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Master's Thesis

Building future standard and Knowledge Management for Inventory Management in Logistics Europe Central

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Declaration of authenticity

Herewith I declare that the study and presented Master's Thesis is my own work, or fully and specifically acknowledged wherever adapted from other sources.

Kaufering, August 20th 2015   …………………………

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Title of the Master's thesis:

Building future standard and Knowledge Management for Inventory Management in Logistics Europe Central

Abstract:

The aim of this master thesis is to build standards and Knowledge Management for the Inventory Management in the Materials Management department in the Logistics Europe Central region in Hilti Corporation.

The theoretical of this master thesis part provides a theoretical basis in Lean management with the focus on administrative environment. It further clarifies the importance and benefits of standards and Knowledge Management in the context of Lean and describes Lean frameworks used for building the project steps of the practical part of this master thesis. Furthermore, an overview about current Lean practices in Hilti is provided.

The practical part of this master thesis portrays the establishment and development of standards and Knowledge management in the Materials Management department. In details, the project steps are discussed and illustrated where applicable. Status update of the project is provided including the feedback of relevant stakeholders. Lastly, author gives recommendations for the further continuation of the project for the department from strategic, tactical and operational perspective.

Key words:

Standards, Knowledge Management, Lean Management, PDCA, SDCA

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List of abbreviations

ATS	Availability to Standard
BOD	Business Opportunity Description
BPPM	Best Practice Process Management
CHF	Swiss Franc
CIP	Continuous Improvement Process
CW	Central Warehouse
DFU	Demand Forecast Unit
EB-2	Executive board minus 2 level
EB-3	Executive board minus 3 level
ET&A	Electronic Tools & Accessories
F&P	Fastening & Protection
HIP	Hilti Integrated Planning
HQ	Headquarters
ICLe	Inventory Coverage Logistics
JF	Jour fix
JIT	Just-in-Time
Kaizen	Continuous Improvement (Japanese)
KPI	Key Performance Indicator
LEC	Logistics Europe Central region
LECMM	Logistics Europe Central Materials Management department
Muda	Waste (Japanese)
MyKL	My Knowledge portal
PDCA	Plan-Do-Check-Act cycle
Poka-yoke	Mistake-proofing (Japanese)
RACI	Responsible-Accountable-Consulted-Informed assignment matrix
RDC	Regional Distribution Center
SC	Supply Chain
SDCA	Standardise-Do-Check-Act cycle
SFM	Shop-floor management
SOP	Standard operating procedure
TL	Team leader
TPS	Toyota Production System
VOC	Voice of the customer
VSM	Value Stream Mapping

Introduction

Lean Management in the world of supply chain is a continuously more and more used term. Companies that do not apply Lean principles are slowly lacking behind its competitors in cost and time efficiency. The main aim of the Lean Management is to eliminate waste activities that do not bring added value to the customer. It is the philosophy of continuous improvement driven by the bottom-up change, which stimulates innovation.

Hilti Corporation is a company operating in the construction industry, which establishes its success on being a market innovator. In order to support the bottom-up innovations and continuous improvement in line with Lean principles and their corporate strategy, there has to be a reference basis created, documenting current best practice in the company. Once, the basis is clear, the systematic continuous improvement process can take place without former achievements being deteriorated in the meantime.

Based on abovementioned, the Materials Management department in the Logistics Europe Central region has decided as the first department in the Hilti world to create standards for office environment. Therefore, the aim of this master thesis is to build standards and Knowledge Management for the Inventory Management in the Materials Management department in the Logistics Europe Central region in Hilti Corporation. This master thesis is based on the real project executed in the LECMM department between March and August 2015 with the further continuation. Since knowledge management has already started to be developed by headquarters at the time of the project, the main emphasis of the project and the master thesis is put on the establishment of standards for administrative environment, as the LECMM department is a pioneer in their development in Hilti.

This master thesis is divided into 5 chapters, in which it narrates readers the course of the project executed in the LECMM department and provides the theoretical background for its execution. The first chapter introduces the reader deeper into the subject of Lean management with special focus on Lean practices in administration. It introduces Hilti Corporation, its strategy and its previous experience with Lean implementation. Lastly, it defines the methodology of the work, its aims, hypotheses and indicators for their evaluation.

