on something it's really-- it's also team building.” A special aspect in team building comes into place, when new hires join established teams. Generally, Lean companies pay more attention to the cultural and personal fit of a new hire, so it is not uncommon that potential candidates meet their future team and eventually work with them before they are hired.

Since teamwork is so central, I extracted the network in which “teamwork” is embedded, see Figure 34 below. Concepts that stand in relation to teamwork are: flexibility, problem solving, competition internal, communication, team building, fluctuation, long term employees / workers, involvement of people, team bonus, hierarchy and leadership. Each has either a mono-directional or bi-directional link to the category “teamwork”. In fact, the network can be easily extended, to neighboring or influencing concepts, just as shown in the case of “team building”, which itself has four characteristics that are partially interconnected. Those sometimes complex connections may point out problems that have to be addressed in the course of a Lean transformation. If the company who wants to adopt Lean management does not have a history of teamwork and wants to establish this cornerstone, they should think about teambuilding. This step requires a re-organization of some departments or the entire company and will spark emotions which may cause problems that should be resolved.

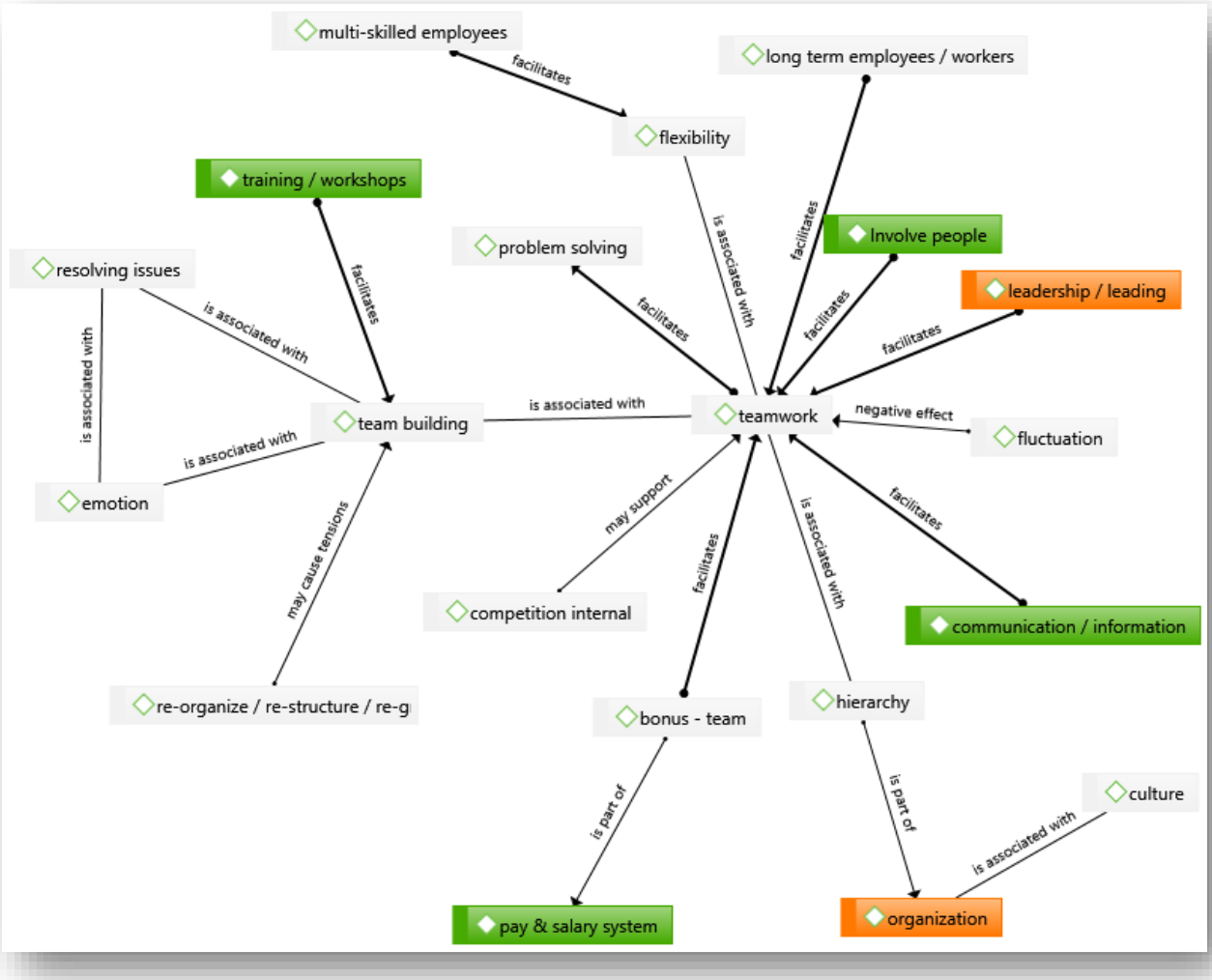

Figure 34: Teamwork as one of the most important codes with the neighboring codes and their relation amongst each other. Source: own creation

Problems are usually easier solved by teams and in Lean companies, problems are generally seen as an opportunity to learn and to improve. The problem-solving skill is therefore critical and people are given the ability to solve problems by specific training. Internal competition can be healthy for teamwork, when teams compete against in each other in a fair and transparent way. Competition may arise organically, for example from visual management, which displays results of each team. RGW stated: “Okay, of course people aren't always happy with the-- … when you then start to see your problems, backed by figures. But from the other side, it helps of course to motivate the whole crew because human nature is of course everybody wants to be the first.” Competition can also be induced, as WMP put it: “We wanted to do something which stays in the mind of the people and we also wanted, a little bit, to raise the competition between the teams, so we designed it as competitions.” Interviewee MKW added another dimension to the discussion, namely if there should be some kind of incentive attached: “Well in some plants there's kind of things for teams, if they

have a good performance they will get a barbecue sponsored at the end of the year. Things like that or they would get smaller [sic! – should read “small”] premiums. And then there's of course also for very good projects there's a yearly competition for the plants.”

Because a Lean organization is also a flexible organization, reacting on oscillation in customer’s demand (see Pull, Heijunka, etc. in 1.6.1 “Concepts”), also the people need to be more flexible than in traditional manufacturing. One way to achieve flexibility is the combined concept of standardization and multi-skilled workers. All researched companies require their shop floor workers to be able to operate on more than one workstation. It is common that people in Lean companies can work on three to seven different workstations. In order to switch people from one job to the next, the jobs need to be accurately defined and standardized. Of course, having people working numerous different jobs, requires a higher training effort than in traditional manufacturing companies. Taken to the extreme in Henry Ford’s mass production, one worker would only perform one task all his life. Lean employees have a much richer and varied range of tasks, which leads to higher employee satisfaction, see Seppälä and Klemola (2004, p. 177) and Alves et al. (2012, p. 219).

Almost all companies I examined, had a very precise list of skills, which were required to operate one specific task. If an employee fulfilled all the requirements, then she/he was able to work on that station. Frequently, such skill requirements are recorded in so called „skill-matrices“, where one can clearly see all the requirements of a certain step and on the other hand all people who can perform this. Blank spaces, meaning missing skills, can be transformed in a training matrix, which then serves as a basis to determine training needs for a person or a team. Highly skilled employees often take the role as a trainer or coach to lift trainees to the next qualification level. Furthermore, it can also easily be seen, which persons can bridge the gap when a colleague is on sick-leave or on vacation. This further increases the flexibility of the firm.

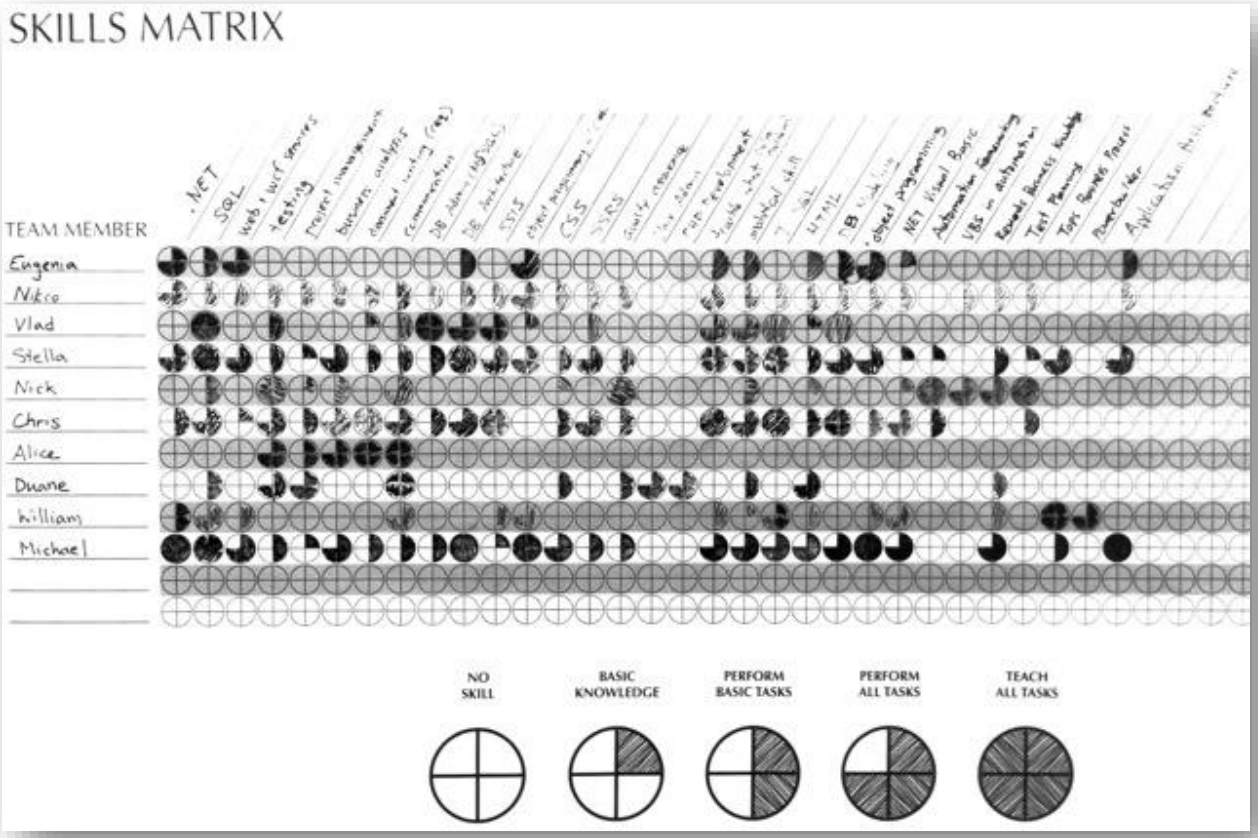

Figure 35: Example of a skill matrix with visual display of knowledge levels. Source: Agile Advice, "*Leaving your title at the Scrum team room door and pick up new skills!*", http://www.agileadvice.com/2013/06/18/agilemanagement/leaving-your-title-at-the-scrum-team-room-door-and-pick-up-new-skills/, accessed 2017.08.22

Concluding, we can assess that managing people with all its factettes is a challenging mission. HR can certainly contribute to the successful handling of a lot of people-related issues, nevertheless it requires concerted actions from all hierarchical and functional levels within an organization to cover and maintain all people related processes. A careful alignment of all levels involved seems imperative. Furthermore, we have to remind ourselves that processes have a tendency to erode over time, when they are not constantly renewed – this also holds a few challenges for HR.

2.7.6. Recruiting and Selection

Getting quality people on board is a principal factor in Lean transformations and in running a Lean enterprise. While this category holds only two sub-categories, the qualitative analysis revealed that those aspects discussed in this paragraph have extensive influence and appear directly or indirectly in every interview. The researched companies have different strategies to attract the workforce they need, taking into account the specifics of their industry, geographical location or type of job. However, Lean companies pay a greater attention to soft factors, such as personal traits, mindset,

values, mindfulness, ability to learn or to work in a team. On the lower level jobs, it is common, to have job candidates work in trials, where not only physical and job skills are monitored, but also how well they fit into the team. Some companies, especially those with exceptional, rapid growth, admitted that they could not pay a lot of attention to selecting the right individuals – they just had to get people on board as quickly as possible and trained them on the job. When companies have sufficient time and a proper HR strategy, they tend to recruit people who are experienced in Lean, at least in leadership positions. Furthermore, RGW pointed out how important it was to also train the HR department on how to recruit and select those wanted individuals. KSE employed an outside consultant, because they did not have the knowledge within the company.