Second chapter sets standards and Knowledge Management into the context of Lean management and enumerates benefits of their implementation. Furthermore, it gives a theoretical background for planning of the project and creation of project steps that are discussed in depth in the third and fourth chapter of this master thesis.

The focus of the third chapter is on standards establishment in the LECMM department. This chapter contains project phases and outcomes from standards development and creation, testing, implementation and subsequent control and maintenance. Moreover, on the example of process improvement, the standard's improvement is demonstrated.

The fourth chapter narrates the project steps and outcomes of the Knowledge Management establishment in the LECMM department. At first, it speaks about current practices in Knowledge Management in Hilti globally. Then it focuses on the LECMM department solely and narrates the phases of knowledge collection, documentation and organisation and it is concluded by the knowledge maintenance.

The last chapter gives the project status update as of the end of August 2015, including the feedback collected among the stakeholders of the project. Furthermore, it provides the recommendations for the future for the LECMM department from strategic, tactical and operational perspective.

1 Introduction to the subject

Chapter 1 introduces the subject of this Master thesis. In Section 1.1 Lean Management is introduced, with the focus on Lean in administration. Section 1.2 gives an overview of the company where this study was taken, its long-term corporate and logistics strategy. Section 1.3 introduces current Lean practices in Hilti Corporation. Section 1.4 presents problematic of the study, which results in definition of aims and hypotheses of this Master thesis in section 1.5 together with the methodology used for writing this Master thesis.

1.1 Lean Management concept

The roots of the Lean management lie in the Toyota Production System (TPS). According to Womack, Jones & Roos (1990), in 1950´s due to scarce space in Japan, strong labour laws and limited capital Toyota Company could not implement mass production as seen in General Motors in America. They had to create their own system. First key of their success was having a look at the production process as a whole, from production to customer. Toyota received a compact picture of their value stream flow and suddenly waste activities were made visible to them. By removing waste, reducing down time, production lots were decreased and defects more easily and quickly identified and reworked. Empowering employees to adopt changes if needed, communication between departments and thinking in the entire value stream perspective instead of just own department brought Toyota to greater efficiency and productivity, reduced costs and improved quality.

Resulting from TPS, Lean management´s trigger is a customer and his needs. This is the pull force of the company´s supply chain. Lean´s main initiative is to eliminate waste – non-value adding activities for the customer, and optimise the entire supply chain process in order to create one flow (Cudney & Elrod, 2011). In result, this goods´ flow can more flexibly react to customer needs without creating excess inventory in the course of the process, thus increasing efficiency and nearing Just-In-Time (JIT) production (Liker & Meier, 2006).

According to two scholars and original transformers of TPS to Lean principles and thinking that can be applied by companies worldwide, James Womack and Daniel Jones, Lean thinking and implementation is based on **5 principles** (Trent, 2008):

1. **Value (for a customer)**
2. **The Value Stream**
3. **Flow**
4. **Pull**
5. **Perfection**

In the centre of the Lean approach there is always a customer. Lean forces companies to look at its processes from customers´ perspective, analyse value added for the customer and distinguish between processes that create or support the creation of added value and

those that are pure waste and can be removed without an impact on the final outcome. Moreover, it is not enough to analyse processes separately and focus on the unit cost reduction solely. Companies need to take into picture the whole value chain from ramp to ramp in order to analyse the biggest wastes throughout the value chain and eventually optimise it (Liker & Meier, 2006).

Once the waste is eliminated and the value stream encompasses only value-adding and value-supporting processes, continuous flow of these processes is necessary (Lean Enterprise Institute, n.d. a). "Interruption of the flow of any of these areas (different types of flows) can be wasteful" (Trent, 2008, p. 6), because inventory – one of the seven fundamental wastes – pile up in the breaking points. That decreases the productivity of capital employed and overall efficiency of the value stream.

Since the entire value chain is focused on delivering relevant value added for the customer, he is supposed to be the trigger to the value stream. His demand should pull the production and sourcing activities. Despite the fact that majority of companies have both pull and push parts of their supply chain, the main aim of Lean is to push the decoupling point as upstream as possible in order to maximise consumption-driven activities and minimise forecast-driven activities.