Figure 36: Recruiting and selection category. Source: own creation

Whichever way to go, the common ground was that it is crucial to also evaluate the "soft factors" and psychometrics closely, which requires the organization to think about which traits, values and other factors they need for their specific industry and for the specific jobs to be carried out.

2.7.7. Training

Training is a very central category across all my interviews. It not only is important in preparing and executing a Lean transformation, but in fact is an ongoing effort, since Lean is all about continuous improvement. Training fulfills many purposes – some very obvious like adopting new skills, but also some less obvious like to ease anxieties which come with change. There are different approaches how training is used in Lean transformations, but typically, there are two approaches: to train a broad mass of people or to start narrow and focused in a project area and roll it out thereafter incrementally or in waves. All have a common set of goals however: to facilitate the change process, to prepare people for new tasks, to add new skills and to continuously develop

all employees. Particularly workshops are often used to convey the new way of working, where also the new directions are set.
Trainings are typically custom-made to address the specific needs of a targeted group of people or individuals. All respondents said that in a top down approach, they try to train everybody, as also Lean requires all functions and departments to fully understand the Lean principles. In large organizations or when implementing Lean in waves, it is hard to reach everybody simultaneously – also because training resources are usually scarce. A training program and strategy has to be developed, which specifies the focal points, content and timing of the trainings. It was also noted, that training and the training needs itself are a moving target, or as one respondent said "[…] nobody really could get the whole picture at the very beginning." (AKC) Also training efforts are subject to continuous adaption and improvement in line with the companies need and progress in the transformation. An issue which produced controversial data was, when to start with training and preparation efforts. It seems that every organization must find its own strategy and tactics. One aspect seems notable however: early and comprehensive training efforts ensure a faster transition; BKN: "For those people taking part in this workshop it's really a fast transition."

As indicated in the introduction, training before and during a Lean transformation can also reduce resistance of people, for instance by demonstrating the power of Lean and the advantages for the individual. In my sample, a popular method to avoid resistance which stems from the occasional negative associations with the word "Lean" (job loss, higher pressure, etc.), was to name the system differently. Six out of eight interviewed companies named their Lean program differently, for example WCM (World Class Manufacturing), ZERO, Synchro, or "company name" + "production system" (e.g. Nike Production System).

The methods to train people are as multifaceted as the needs of the companies. Mostly, different methods are applied to train certain groups of people. Workshops seem to work on all hierarchical levels and can be used to train common, undifferentiated content to a fairly large number of people, whereas coaching is highly individualistic and thus more elaborate. Wherever production is the focus, a lot of my interviewees have created some kind of training centers either on-the-line or off-the-line, which are used both for onboarding new employees and for training/cross-training existing employees. The specific needs of the target audience are occasionally casted into specific career paths and/or talent programs, where the levels of skills needed to reach the next step are specified, along with the trainings which an individual must complete to reach the higher level. Whether this continuous education should be pushed or pulled is contested. Some argue, that people who are confident in doing "work A" have no intrinsic motivation to learn "work B", whereas

others say, that they invite people to make a career and thus to educate themselves, which in turn will lead to a climb on the career ladder. A great emphasis is paid not only to develop hard skills, but also to develop soft skills, such as leadership or communication skills. The programs usually also take into consideration, if a person is following a leadership, expert or project career and tailor the training efforts accordingly.

In a project based rollout, it is common to deploy a very topic driven workshop for a start, for example on eliminating waste, PDCA or how to create value. Some companies make use in this phase (and also in regular Lean operations) of best practice experiences and exchanges. CEA explained "we always visited another best practice company before our workshops - so for example, BMW in Steyr and Trumpf in Pasching- and then we made a one-and-a-half-day workshop and ask them, 'What are these companies making different to us?'." This is a good example of also motivating the people to think of their own solutions, rather than getting some input from outside. Training efforts from outside are needed, if there is a lack of internal resources or knowledge, but all the companies agree that the organization has to build up the capacity to train their own people. Consequently, it is the goal to develop a learning organization and also to develop capable trainers. Here is one important link to the skill matrix as shown in Figure 35. All interviewed companies had skill matrices (some also named it qualification matrix or any other tantamount expression) in place, where they marked the skills needed for a job, or a workstation or other duties. A fully trained person, is then often designated as in the example in Figure 35 with „teach all tasks". In this way, an organization develops its own trainers – sometimes also aided by external consultants with specific knowledge, but in the end, the know-how should be transferred into the company. On the flipside, blank spaces indicate a training effort and are consequently trained. Once the training is completed and a new skill is acquired, the skill matrix is updated accordingly. Skill matrix and training matrix are therefore often designed as loops or cycles. Here, two more factors come into play: firstly, people may be re-trained or re-certified to maintain their status or to update to the latest skills and knowledge. And secondly, training efforts should be measured as also CNH indicates: "We have an approach which is strictly driven by money. So at the end if we are training hard skills, then these hard skills should be somehow translated into finished projects. And finished projects means that we have gained some benefit in terms of money." Of course, monetary returns are not the only way to measure a return on training efforts.

As a good practice, most companies have the training matrix displayed at the area where the specific work is done in an effort make information visible and accessible. One interviewee said, that they previously had the matrix on their computers in digital format only, but then they would have

to deliberately access and view the file, whereas a printed version is always there and visible. Other links which can be established here are the connections of the skill and training matrices to multi-skilled employees, to standard operating procedures, to accurate job descriptions and finally to the resulting flexibility. Only where jobs are accurately specified and the scope of the job including the necessary skills are standardized (SOP's), multi-skilled employees can take on different roles depending on changing workload – may it be seasonal changes in demand or any other fluctuation in customer demand. Of course, this is once more in relation with principles, such as Heijunka, JIT or the Pull System.

Training is not limited to Lean tools and methods, but includes all areas which need to be trained in an enterprise – for example the so important topics of safety and security, which are heavily emphasized in Lean companies, as accidents also represent waste in the form of a lost worker, downtime and other factors. On this intersection, it becomes very obvious, that Lean is not a set of stand-alone measures, but a highly integrated and interdependent system.

Once that complex training system is set up, it is also used for onboarding new employees. The aforementioned training stations or centers are utilized to acquire and practice skills. This is contrasted by a training on-the-job concept, where people are brought straight to the line, mostly under supervision. Sometimes, a mix of the two methods is applied. Interestingly, Liker and Meier (2007, p. 32) find that the performance curve of people trained on-the-line versus off-the-line deviate considerably in favor of off-the-line training, which reaches a better overall performance level and is even able to sustain it, because they argue that on-the line trainees have not mastered the fundamentals equally good. A way to train fundamentals is the Kata routine, as presented above.

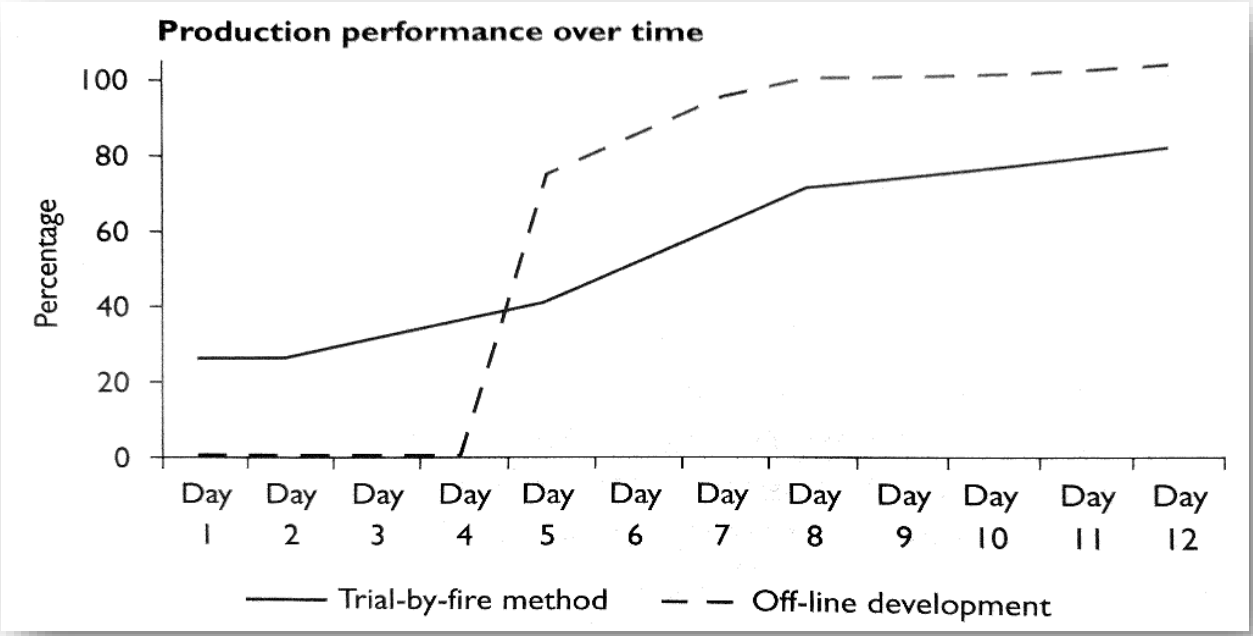

Figure 37: Performance levels reached by on-the-line training versus off-the-line training. Source: Liker and Meier (2007, p. 32)

When it comes to an initial contact of new hires with the firm and its specific Lean approach, some companies use kick-off events, where they introduce the program and the company – often across many manufacturing plants, sometimes globally in the framework of a talent development program. KSE noted however that not everybody has the same starting point in terms of knowledge or learning pace, and thus smaller programs or even individual coaching would be preferential.

The ultimate goal of all training efforts is to create a sustainable learning organization. There are many approaches to achieve such a state and some are outlined in this paragraph. CNH views problems as one source of a learning possibility and has found ways to incorporate those lessons learned into the firm – one tool that would aid this process is the A3, where the final stage deals with standardization, thus making the new, elevated level of performance the new organizational standard. Another frequently applied concept is that of installing dedicated Lean managers, or "Kaizen Promotion Offices", as Byrne (2012, p. 66) calls them. They are staffed with one or more Lean expert(s) which assist the organization with Lean tools, document learnings, exchange best practices and thus driving the Lean agenda.

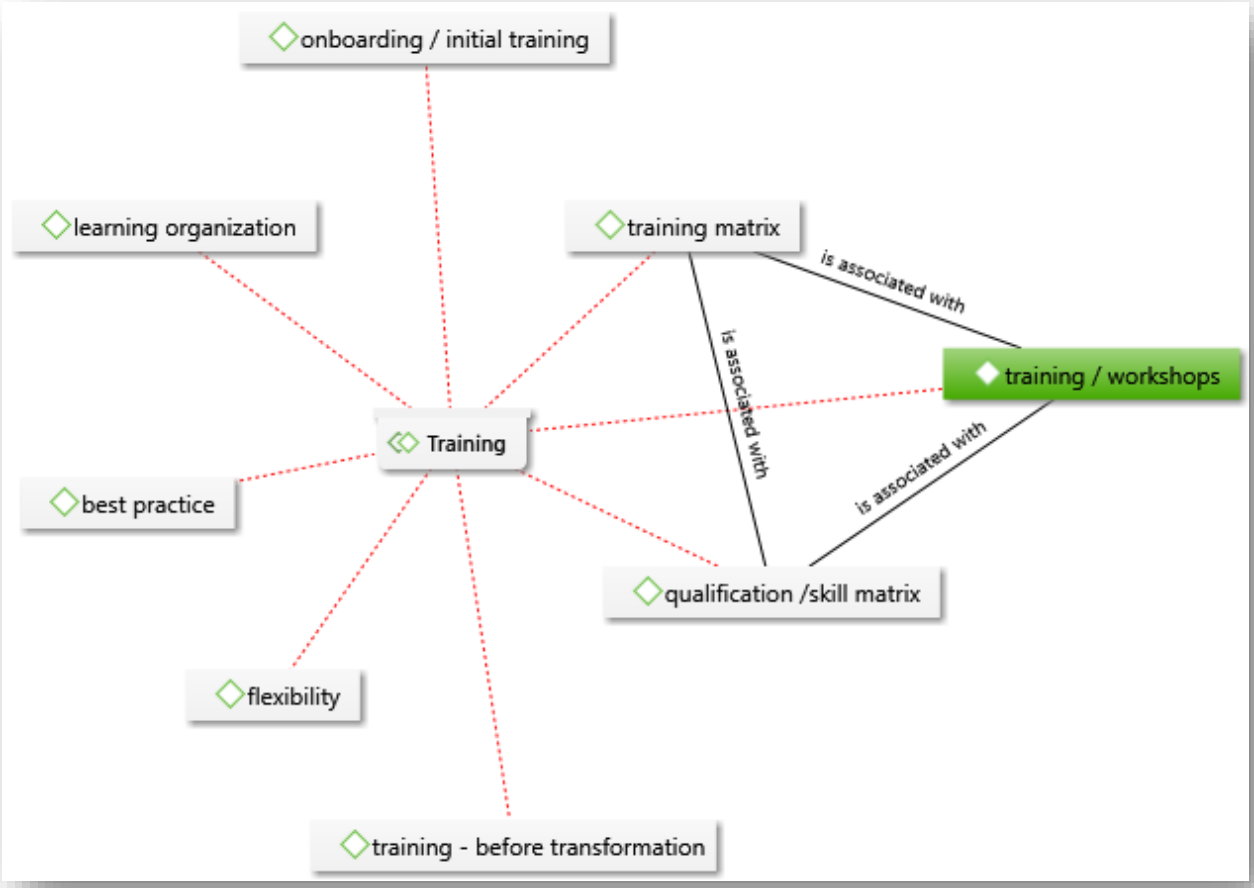

Figure 38: Training category with its sub-categories and connections. Source: own creation

In summary, the category training is very complex and embedded in a number of related topics, tools, concepts and methods. There is no single right solution as to how a training program with all its features should be designed. A great deal of thinking has to be invested to develop a training program, which addresses the most crucial elements of the business. An indication of what to train can certainly be found through a rigorous VSM. How and at which point in time training is started is subject to strategic decisions or operational needs, but the common ground is that any program must be dynamic and constantly adapted to the organizations needs and wants.