The ultimate goal of the Lean is the state of perfection. Quality issues result in waste creation, therefore the more flawless the processes are, the closer to Lean desired outcomes the company is (Trent, 2008). Moreover, once previous steps are introduced and put into practice, the process of removing waste and optimising the added value activities shall be repeated. Continuous improvement of processes will drive the company to the perfections unless the conditions and factors influencing these processes are changed (Liker & Meier, 2006).

Liker & Meier (2006) go even further than 5 principles of Lean and name **14 principles**. The 4 main areas they focus on are correct performance of processes, development of people and partners, organisational learning through solving roots of the problems. These aim to "generate value for the customer, society, and the economy" (Liker & Meier, 2006, p. 8), which is the essential philosophy underlying the entire Lean concept.

On top of aforementioned principles, Liker & Meier (2006) as well as Morgan & Liker (2006) emphasise the importance of workload levelling, in Japanese "Heijunka", which means production in small batches with higher frequency of repetition. That builds more flexibility into production allowing reacting more promptly to variation in consumption. Furthermore, they state that "standardised work and processes are the basis for continuous improvement and employee empowerment" (Liker & Meier, 2006, p. 10) and since people are visual beings, visualisation of indicators and standards is a key for transparency. Concerning technology, taking the example of Toyota, they never implement a new technology without thorough investigation and testing period. Only when reliability is proven, the technology can be incorporated into the production process. Moreover, it is important to realise that technology serves people, not vice versa. It does the automated

part of the process, but human being is the one to spot deviations from the standard and adjust the production when needed – the process called "Jidoka" in TPS.

In order to develop potential in people, true experienced leaders are needed. The strong preference is for internally developed managers who know the operations, have managerial experience and most of all are able to lead the others to their self-development. Furthermore, talented people need to be hired, who live company's philosophy in order to increase the value of the company. Last but not least, once company's employees are aligned with corporate soul, the incorporation of corporate partners, such as suppliers, should take place in order to optimise even broader value stream than within the boarders of one's own company (Morgan & Liker, 2006).

To solve problems and learn from them, Lean management stresses the importance of going to the place where action takes place, and see the problematic situation in your own eyes – also known as "Gemba" approach. To learn about the real cause of the problem however, one must use various techniques such as Root-cause analysis, 5 Why's or Pareto diagram. Understanding the real cause of the problem enhances learning and improvement in order not to repeat mistakes from the past. Feedback and reflection shall therefore play an important role in the company.

The ultimate goal and philosophy of the Lean management lies in **Kaizen**. Kaizen is the Japanese term introduced by Massaki Imai in 1986. "Kai" meaning change and "zen" – better. Put together, it means "change for better". In other words Kaizen in the equivalent of CIP process as known in western countries (Ehlers & Pawlowski, 2006). Kaizen declares the continuous improvement via small steps that build the improvement incrementally. This improvement, however, as Kosturiak & Frolik (2006) point out has to be based on the bottom-up approach. It has to result from employees' initiative and suggestions for improvement as they are closest to the processes and know them the best. Japanese believe that this philosophy shall be applied in professional life as well as in personal and social life; both by managers and operational workers (Kosturiak & Frolik, 2006). Since western people are not that widely used to this philosophy, it is necessary that the corporation builds its culture supporting this bottom-up approach. The result will bring the complete continuous improvement cycle, as suggested by Liker & Meier (2006) in the picture below. The incremental levelling will be initiated by operational employees – the experts in their fields; that will be subsequently stabilised and variation removed; one flow of the value stream, as mentioned above, will be created; thus, preparing the stream and processes for standards update. Once a new small step forward occurs, the cycle shall be kicked off again.
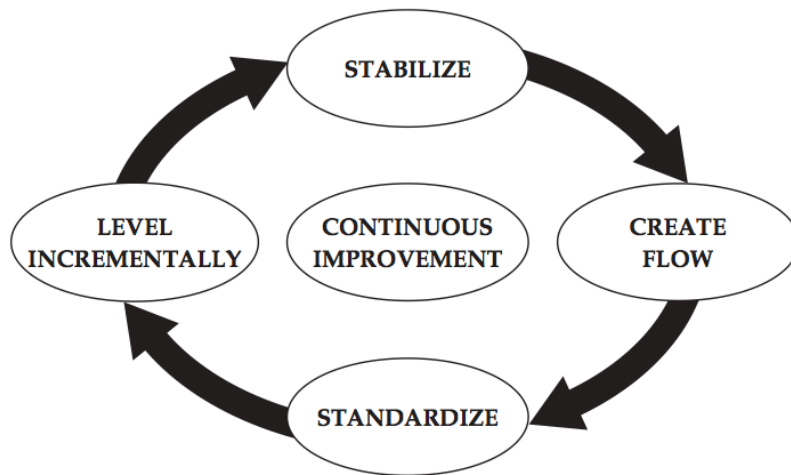
Fig. 1: Continuous Improvement Cycle, Liker & Meier (2006)