2.7.8. Miscellaneous Findings

With the introduction of Lean, a lot of effort is put into developing meaningful KPI's. The logic behind it is that to improve something, one has to know about the actual status in great detail. If KPI's are selected and measured in the right way, they make non-value adding activities very transparent – not only in processes, but also the contribution and achievements of employees become very transparent. One Interviewee (BKN) expressed this quite vividly: "There's much more

transparency in terms of measuring productivity, the work, the people, the problems also. So, everybody knows what's happening and what the problem is today.“ And further: “We had some fluctuation, especially in the management area. It was quite interesting that some who were not able to perform any more - or at least not as good as before. They decided to leave.”

Art Byrne (2012, p. 70) also pointed out that middle and senior management are likely to resist change the most and that HR needs to be prepared for this. The implications for HR managers are important: they can expect that there will be people, who cannot or do not want to perform within the Lean system. Also, some people might actively sabotage the efforts to introduce Lean. This necessitates a few actions, namely how to deal with voluntary resignations, how to deal with underperformers, who want to stay after all, how to deal with saboteurs and how to find new, suitable people to fill the vacant positions.

2.8. Summary

My study was designed to explore all relevant HR-related elements and connections, which Lean companies have established before, during and after their Lean transformation. I paid a lot of attention to choosing an appropriate methodical framework and to avoid any sort of bias. The setup and the execution of the research was handled meticulously, as I believe that only a stringent and accurate research process leads to valid results. The interview partners are all experts in their field and were able to provide a comprehensive account of the researched areas. The question remains however, if my interviewees are biased from any sort of Lean paradigm. I do not think that this is the case, because they did not cite general events from Lean literature, but provided specific examples of their particular Lean transformation. Additionally, I could convince myself in many cases of the reports my interviewees provided, by either data triangulation or factory visits, where I could see first-hand, how they deployed their Lean and HR systems.

The empirical study revealed a number of factors, which are relevant in Lean transformations. They were developed into codes and later into concepts/categories. Overall, 11 categories could be identified and were consequently split up in “key drivers” and “facilitators”. The key drivers are the central element of the research and were presented in detail.

3. Chapter – HUMAN RESOURCE MANAGEMENT

3.1. Introduction

Chapter two revealed that not a single measure is important in Lean transformations, but rather a number of HR practices and systems make up for an effective, efficient and sustainable Lean transformation. This chapter will explore existing HRM practices, which cover all the categories described as key drivers and show how such systems should be designed. Those holistic, integrated work systems are often referred to as HR bundles, High-Commitment or High-Performance HRM, High-Performance Work Places or Organizations or as High-Performance Work Systems (HPWS). I will show which practices they entail and how they can be used to support a sustainable Lean transformation.

3.2. Definitions and Characteristics

As touched in the introduction to this chapter, there are a lot of different terms, which in part are tantamount and in other aspects they differ. For a clearer picture in the subsequent analysis and discussion, the succeeding paragraphs will introduce the most widely used definitions of the major terms.

Unfortunately, the terminology used in many publications varies substantially – even within publications of the same author, terminology is often mixed as Hughes (2008, pp. 14-15) finds.

Table 7 is an attempt to categorize and arrange the multitude of terminologies, whilst extracting their dominant emphasis.

Terminology	Examples	Dominant Emphasis
High-Performance Work Systems	Appelbaum *et al.* (2000) Becker & Huselid (1995) Danford *et al.* (2004) Farias (1998) Harley (2002) Kling (1995) Ramsey *et al.* (2000) Takeuchi *et al.* (2007) Way (2000)	Production Management
High-Performance Work Practices	Combs *et al.* (2006) Handel & Gittleman (2004) Huselid (1995)	
Performance-Enhancing Practices	Delaney & Huselid (1996)	
High-Performance Work Organisation	Ashton & Sung (2002) Blasi & Kruse (2006) Lloyd & Payne (2006) Osterman (2000)	
New Forms of Work Organisation	Edwards *et al.* (2002)	Work Organisation
High-Involvement Work Systems	Edwards and Wright (2000) Felstead and Gallie (2002; 2004) Harmon *et al.* (2003)	
High-Involvement Work Practices	Pil & MacDuffie (1996a, 1996b) Fuertes & Sánchez (2003)	
High-Performance Practices	Godard (2004)	
Human Capital-Enhancing Practices	Youndt *et al.* (1996)	
High-Involvement Management	Forth & Millward (2004)	
High-Commitment Management	Wood (1996) Geare *et al.* (2006)	
Innovative Human Resource Practices	MacDuffie (1995)	
High-Commitment Work Practices	Iverson & Zatzick (2007)	
High-Performance Employment Systems	Brown & Reich (1997)	
High-Commitment Human Resource Policies	Green (2004)	
High-Commitment Management	Baird (2002) Whitfield & Poole (1997)	
High-Commitment HRM	Bryson *et al.* (2005)	Employee Relations

Table 7: Overview of terminology and authors in the "High-Performance" literature. Source: Hughes (2008, p. 14)

Despite the broad terminological array, three dominant spheres can be identified, namely: production management, work organization and employee relations. Hughes (2008, p.15) adds: "It is in only in considering each of these areas that it is possible to obtain an adequate sense of *which practices* are involved in the High-Performance paradigm."

As for the ongoing discussion in this paper, I will aim to be as specific as possible when describing the different work practices with their terminology as displayed in Table 7. If I talk about the topic more broadly, I will use the term "High-Performance" as a summarization of the above mentioned.

An indication as to what is meant by High-Performance, can be derived from the work practices commonly described as High-Performance or High-Commitment. Mathis and Jackson (2011, p. 43) characterize High-Performance work practices in the dimensions: (1) Incentive Compensation: Pay-for-performance systems that tie employee rewards directly to successful performance of job responsibilities, (2) Training: Talent development programs to ensure that all employees have proper knowledge, skills and abilities to perform their jobs and to grow the organization, (3) Employee Participation: Soliciting and using employee ideas and suggestions to give employees a sense of importance and value to the organization, (4) Selectivity: Setting stringent hiring standards to maintain a high level of quality when bringing employees into the organization, (5) Flexible Work Arrangements: Providing alternative work schedules to help employees balance their personal and professional lives.
A comparable approach can be found in "*The Human Equation*" by Jeffrey Pfeffer (1998, pp. 64-98), where he identifies seven key dimensions: (1) Employment security, (2) Selective hiring of new personnel, (3) Self-managed teams and decentralization of decision making as the basic principles of organizational design, (4) Comparatively high compensation contingent on organizational performance, (5) Extensive training, (6) Reduced status distinctions and barriers, including dress, language, office arrangements, and wage differences across levels, (7) Extensive sharing of financial and performance information throughout the organization.
Baron and Kreps (1999, p. 191) define the goal of High-Commitment HRM as having a dedicated and flexible workforce, which is working with both their hands as well as their heads. Practices that they see as supportive to this goal are: (1) employment guarantees, (2) egalitarianism in word and deed, (3) self-managing teams and team production, (3) job enlargement and enrichment, (4) premium compensation, (5) incentive compensation based on team, unit or firmwide performance, (6) extensive socialization and training, (7) extensive job rotations, (8) open information, (9) open channels of communication, (10) flattened hierarchies, (11) strong culture with some superordinate goal, (12) extensive screening of future employees with emphasis in cultural fit, (13) strong emphasis on ownership, both symbolic and financial, e.g. through stock.

Further, Tamkin (2004) provides a comprehensive overview of practices included, which are characterized by high skill requirements, discretion at work, teamwork and incentives enhancing organizational commitment. A more detailed list is compiled in Table 8 below.

Terminology	Authors	Practices
High-Performance or High-Commitment HRM	GUEST, D. 2000, *The Future of Work.* CIPD	• Realistic job previews • Use of psychometric tests for selection • Well-developed induction training • Provision of extensive training or experiences employees • Regular appraisals • Regular multi-source feedback on performance • Individual performance-related pay • Profit related bonuses • Flexible job descriptions • Multi-skilling • Presence of work-improvement teams • Presence of problem-solving groups • Information provided on the business plan • Information provided on the firm's performance targets • No compulsory redundancies • Avoidance of voluntary redundancies • Commitment to single status • Harmonized holiday entitlement
High-Performance HRM	THOMPSON, M. 2000. *The Competitiveness Challenge: The Bottom Line Benefits of Strategic Human Resources.* DTI	• **High involvement practices that aim to create opportunities for engagement** (e.g. semi-autonomous teams, problem-solving teams, continuous-improvement teams, responsibility for own work quality, job rotation within and/or between teams, team briefings, staff suggestion schemes, attitude surveys) • **Human resource practices to build skill levels, motivation and ability** (e.g. formal recruitment interviews, performance or competency tests, psychometric tests, share ownership schemes, personal development plans, training, competence-based pay, team rewards, incentive pay) • **Employee relations practices that help build trust, loyalty and identity with the organization** (e.g. single status, formal grievance procedures, formal salary reviews, social gatherings).
HR Bundles	MACDUFFIE, J. P. 1995. *Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry*. ILR Review, 48, 197-221.	• On line work teams • Employee involvement practices • Problem-solving groups • Job rotation • Suggestion programs • Decentralization of quality efforts
High-Performance Work Systems (HPWS)	ASHTON ,D. and, SUNG, J. 2002. *Supporting Workplace Learning for High Performance Working*. ILO	• **Employee involvement and autonomy in decision making** (the use of self-managed work teams and multi skilling which provide the employee with the opportunity of developing teamworking and decision-making skills) • **Support for employee performance** (appraisal systems, mentoring, coaching) • **Rewards for performance** (individual and group-based performance pay) • **Sharing of information and knowledge** (communication of information to all employees)

Table 8: High-Performance practices and HR – an overview. Source: own creation, based on Tamkin (2004, pp. 6-7)

A more generalist definition is provided by Takeuchi et al. (2007) who find “HPWS refer to a group of separate but interconnected human resource (HR) practices designed to enhance employees’ skills and effort.”

3.3. Outcomes of High-Performance Work Systems

Before we dive into outcomes of HPWS, I want to reflect on the beneficiary of High-Performance work places. Boxall (2012) scrutinizes: “The nub of the question is: for whom is a ‘highly performing’ work system highly performing?” An obvious answer would be the enterprise, which is certainly true. But as shown in chapter two, both backed by my research as well as by literature - Seppälä and Klemola (2004, p. 177) and Alves et al. (2012, p. 219) - also employees are likely to benefit from HPWS. Further it has to be discussed, how performance is measured on the side of the enterprise. Tamkin (2004, p. 10) says there is a substantial amount of inconsistency when it comes to method issues – some measure financial performance or productivity whilst others measure employee commitment, absenteeism or customer satisfaction.

To start with, let us have a closer look at an example of company performance, as studied by Macduffie (1995). He analyzes the data gathered by the “International Assembly Plant Study”, which was the centerpiece of the “International Motor Vehicle Programme” (IMVP) at the MIT – see Table 9 below.

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Table 5. Means of Production Organization Variables and Indices Across Clusters of Plants.

Variable	*Sample (n = 57)*	*MassProd (n = 29)*	*Transition (n = 14)*	*FlexProd (n = 14)*	*F*
Repair Area (sq. feet as % of assembly area)	10.4%	13.7%	9.1%	4.8%	15.8***
Paint-Assembly Buffer (% of 1-shift production)	23.3%	29.7%	18.7%	14.6%	3.9**
Inventory Level (days' supply for 8 parts)	2.1	2.8	2.1	0.63	18.7***
% Work Force in Teams	22.4%	5.0%	10.4%	70.2%	38.6***
% Work Force in EI, QC Groups	32.5%	16.5%	20.9%	77.4%	17.8***
Suggestions per Employee	9.2	0.24	0.33	36.5	15.3***
% Suggestions Implemented	36.3%	25.5%	23.8%	72.0%	16.8***
Job Rotation Index (0 = none; 4 = extensive)	1.8	1.2	1.9	3.0	20.8***
Quality Control at Shop Floor (0 = none; 4 = extensive)	3.1	2.6	2.9	4.5	2.8*
Hiring Criteria (Low = match past experience to job; High = interpersonal skills, willingness to learn new skills)	35.1	32.7	35.8	39.4	12.7***
Training New Hires (0 = Low; 3 = High)	1.6	1.0	1.9	2.4	13.1***
Training Experienced Employees (0 = Low; 3 = High)	1.4	0.9	1.6	2.1	7.9***
Contingent Compensation (0 = none; 4 = based on plant performance)	1.6	0.72	2.2	3.0	20.0***
Status Differentiation (0 = extensive; 4 = little)	1.9	1.1	2.0	3.4	17.7***
Use of Buffers Index	58.7	44.7	62.7	83.5	28.3***
Work Systems Index	32.0	18.8	24.3	66.7	59.4***
HRM Policies Index	47.3	26.5	55.9	81.8	73.4***

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.
Source: International Assembly Plant Study.

Table 9: Means of production organization variables and indices across clusters of plants. Source: Macduffie (1995, p. 211)

This table underscores the main topic and findings of my thesis, as it shows how certain aspects in manufacturing and HR change throughout a Lean transformation. Furthermore, we can see that he picked an interesting set of performance indicators, which are typical for Lean manufacturing companies – and especially for car manufacturers. As written above in the KPI section, it is important to find meaningful metrics that really have a lever and influence on the firm's performance. Macduffie (1995) researched on the connection between HR bundles and manufacturing performance and successfully tested two hypotheses: (a) that HR practices effect performance not individually but as a bundle and (b) that those bundles contribute most to plant productivity and quality, especially when integrated in a flexible production system. He finds:

> Overall, the evidence strongly supports the hypothesis that assembly plants using flexible production systems, which bundle human resource practices into a system that is integrated with production/business strategy,

> outperform traditional mass production systems plants using more in both productivity and quality. (Macduffie, 1995, p. 218)

More evidence, that HPWS works in both ways, can be found in the research of Messersmith et al. (2011). They were able to demonstrate the linking of high organizational performance to HPWS and also provided solid evidence which forces drive performance:

> […] the effectiveness of HPWS is partially owed to the effect such systems have on employee attitudinal variables such as job satisfaction, organizational commitment, and employee empowerment, which ultimately build higher levels of OCBs[14]. The findings underscore the importance of the human resource and suggest that employee attitudinal variables are an important element of the black box linking HPWS to performance. (Messersmith et al., 2011, p. 1115)

Boxall (2012) was also contributing to unlocking the HRM "black box", by taking a managerial perspective. He outlined how HR systems and managerial practices can be linked to organizational performance and outcomes, as displayed in Figure 39.

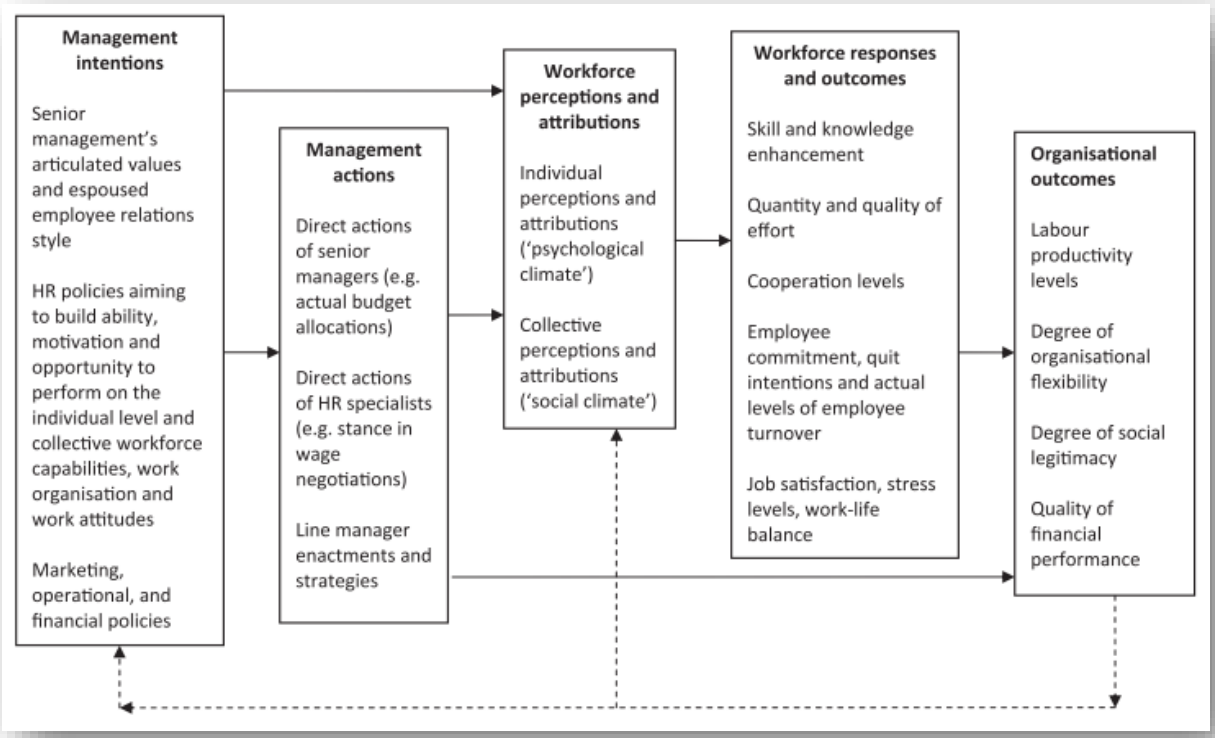

Figure 39: HR and managerial systems in the context of organizational performance. Source: Boxall (2012, p. 177)

[14] OCB stands for **O**rganzational **C**iticenship **B**ehavior, see https://en.wikipedia.org/wiki/Organizational_citizenship_behavior, accessed 2017.10.13

3.4. People – a Sustainable Competitive Advantage?

For a better understanding, of why people are so central in the High-Performance and Lean environment, it may be helpful to have a look at strategic management. Not only since the landmark book "*Competitive Advantage: Creating and Sustaining Superior Performance*" by Michael E. Porter (1985), corporations were seeking a competitive advantage, which they could exploit and preferably also sustain for a longer period of time. Porter introduces four generic strategies, which lead to competitive advantage (cost leadership, cost focus, differentiation, differentiation focus) – there are undoubtedly a few parallels to Lean and operational excellence, which often focuses on cost leadership. Nevertheless, Lean production/management can also be used for differentiation strategies. Either way, Porter stresses the importance, to clearly select and follow one particular strategy, as following more than one strategy might maneuver corporations to be "stuck in the middle" – a position with no clear focus, which in most cases will lead to deteriorating performance.

To determine which strategy to follow, one must be familiar with the value chain a corporation covers. This is very similar to the VSM which we know as a common Lean practice. Porter further adds, that the value chain might also play a valuable role in designing the organizational structure (Porter, 1985, p. 59). One element Porter features in his depiction on the value chain and the organizational structure is Human Resource Management. So how can HRM contribute to a sustained competitive advantage? A good example is provided in a case of a differentiation strategy, where many aspects of my research findings are covered in the HRM section, see Figure 40 below.

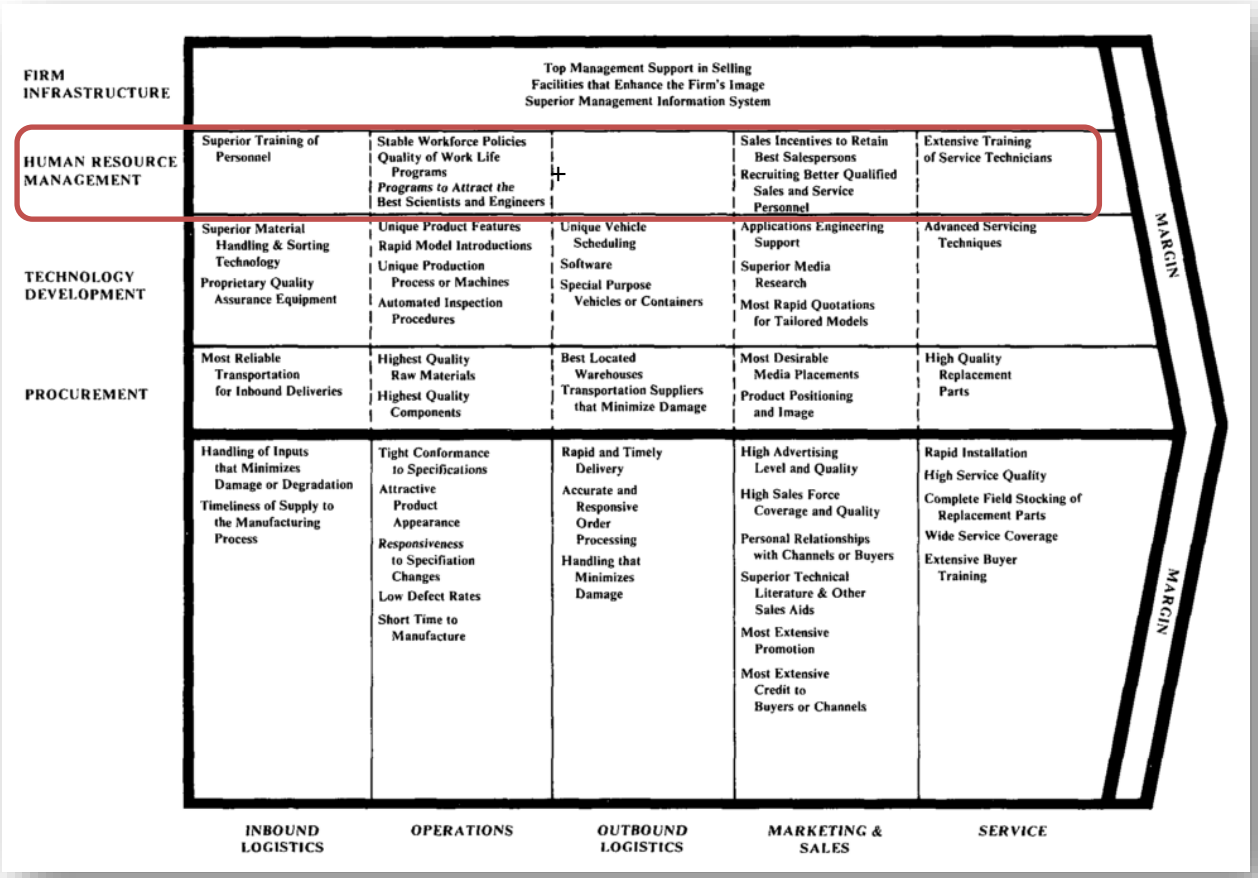

Figure 40: Value chain in a differentiation strategy, outlining the responsibilities and contributions of HRM.
Source: Porter (1985, p. 122)

Another strategic framework also emphases the importance of people as a competitive advantage. Prahalad and Hamel (1990) follow the "Core Competence and Capabilities" framework in their celebrated Harvard Business Review article "*The Core Competence of the Corporation*". One of the three factors which determine competitive advantage is that a core competence should be hard to imitate. They say "a rival might acquire some of the technologies that comprise the core competence, but it will find it more difficult to duplicate the more or less comprehensive pattern of internal coordination and learning".