Since TPS introduction, Lean management was adopted not only by automotive companies, but its usage has spread to other industries irrespective of their scope. Nowadays, Lean practices can be applied to manufacturing, administration as well as to service providing companies.

1.1.1 Lean in Administration

As mentioned above, Lean started and currently is most widely spread in manufacturing sector, since these processes are the most visible and as traditionally believed, concentrate the greatest deal of value adding activities to customers. However, as Lean theory states, there is a need to consider the entire value stream of companies including office processes and R&D. Juroff points out that "60 to 80% of all cost related with meeting a customer demand is in administrative or non-production-related functions." (Juroff, 2003, p. 45). That means that office processes represent a great potential for waste elimination and subsequent cost reduction.

In order to better understand specific conditions for Lean application in administration, it is necessary to point out the differences between manufacturing and office environment. The fundamental difference between shop-floor and office processes is that in shop-floor production processes with the flow of material prevail, whereas in administration transactional processes with information and paperwork flow dominate. Shop-floor processes are defined by customer needs and the output of the process as well as production process itself are identical. In office though, the processes are repetitive with the same aim, however entry parameters usually differ, which makes the process more difficult to standardise. Moreover, the actions possible to be taken in office processes are various, therefore one can come through alternative routes to the desired result, which can differ from case to case.

	Shop-floor	Office
Transaction object	Physical product	Service, file, information
Morphology	Tangible, visible	Intangible, invisible
Product definition	Determined according to defined specification	Ranging from parametric defined template to VOC
Product variation	None	Virtually unlimited
Product quantity	Virtually unlimited batch size	Single transaction batch size
Product non-conformity	Visible with defined out of control procedure	Break, often invisible, undefined mitigation
Degree of control	High (directly influenced)	Low (externally influenced)
Predominant actions	Executing	Analysing/planning/executing
Make to	Make to stock possible	Make to order
Assets	Mainly product specific equipment, capital intensive	No task specific equipment, IT is integrating backbone
Set-up costs	May be relevant	Low, but task switch-over

Fig. 2: Differences in transaction objects of shop-floor and office activities, Rüttimann et al. (2014)

Furthermore, there are differences in process characteristics and execution between shop-floor and office. The main difference lies in the orientation of processes. Shop-floor performs task-oriented activities whereas office environment performs mostly result-oriented activities, aiming to reach set KPIs. Since shop-floor activities are possible to measure by time and results produced, the waste becomes obvious in short time. However, office processes are not possible to measure by time since inputs vary, therefore waste is rather invisible. Moreover, tasks performed in shop-floor are sequential whereas in office, they are of a functional nature and can be dealt with 7tandard. Overall, processes in office are less structured due to input variability, with more freedom for an executor, who is the master of the process and who influences the outcome of the process up to great extent.

	Shop-floor	Office
Principle orientation	Process-centric (task-oriented)	Output-centric (result-oriented)
Transformation model	Procedural type	Relational type predominant
Task description	Detailed SOP including time to comply with customer takt	Approximate, rather description of output to be performed
Task characteristic	Very structured, no degree of freedom, no alternatives	Less-structured, allows execution discretionality, many alternatives
Task content (width)	Simple, confined (narrow, to be takted)	Complex, comprehensive (large content, difficult to be takted)

Waste, Value stream	Visible	Mainly invisible
Value add	Usually transformation time	Includes think, write, listen, talk
Process flow	Ideally 1-piece flow	Mainly push on "boss"-pull
Process concept	Usually sequential steps	Random access to resources
Process aim	Balanced and takted flow	Maximise parallelisation

Fig. 3: Differences in process execution of shop-floor and office activities, Rüttimann et al. (2014)

From the above stated results that when implementing Lean into administration, differences between shop-floor processes and office environment need to be taken into consideration. Tools applied need to be adjusted to the specific department, its needs, conditions and team characteristics in order to bring promised results.