Prahalad and Hamel (1990, p. 87), who take a very Strategic-Business-Unit (SBU) centric view, say that line managers often battle for cash in the budgeting process, but are surprisingly „[…] unwilling to compete for people – the company's most precious asset". They also argue that it is the skills of the people, which embody the core competencies and that SBU managers often protect their human assets, as losing them – for example to another business unit - would mean a harm to (internal and maybe also external) competitive advantage. As a cure, cooperative SBU managers should be celebrated as team players. I believe Lean management, with its focus on flat hierarchies,

autonomous teams and high individual ownership is less vulnerable to this phenomenon, especially if the leadership system is properly designed – a subject which I will address later.

Finally, I find the Resource Based View (RBV) framework helpful to see the value of people as a sustainable strategy to win over the competition. Furthermore, Human Resources has the "resource" already in its name and is thus implicitly a valuable input, not only in the production process. Similar to the framework of core competencies and capabilities, the RBV calls the collection of tangible, intangible or organizational assets "resources". The competitive advantage is derived from the ownership of the valuable resource. The RBV therefore combines the internal (core competence) and external (industry structure) perspective. (Stanford, p. 6)
Angwin et al. (2001) suggest that the more unique a resource is, the higher the competitive advantage is – that is, if the firm is able to exploit it. Moreover, they argue that tapping into long-term resources requires a firm to be able to learn, improve and change their capabilities of exploiting new resources (they call this "dynamic capabilities"). Similar to the "Core Competencies" approach above, Angwin et al. (2001, p.147) say that a long-term competitive advantage must have two characteristics, namely be (a) competitively superior and (b) scarce. Literature and my research shows, that people and their culture fulfill both prerequisites superbly, as they are undoubtedly hard to imitate. To test the uniqueness and sustainability of a corporation, tools like VRIO can be applied. Figure 41 provides an example of a VRIO analysis. If all points are fulfilled, a long term competitive advantage is achieved. Other, similar models with slightly different focus (internal / external perspective) can be found in the works of Collis and Montgomery (1995) and Peteraf (1993).

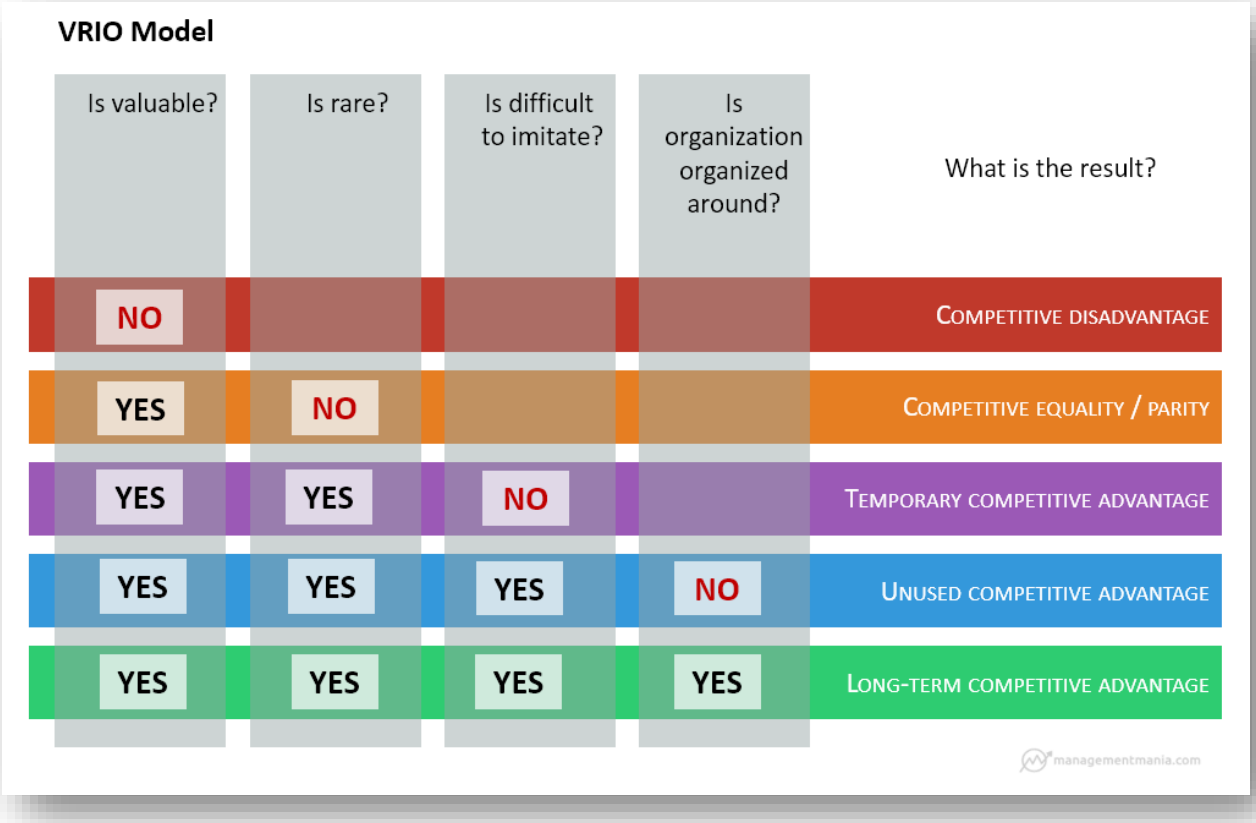

Figure 41: VRIO model as one way to analyze the sustainability of a competitive advantage. Source: https://managementmania.com/en/vrio-analysis, accessed 2017.10.14

To provide a comprehensive understanding as well as a valid impression of a firms competitive advantage it is important to pick the right resource to be analyzed – particularly in an RBV framework. Özçelika et al. (2016) indicate in their paper on "*High-Performance Work Systems and Organizational Values: Resource-based View Considerations*" that people and the management of human resources can be the unit of analyzes. They find that HRM can contribute to the organization's success by reinforcing firm-specific competencies, such as people's capabilities. They even regard adapting a HPWS as a strategy, which helps shaping the organizational culture:

> For, through various such practices, including selective recruitment, internal promotion, performance-contingent pay, employee participation, etc. employees are further developed in terms of their knowledge, skills and abilities, which in turn can also increase their levels of motivation and commitment. Consequently, HPWS help create and maintain High-Performance organizational cultures. (Özçelika et al., 2016, p. 336)

The model with its key elements and connections is drawn up in Figure 42. In fact, this people centric approach seems to be not only a source of competitive advantage, but in combination with a HPWS also serves as an independent strategic approach or framework.

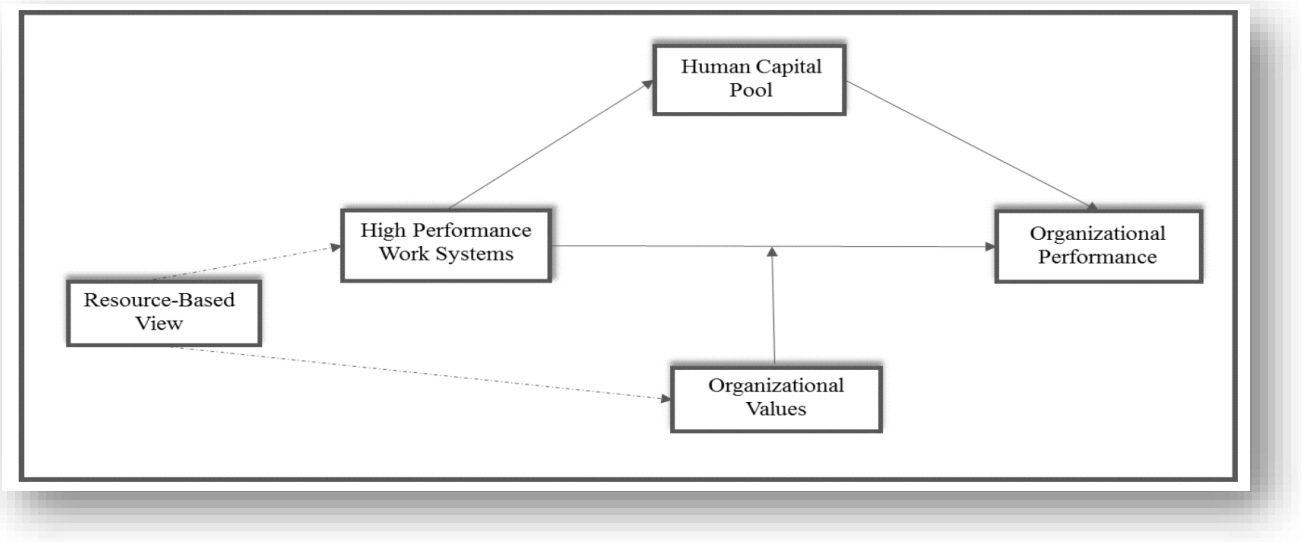

Figure 42: Integrated model for HPWS and organizational performance, based on a RBV. Source: Özçelika et al. (2016, p. 336)

From the practitioners perspective, Fiume (2017) makes the point, that indeed, Lean itself is as strategy and should be enforced like a strategy. He argues, that so many Lean transformations fail, because Lean is not seen or being implemented as a strategy (with all its far-reaching implications), but rather as an operational tactic. Only if all the organizational systems are designed to support the strategy, a transformation can be successful. Fiume (2017) concludes: "Lean uses a people-centric approach to strategy that respects people by continuously challenging them to become the best that they can be and finding ways to create more value for customers."

To sum up this paragraph: corporations are aiming to achieve a sustainable competitive advantage. All the strategic frameworks I outlined, when following a people-centric approach, which aims at developing people (and in turn culture), can lead to a sustainable competitive advantage. I would like to close this paragraph with Liker and Hoseus (2010, p. 49) who correctly find "HR management is one of the most visible and important functions in the company because humans are the only competitive resource that cannot be copied."

3.5. Leadership

High-Performance Work Systems have a large overlap to the findings of my research. However, there is one area, which is not particularly well covered by HPWS – and that is my key category "Leadership". Leadership itself is a very broad subject, so I will narrow it down to its relevance in

answering my research question. The essence is, how HR can make sure and support that leaders in the organization are capable, willing and motivated to support the Lean transformation.

In fact, the requirements for leaders are very different in traditional manufacturing settings as opposed to Lean manufacturing settings, some even argue it is a radical change that comes with Lean implementations (Poksinska et al., 2013, p. 886). This is owed to the specifics of Lean management, such as flattened hierarchies, the high degree of teamwork in highly autonomous teams, different planning routines, different objectives, different measuring systems and generally a different culture, where the worker is less of a heeler, but very much a creative, empowered, critically thinking contributor. So instead of a highly directive behavior, coaching, supporting and developing subordinates is in the focus of Lean leaders, or as Poksinska et al. (2013, p. 886) find "The focus in managerial tasks changed from managing processes to developing and coaching people."

Grasl (2015) was researching on the differences and parallels of classical leadership frameworks versus Lean leadership. He found that Lean leadership is a combination and further development of established leadership styles, often enhanced by Lean specific methods, like (1) extensive shop floor management, (2) horizontally and vertically aligned planning process (Hoshin Kanri), (3) viewing problems as a learning opportunity which are never caused by people but because of faulty processes, (4) extensive use of coaching, (5) transparent and open communication, (6) responsibility to support, develop and train subordinates. Grasl also found that the issue of "Lean-Leadership Development" received a lot of attention in literature, but was less evident in his empirical research – he draws the conclusion that the purposeful development of leaders into Lean-leaders has improvement potential. Training leaders and preparing them for their altered duties is certainly an area, where HR can play an active role.

One leadership style seems particularly suitable when it comes to the behaviors and traits, Lean-leaders should embody. The so called "Transformational Leadership" is a very trait oriented style, which often incorporates charismatic and visionary leadership that will influence followers to accomplish more than what is expected from them (Northouse, 2015, pp. 161-194). Poksinska et al. (2013, p. 894-895) were able to establish and verify the link between "Lean Leadership" and "Transformational Leadership" in their study about the daily work of Lean leaders in both manufacturing and healthcare. They also discovered, that Transformational Leadership was particularly important during Lean transformations, and that once Lean managerial practices were established and people accepted their new roles, the demand for transformational leadership decreased and the managerial push during the implementation was later replaced by employee pull. When speaking

of Transformational Leadership, it is important to see the entire continuum, which spans from Laissez-Faire Leadership, via Transactional Leadership to Transformational Leadership. The three styles are not seen as opposing strategies, but rather as continuum, where also the leader moves back and forth on the scale, depending on the situational need. The styles are characterized by the factors depicted in Figure 43.

Transformational Leadership	Transactional Leadership	Laissez–Faire Leadership
Factor 1	**Factor 5**	**Factor 7**
Idealized influence	Contingent reward	Laissez–faire
Charisma	Constructive transactions	Nontransactional
Factor 2	**Factor 6**	
Inspirational motivation	Management-by-exception	
Factor 3	Active and passive	
Intellectual stimulation	Corrective transactions	
Factor 4		
Individualized consideration		

Figure 43: Leadership factors in Transformational-, Transactional-, and Laissez-Faire Leadership. Source: Northouse (2015, p. 167)

Transformational leaders create a connection with the followers, that raise the motivation and the morality in both the leader and the follower – they form an inextricable unit in which both are subject to the transformation process. Transactional leaders in contrast, focus on the exchange between leaders and followers, put simply: “If you do this, I give you that”. However, to achieve outstanding performance, both styles are often combined, thus creating an additive effect, see Figure 44.

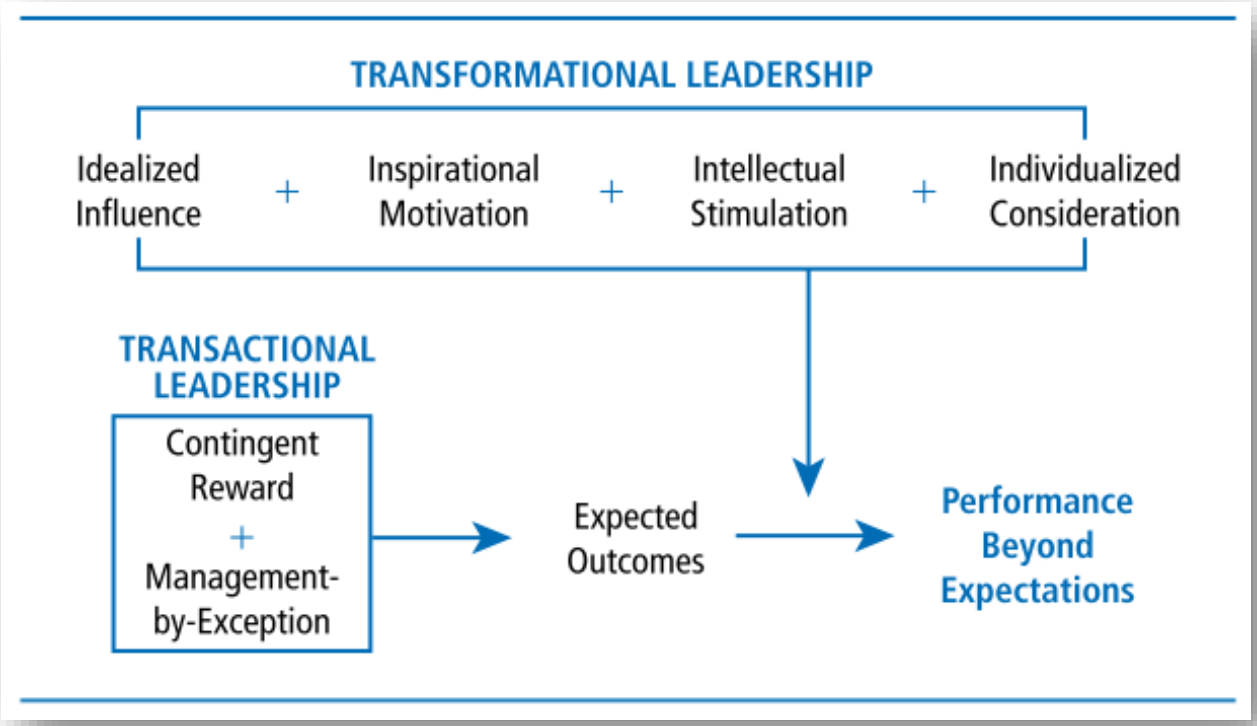

Figure 44: The additive effect of combining Transactional with Transformational Leadership. Source: Northouse (2015, p.170)

Northouse (2015, pp. 174-175) highlights the work of Kouzes and Posner, who offer a different approach to Transformational Leadership, as they have modeled five different practices into a system, which can be acquired through training and is not entirely trait/charisma/personality oriented. Those five practices are: (1) Model the way, (2) Inspire a shared vision, (3) Challenge the process, (4) Enable others to act, (5) Encourage the heart.

The practices are accompanied by ten commitments (Figure 45), which feature a large congruency to Lean values, as also confirmed by my research and by literature.

Figure 45: Five practices and ten commitments of exemplary leadership. Source: https://www.pinterest.at/pin/112238215691314020/, accessed 2017.10.03

Another aspect which is beneficial from an HR perspective is that those practices can be measured and validated by an instrument which is called the "Leadership Practices Inventory" (LPI) - basically a 360° leadership assessment tool, which is widely used in leadership training and development (Northouse, 2015, pp. 174-175).

Yukl (1999) assesses the conceptual weaknesses of transformational and charismatic leadership theories and comes up with "refinements", or some rather hands-on advice. In particular, he suggests developing a challenging and attractive vision in cooperation with the employees, which is linked to a strategy and finally broken down into actions. In the operationalization of the strategy he recommends leaders to show strong confidence in the implementability of the vision and to roll it out in incremental steps until it is fully implemented and reached.
In a Lean context, Byrne (2012, p. 8, pp. 48-49) suggests that leaders set "stretch goals", which are hard to reach. The simple rationale behind it is that easy goals will just be met with some additional effort, whereas stretch goals force people to rethink everything.

Other leadership models, which can be observed in various stages of Lean transformations are the servant leadership model (Liker and Meier, 2007, p. 25) as well as the situational leadership model, as described by Liker (2003, p. 188-189) in his book "*The Toyota Way*".

The development and/or recruitment of capable leaders is a major challenge for HR. As the above paragraph shows, there is ample research in leadership styles and it is also clear, which requirements Lean companies have for Lean-leaders. HR can contribute to the success of a Lean transformation in providing trainings to transform existing leaders and recruiting the right leaders from the market, as well as creating systems to ensure that leadership effectiveness is measured correctly.

3.6. How do HPWS work?

In the previous passages of chapter three, I have outlined what High-Performance means in the context of my research and how it is characterized. I also showed, how intertwined and elaborate the individual components of such a system are. To get a better understanding of the "how", I want to start with Toyotas human system Lean management model as displayed in Figure 46.

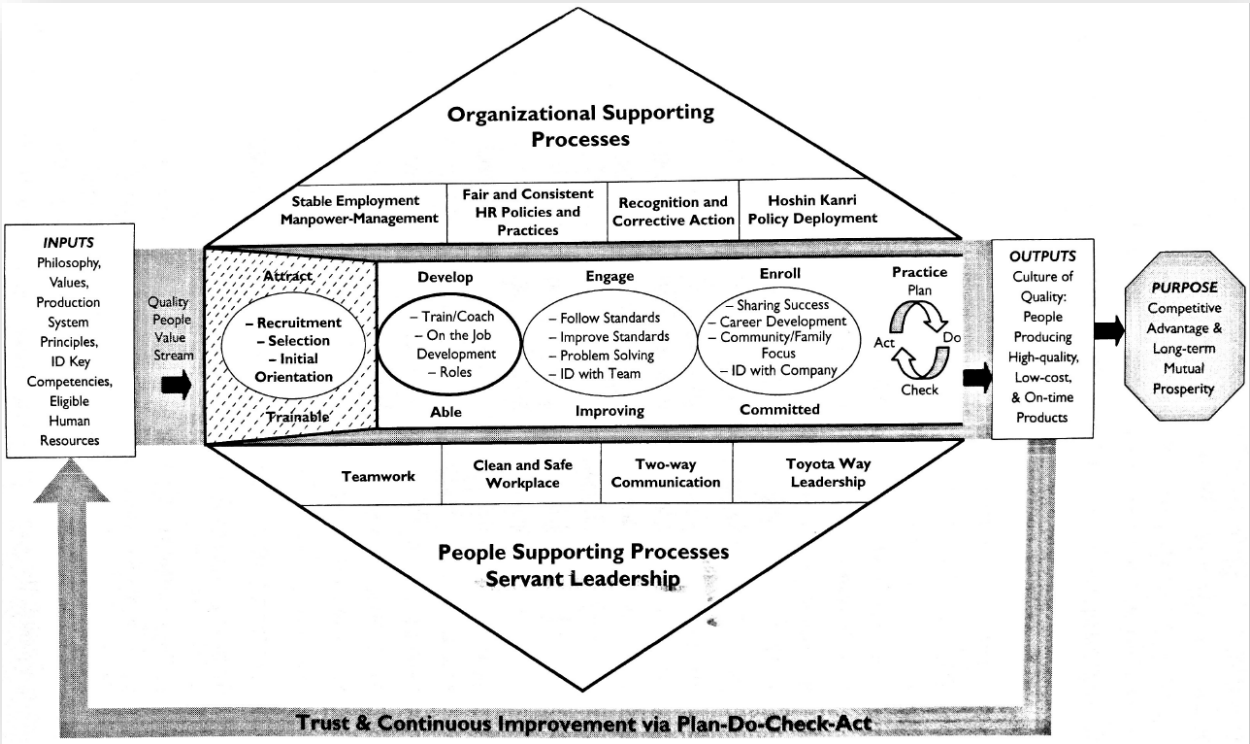

Figure 46: Building culture and people the Toyota Way. Source: Liker and Meier (2007, p. 25)

At first glance, one could see how sophisticated the whole design of the model is. It contains a broad variety of relevant aspects in managing people and shows, how well one process step is

connected to the other and is supported by both organizational processes and people supporting processes – the afore mentioned servant leadership. Liker and Meier (2007, p. 26) explain the propose of Toyotas human system as follows "The Toyota Production System is designed to identify and highlight problems, while the Human System model is designed to engage people who are able and willing to solve them". Having a closer look at the model, we can see, how Toyota achieves to engage their people to deliver the desired output. It is a bundle of measures, containing teamwork, open two-way communication, recognition, Hoshin Kanri planning and policy deployment process and the value stream of quality people, which are attracted, developed, engaged, enrolled and given the chance to practice and thus learn and continuously improve. Although every single component is not very complicated, all the components together form a complex and very challenging model, even for Toyota (Liker and Meier, 2007, p. 24).

In another interesting journal article of Liker and Hoseus (2010) they provide a very practical example of how Toyota restructured its HR department in response to a crisis. The paper analyzes the proceedings at Toyotas first wholly owned assembly plant in the USA, referred to as "TMMK" in Georgetown, Kentucky. After a number of problems occurred, Toyota applied its problem-solving capacities to find the root cause of the deviation. They declared that "The standard of HR is to uphold the company's values and to partner with manufacturing in order to reach the business goals." (Liker and Hoseus, 2010, p. 41) Toyota realized they were far from that and set up a diverse team from different hierarchical levels as well as organizational functions, who were able to re-instate the desired outcome by changing the way HR is embedded in the organization. Let us have a look, how they did that and what the situation was before and after the re-organization – see Figure 47.

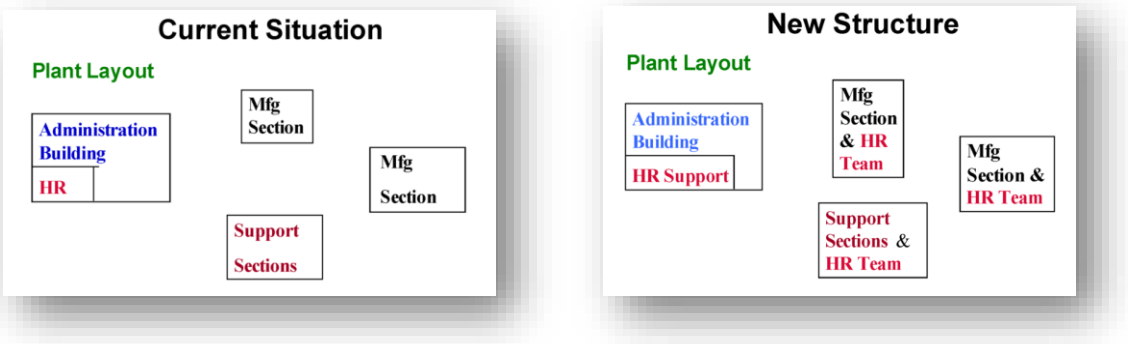

Figure 47: Old and new HR structure at Toyotas TMMK plant. Source: Liker and Hoseus (2010, p. 42-43)

The most striking and visible difference is that they split up the “old HR” into mini HR-teams and created a central HR support. Why did they do this and which effects did it have for HR and the organization?

After the reorganization, the mini-HR teams were directly located in the manufacturing areas and performed two major roles: (1) being an employee champion and (2) acting as a strategic partner. The roles included: (a) Development: on-the-job development, process improvement, section-specific training, coaching, section business and strategic planning, (b) Employee Relations: employee advocate, concern resolutions, peer reviews, safety and health, (c) HR Systems: salaried promotions up to assistant manager, salaried relations, training for salaried members.

The duties of the central HR Support changed as well. They were formed to connect the mini HR-teams amongst each other to ensure consistency and fairness across the plant and fulfilled the following functions: (a) Personnel: Compensation/Benefits, Payroll, Staffing and Recruiting, Transfer System, (b) Health and Safety: Medial Leave of Absence, Ergonomics Support, Early Symptom Investigation Support, Family and Medical Leave, Americans with Disabilities Act, Data Reporting, New Hire Health Evaluation, Health Assessment, Workers Compensation, (c) Employee Relations: Policy Development and Training, Communications, Recognition, (d) Training: Promotion Process, Team Leader Training, Problem Solving Training, Quality Circles and Suggestions, Plant-wide Training.

As a result, the central group was able to focus on planning and policy setting again and became experts in their areas (Liker and Hoseus, 2010, p. 43-44). I find this example demonstrates nicely how Toyota views the role of HR and how they designed their human system.

Some more input on how to design the HR architecture comes from Sparrow and Otaye-Ebede (2014) who researched on the role of HR architecture in Lean companies and where the intellectual capital should be located. They interviewed 18 senior managers from 12 different organizations and divided their HR findings in two organizational settings, namely a traditional manufacturing and engineering setting and a white-collar setting. Their findings are summarized in Figure 48.

Organizational setting	*Organization*	*HR architecture*
Traditional manufacturing and engineering setting	Automobile manufacturer	Employee role behaviour: team climate HR competencies/skills: hiring, promotion HR practices: team building, training and development
	Defence equipment manufacturer	Employee role behaviour: cultural change, leadership style: visioning and policy deployment; empowerment; facilitation; discipline; listening; coaching; problem-solving HR competencies/skills: process design; change management; problem-solving; coaching conversations HR practices: training/coaching
	Nuclear waste re-processing organization	Employee role behaviour: team building; conflict management; time management; development orientation; leadership HR competencies/skills: leadership, proactive management HR practices: team behavioural building
	Energy, safety and security solutions organization	Employee role behaviour: future Org design and transitions; learning/knowledge sharing. Communication strategies; engagement with the issue of lean, change management, coaching HR competencies/skills: coaching skills; leadership behaviours leadership development skills HR practices: training; organizing; capability building, leadership development; coaching
	Logistics, supply chain and manufacturing consulting organization	Employee role behaviour: employee involvement and voice mechanism enabling people empowerment; employee engagement; relationship management HR competencies/skills: motivational skills; organizational skills; problem-solving skills HR practices: capability development

Figure 48: Changes in HR architecture across different industries. Source: Sparrow and Otaye-Ebede (2014, p. 2901)

Despite that all samples in Figure 48 are coming from a manufacturing/engineering setting, the HR competencies/skills and HR practices vary considerably across industries. This is in line with my findings and rooted in the different underlaying internal and external factors of a specific firm. Further, Sparrow and Otaye-Ebede (2014, p. 2905) argue that HR needs to update its skills, component and architectural knowledge in order to play a strategic role in Lean transformations. They found that "the majority of organizations in our study, the HR function lacked the component

knowledge needed in Lean. They had some architectural knowledge, in that they generally understood the business strategy, but had the difficulty of understanding how the components can all work together."

Moving from the specific set-up that Toyota has chosen to the general designs of HPWS, we can have a look at Tamkin (2004). She pointed out the two main perspectives, which are common for High-Performance work practices. On the one hand, there is the universalist perspective, which claims that there are some HR practices which, irrespective of the context, will always lead to superior performance. On the other hand, there is the contingency model, which argues that only a distinct combination will work under specific conditions.

Den Hartog and Verburg (2004) found evidence in their analysis of 175 Dutch firms that some practices, which were combined, clustered very well – an indication that those have universal validity. The practices include "[…] rigorous selection, extensive employee development and an overarching philosophy." (Den Hartog and Verburg, 2004, p. 74) Likewise, Tamkin cites Huselid and Becker (1997) as proponents of the universalist perspective, as they have argued that the intensity with which HR practices are deployed are more important than organizational fit.

In support of the contingency model, Tamkin (2004) finds that a strategic approach as discussed in the Resource Based View (RBV) emphasizes the competitive advantage which stems from the uniqueness of the internal resources and is not acquired off the shelf, but rather developed over time. This is in line with the works of Hamel and Prahalad (1994).

The contingency model suggests that practices need to be bundled into meaningful groups of practices in order to achieve internal contingency. Here again, the work of Den Hartog and Verburg (2004, pp. 74-75) contributes some valuable insights:

> Several other High-Performance work practices we measured, such as autonomy, pay-for-performance, profit sharing and information sharing, did not cluster and were analysed separately. The set of practices labelled `Employee skill and direction' and several of the other practices were positively related to workers' willingness to go beyond contract and perceived economic performance of the firm and negatively to absenteeism. Also, relationships with organisational culture dimensions were found. (Den Hartog and Verburg, 2004, pp. 74-75)

The main problem is to determine, which practices work in which setting. There is controversy, how many practices should be combined and in which bundles. Moreover, it is not yet fully discovered, if practices are additive, substitutable or synergistic (Tamkin, 2004, p. 10). Becker and Huselid (1998) suggest that bundling practices in a complimentary manner is the defining characteristic of the High-Performance paradigm, where the set of measures has a larger effect on performance than the individual parts.

Further indications of which practices are involved in a HWPS can be found in the paper of Hughes (2008), where we lists work-flow and inventory management techniques aimed at securing productive flexibility as one characteristic feature. With regard to work organization, Hughes (2008, p. 16) highlights the importance of teamworking and the autonomy of self-managed teams, which promote tacit knowledge and skill sharing across functional divisions. More generally, it is three dimensions, which cut through all dimensions, displayed in Table 7 above. Those are, "(a) high skills, (b) opportunities to participate in substantive decisions, and (c) incentives to use skills and participate in decisions." (Hughes, 2008, p. 17)

As we could see throughout the paragraph and also in my empirical study presented in chapter two, the practices applied to reach an increased level of performance, vary considerably. So does the definition of what High-Performance means in the individual context. Despite all those questions and concerns, the evidence that HPWS indeed leads to higher levels of performance is strong and persuasive (Tamkin, 2004, p. 12). The bottom line is that an investment in the workforce and a smart management of the human resource, preferably in HR bundles as part of a HPWS, yields not only better firm performance, but also to more satisfied, committed and empowered employees (Messersmith et al., 2011, p. 1115).

3.7. Summary

It is evident, that bundling of HR practices leads to increased company performance and in most cases also to heightened employee satisfaction. I presented High-Performance Work Systems as a very suitable way to put the findings of my research into action and provided examples, how this can be achieved and which outcomes can be expected. One area, which is not sufficiently covered by High-Performance research is my key driver "Leadership", which according to my data also plays a crucial role in Lean transformations. I therefore presented Leadership styles that are apposite to support Lean implementations. I also pointed out the strategic aspect, that people-centric approaches can have and how they can be used to develop and maintain a sustainable competitive advantage. Within all the sections, I linked the topic to my research question – in particular to the second part of it (how the HR systems and practices have to be designed) – and tried to suggest actions, how HR managers can contribute and support Lean transformations. Similar to Grasl (2015), we can learn from my research, that the HR departments and managers played no vital role in the actual transformation and that there is room for improvement. Hence, I want to close this chapter three with an important reflection of Sparrow and Otaye-Ebede:

Even though, as noted above, the more recent and non-traditional applications of lean clearly create the need for more involved and strategic relationships between HR and line managers, only a small (but a growing) subset of organizations studied had, in one way or another, been providing specialist HR support to the organization to help it execute lean management effectively, i.e. changes had been made to the internal HR architecture in response to lean activity. This is clearly an opportunity that is more open to HR within the non-traditional settings, but one that is still largely being missed by HR functions. (Sparrow and Otaye-Ebede, 2014)

4. Discussion and Conclusion

With hindsight, the outcome of the master's thesis looks predictable and logic. I believe, this is an example of a hindsight bias[15]. When I decided to write about Lean and HR, I had limited knowledge of either field, which in this case was beneficial. During the research, I took a few decisions, which – with hindsight – turned out to be very valuable for the exploration of the subject and therefore for the original value of the thesis. The first fortunate decision was the choice of the research methodology. Rather than performing an extensive literature research on HR practices during a Lean transformation and then looking for theory guided patterns to evolve from the qualitative data (essentially the Mayring approach), I opted for the Grounded Theory approach, which proved to be perfect for my exploratory, inductive research process. This open process, which understands context as an integral part of the research, yielded more well-defined themes/categories than a traditional qualitative content analysis. Owing to the GT approach, I was not only able to discover key drivers of Lean transformations, but was also able to determine facilitators of the change. Furthermore, within the key drivers, I was able to identify one category which is largely neglected by High-Performance Work Systems – the issue of Leadership. Those two aspects provide for the novelty of this work.

There are three overarching subjects in this thesis: people, bundles and continuous development/improvement. I underscored the importance of people from various angles – as the source for improvement ideas, the carrier of cultural change or even as a source of competitive advantage. To achieve High-Performance for both the organization and the people it is important to create smart frameworks, which enable this development – HR has the potential to be the architect of those frameworks, if they understand the needs of Lean businesses.

A second dominant theme was bundling. Whether it is Lean practices or HR practices, both my research as well as an ample amount of literature are conclusive: the sum of the measures is greater than their individual value. One plus one often equals three. What sounds so plain simple in theory is actually hard to apply in an organizational setting, as the many failed Lean transformations affirm. Unfortunately, there is no simple recipe that states "if you do this, you will get that". The reasons are manifold. First, every business is different – both internally, as well as in its environment. It is therefore important to choose and bundle practices which have an impact on the individual business performance – and here it is important to develop a feasible definition of perfor-

[15] See https://en.wikipedia.org/wiki/Hindsight_bias, accessed 2017.10.14

mance, which meets the objectives of the organization. Needless to say that a publicly traded company will have different objectives than a not-for-profit organization. Secondly, it is not clear, which bundles lead to which effect in which setting. Consequently, it remains critical to exactly determine the organizations objectives and its value stream, to be able to select the right bundles which enable superior performance.

This brings me to the last overarching theme: continuous improvement and development. Continuous improvement is necessary for all aspects of corporate life – in processes, in business strategy and in developing and training people. As in the example above with choosing the right bundles, it is always a try and error procedure. Businesses have to test if a certain measure works for them and if not, adapt it accordingly – Lean as a very agile concept, which sees problems and failure as a learning opportunity, holds a lot of positive aspects to master this continuous adapting process.

During the research it became apparent that all corporate functions must work together and closely align their objectives, functional strategies and actions. HR cannot drive the transformation on its own, but it can be a vital element in leading the cultural change by providing the necessary support for people to perform.

5. Limitations and Implications for Further Research

All the researched companies and most of the literature reviewed throughout this thesis deal with manufacturing firms across different industries. The findings are thus somewhat specific, although Lean management practices are widespread today across all kinds of sectors and industries. It is therefore likely that the findings can also be applied in a non-manufacturing environment, especially the HWPS practices.

Another limitation comes from the geographical locations of my sample. All interviewed companies and people, though some operate globally, were located in the DACH[16] region. Especially when it comes to changing pay systems and other sensitive parameters, other countries may have different legislation or unions play a different role, hence having an impact on the speed and extent of a Lean implementation.

[16] DACH is a German abbreviation for the region Germany (D), Austria (A) and Switzerland (CH)

Surprisingly, the HR departments in the companies I researched, were only rudimentary involved in the Lean transformation. I did not inquire into the reasons why HR was largely left aside, or pushed into a purely administrative role. In no case did HR managers have a strategic say in the process or a truly transformational role. It would be interesting to find out more about this situation in future studies.

Further research could draw on my findings and examine the multiplex leadership aspects (identifying and developing leaders, training, etc.) in HPWS and HR bundles. It would also be beneficial to explore which bundles shall be deployed before, during and after a Lean transformation. Particularly the design and the impact of bundles in different settings would deliver valuable insights.

Finally, the parameters which I defined as "facilitators" could be explained more thoroughly and more research could be conducted regarding their influence on Lean transformations.

6. Personal Reflections

When we talk about Lean and HR, it brings up different associations. Whilst some think of HR's role in Lean companies, others might think of how HR can be Lean in their processes. As a manager I have hired people and as an applicant, I have experienced the recruiting process from yet another perspective. Being used to industrial-grade processes, I was shocked about the inefficiency of recruiting processes. Especially in the age of digitalization, big data and other technology, recruiting could be both faster and more cost efficient, whilst delivering better candidates – the same is true for other classic HR duties, as a recent Roland Berger study showed[17]. Furthermore, some people experience their HR as a bit dusty and conservative – new, Lean approaches in HR have the potential to get better performance out of HR and thus increase its value and appreciation for the organization. In some cases, HR does not even have appropriate metrics in place to measure their performance, not even their costs. In times when processes in production and other functions are optimized for every cent, it is not timely that HR departments are often still a black box.

[17] See "*Between ambition and reality. Key findings from the Roland Berger HR Trends Survey 2017"*, available at *https://www.rolandberger.com/publications/publication_pdf/hr_trends_survey_2017.pdf*, accessed 2017.10.13

Lean places heavy emphasis on continuous improvement. While I think this is particularly true for the employees ("a little better every day"), it has to be put into perspective when it comes to processes and products. Oren Harari famously said: "Edison's electric light did not come about from the continuous improvement of the candle". It means that innovation and sometimes even disruptive innovation undoubtedly is a major force and that continuous improvement and innovation are not substitutes but compliments.

Recent global trends like "Lot Size 1", mass customization, faster innovation cycles and fluctuation in customer demands, provide serious challenges for traditional manufacturing companies. Flexible, nimble companies will have a competitive advantage over rigid giants (free, functioning market provided). It is my conviction, particularly after this study, that companies who view their people as a source of strategic advantage, continuously invest and develop them will have a sustainable competitive advantage. Lean methods, practices, tools and ultimately the Lean culture can help in developing that competitive edge, in particular, if the HR system is designed to reinforce and even drive the transformation process.

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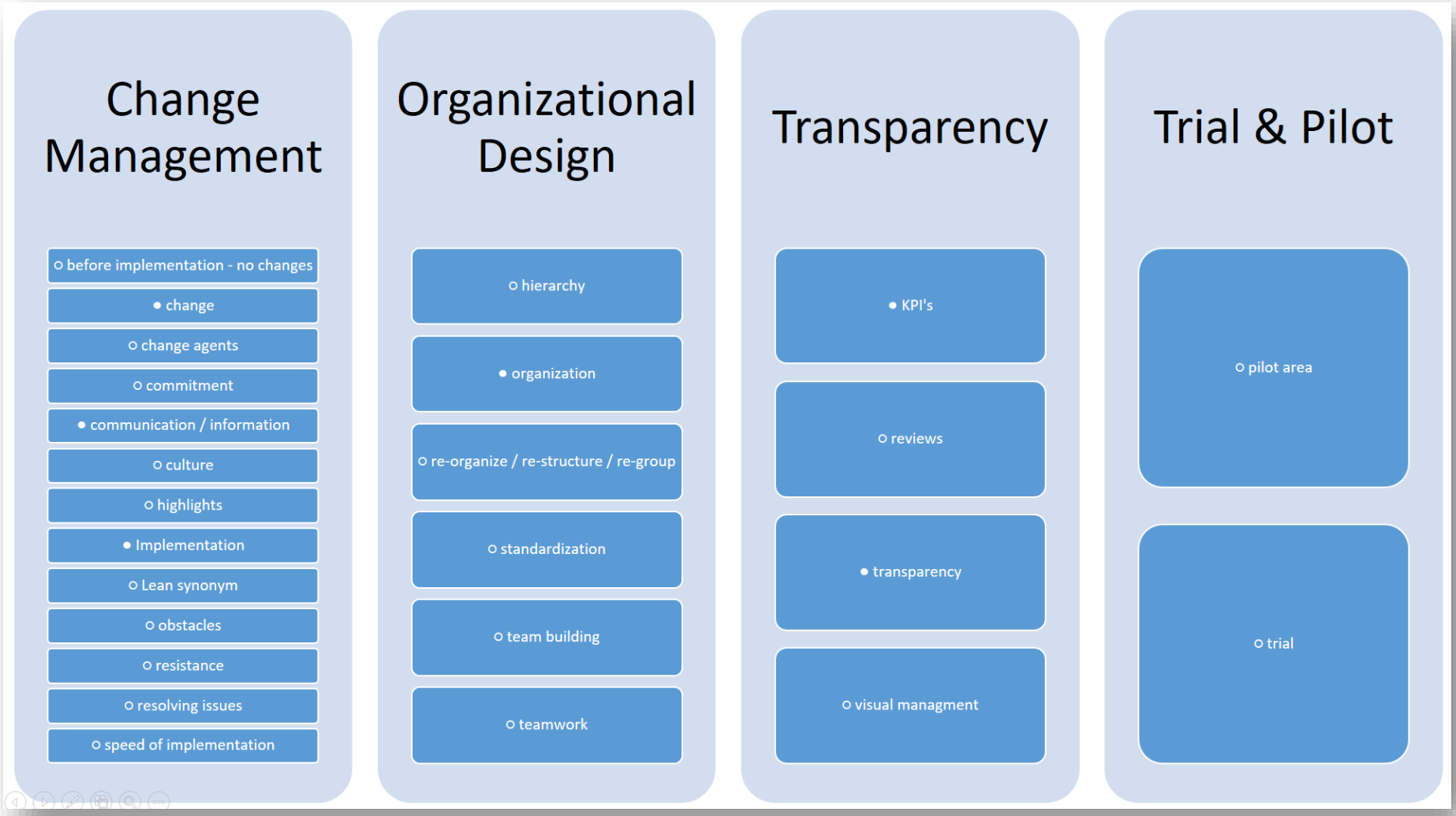
Appendices

The appendix is not included in the master's thesis, hence pagination starts with “1” again.

Notice on Interview Transcripts

To guarantee full anonymity of all interviewees, the interview transcripts are not attached as an appendix. If any questions arise, please get in touch with the author via mario@dermueller.at

Appendix 1: Facilitators of Lean Transformations



Appendix 2: Codes which were not used in Category Building

Groupless

14 Codes:

- additional resources
- Consultant
- continous improvement
- Lean thinking
- lean tools
- philosophy
- pilars
- power
- problem solving
- Processes
- Shop Floor
- Suggestion System
- support
- top down approach

Appendix 3: Briefing of Interview Participants

Dear Mr. [redacted],

thank you for participating in my research about the role of Human Resources in LEAN transformations. With this information sheet I want to introduce you to my study, provide an outline of the interview itself and invite you to ask preparatory questions.

I am currently writing my master thesis with the title "The Role of Human Resources in Lean Transformations" in which I am aiming to find out, how Human Resource Management can support the process of transforming a business from a traditional way of "doing things" to adopting a LEAN philosophy, concepts and tools.
The research question which I am trying to answer with this approach is: "Which HR systems can contribute to the success of a sustainable lean transformation and how do they have to be designed?". I was lucky enough to be advised by Dr. Arno Haslberger – both an HR professional and renowned academic.

My research project will be divided into three main sections:

- First, I will introduce the reader to the history and concepts of LEAN
- Secondly, I will conduct semi-structured interviews with LEAN experts and/or HR experts
- Thirdly, I will link the outcomes of the interviews to latest research and proven theories to create frameworks

You are a vital part of phase two. I rely on your expert know-how and experiences for high quality data.

Themes and questions I want to talk to you about may include:

- How was your organization and workforce organized before and after introducing LEAN?
- Which LEAN concepts / frameworks / tools did you implement?
- How did you train your staff before, during and after introducing LEAN?
- How did you prepare for the LEAN implementation?
- How did you change your compensation scheme, incl. bonus, rewards & benefits?
- How did you change the way you are recruiting talent, retain and develop people?
- What do you think are critical success factors from a people's perspective?
- …

Please feel free to bring any kind of supplementary documents, which highlight your points or help understanding the matters more thoroughly. This can be data, charts, samples, brochures, etc.

Since my master thesis will be written in English I want to conduct the interviews in English as well. You can freely choose if you and your company want to be disclosed. If so, I will mention both you and your company in my paper. If not, I will code both you and the

company to guarantee complete anonymity. I will ask you before the interview, what your preference is.

The interview will be audio recorded and later transcribed for the subsequent data analyses. If you are uncomfortable with audio recordings, kindly let me know. After the document was transcribed, I will send you the transcription document for double checking.

We have three options of conduction the interview: face to face in a location of your choice, via video conference (e.g. Skype…) or via telephone. The estimated total time we need is between 35 and 55 minutes.

I am very much looking forward to your contribution to the ongoing academic and practitioner's discussion about LEAN and Human Resource Management. As a thank-you, I will send you my completed master thesis and I can also offer to hold a presentation in your company on the major findings of my research.

Last but not least, if have a final request: If you know anybody in your network (outside of your own company) who could also contribute to the research, please refer them to me. Part of my research strategy is "snowball sampling" and by spreading the information, you can once more make an important contribution.

Should you have any question before our meeting, please e-mail me at [redacted] or call me at [redacted]

Thank you so much and looking forward to our interview.

Best regards,

Mario Müller

Appendix 4: Themes and Bullets for the Semi-Structured Interviews

Research Question:
Which HR systems can contribute to the success of a sustainable lean transformation
and
how do they have to be designed?

Interview Themes / Sections

Section 1: Pre-Lean
- What did you do, from an HR perspective, before you implemented "Lean"?
- What did you do, from an HR perspective, to prepare for "Lean"?

Section 2: Lean in the company
- Which parts of Lean have you implemented in your company?
- Please describe, which elements of Lean you are using in your company.
- Please describe, how Lean works in your company.

Section 3: Changes in the Organization
- Which changes of the organization came with Lean?
- Which changes in your organization where necessary / did you take?

Section 4: Changes in HR
- Which impact did Lean have on your HR tasks?
- What do you think is critical to think of, from an HR perspective, when adopting a Lean philosophy?
- What would you say are the main differences between traditional and Lean manufacturing from an HR perspective?
    - How do you address them?

Bullets:
- HR Planning
- Recruitment & Selection
- Onboarding
- Work Design / Classification
    - Teamwork
        - Team Building
    - Fluctuation rates
- Bonus & Reward systems
    - No-fire guarantee
    - Contract design
    - Team vs. individual pay-for-performance systems
    - Non-monetary rewards
    - Idea Management / Company Suggestion System
- Training / Skill Development
    - Competence Matrix
    - Learning Organization
    - Coaching and/or Mentoring Program?
    - Job-Rotation

        - Multi-skilled labor / cross training
            - Use of Lean tools
    - People Development
        - Personally / emotional
        - Encourage responsibility
        - Problem solving
        - Empowerment (hierarchies)
    - Talents
        - Retaining talent
        - Talent Management
        - ILM's
        - Designing new or altering career paths
        - Succession Planning
    - Communication
        - Visual Management Boards
        - Making Progress visible, e.g. through easy-to-understand KPI's
    - Performance Management
        - Danfoss: two Lean projects/year minimum to keep leadership position
    - Organizational design
        - Power structure – line of command
        - Change Management
            - Change agents
            - Lean champions
        - Standardization
        - External Consultant / Coach
        - Orga. Chart & hierarchy
    - Leadership & support

Types of Questions:

- Open Questions
- Probing Questions
- Specific and closed questions

Techniques:

- Critical Incident Technique (p. 407)

Appendix 5: Note-Taking Document during the Interview

Research question: "Which HR systems can contribute to the success of a sustainable lean transformation and how do they have to be designed?"

Method: **Face-to-Face** | **Skype** | **Telephone**

Anonymity?	Yes	No
Interview Partner	Date	
Company name	Document: IG - v. 1.1	
Years of LEAN in the company?		
Time start	Time end	
Duration		
permission to audio record?	Yes	No

Introduction: myself, topic, procedure/structure of interview

Questions up front?

Notes

Is any supplementary information available, e.g. charts, samples, spreadsheets, data, ..	Yes	No

Statistical Data

title		
position		
gender	Male	Female
years dealing with LEAN overall		
years in company		
years in function		
company turnover		
number of employees		
headquarter in		

snowball-sampling: any referrals?

voluntary breaks	Yes	No

Interview setting (quiet room, interruptions, one-to-one,...)

Impression of Interview (depth of interview, information flow, rapport, timing,...)

need to amend anything?