Coming to Lean implementation itself, Merwan B. Mehta (2015) states that there are 6 steps to follow when applying Lean principles in the office environment.

1. Track percentage value added time for processes
2. Prioritise processes
3. Document processes via process flow charts
4. Standardise processes
5. Track the quality of work performed
6. Have an executive with relevant authority who supports change and innovation

In the first step, author is unified with Rüttimann et al. (2014) in the idea that tracking time is pointless in administrative, since input parameters and quantities to be processed vary all the time. Therefore, this step will not be considered in this study. Prioritisation of processes can be done in several ways either based on importance of processes or in alignment with other processes. The author will consider prioritisation resulting from given deadlines for every process to be executed. It is in line with global corporate calendar, and therefore it is necessary for region to be aligned and precise in keeping dates prescribed. The interconnection between processes and quality track is important in author's opinion, since the performance of administrative processes as stated above is result-oriented. Therefore, it is necessary to set desired results in the form of KPIs the company/region/department wants to achieve with help of its employees. Moreover, Mehta (2005, p. 42) states that "the simple act of showing interest in a metric and creating a means to track it often results in an improvement in quality and productivity that ranges from 12 percent to 15 percent." Last but not least, since corporate culture highly affects employees' approach and successfulness of Lean implementation in the department (Bhasin, 2013), it is important to feel the support for Lean from the direct team executives.

There are already proven positive effects of introducing Lean in office environment, such as increase of awareness about discussed topic – "Because people want to do the right thing, once they understand the process they can maximize their own effectiveness within the process. … The interviewing step and discussions in a lean implementation increases awareness, …. Team members begin to realize how they fit into the process as a whole and

how their actions affect the upstream and downstream portions of the process." (Huls, 2005, p. 35) Furthermore, with Lean implementation wastes such as the lack of training of employees, double work due to the lack of information and communication, multiple files containing the same data, non-transparent communication flows are made visible and possible to eliminate. Pollitt (2005) proves the benefits of Lean implementation in the administrative environment on the case of Siemens. Siemens won the management of customer operations of National Savings & Investments, a major retail financial service organisation in Great Britain. After Lean implementation results showed the improvement in several areas. "The timeliness and accuracy of contracts have improved from 98.18% to 99.62%. Contractual deductions have fallen from £455,000 to £26,000. Net savings of £6 million have occurred per the lifetime of the contract. Frequent cross-departmental communication decreased yearly postal costs by £105,000; necessary working space has been reduced and the key processes affecting customers had their lead time reduced by 50%." (Pollit, 2005, p. 229)

1.2 Hilti Corporation

Hilti Corporation (further referred to as Hilti) is the leading company in a construction business present in over 120 countries worldwide. It was found in 1941 by brothers Eugen and Martin Hilti in Schaan, Principality of Liechtenstein. It is a family owned company with Martin Hilti Family Trust as the sole shareholder. Currently, the company employs around 22,000 employees and is known for its direct sales business model.

The core of the company´s business is production and sales of tools and inserts for drilling and demolition, screw and direct fastening, cutting, anchoring, installation systems and fire stop and protection products. Company is also known for offering outstanding services, such as fleet management, life time and repair services. The group´s sales reached 4.5 bn CHF in 2014. Leadership through differentiation is the key strategy of Hilti. Company, therefore, heavily invests into continuous development and innovation of its products and services. In 2014, company invested 5% of its sales into R&D and on average, 30 new products are introduced every year.

In March 2014, Hilti introduced its redefined **corporate strategy called Champion 2020**. Company´s ultimate goal is to create enthusiastic customers and build a better future. In saying so, it emphasises the importance of direct relationship with customers and the importance of expressing customer needs, inputs and feedback, which are the main driver of innovations in Hilti. Company aims to build a better future and bring value added to the society as such. To be sustainable in its endeavours, it positions itself into the role of a market leader who sets trends in construction industry. In the long term, this leadership position needs to be maintained in order to create an impact. Moreover, company´s strategy is built on differentiation of its products and services, which create extra added value for customers, and thus they are willing to pay premium for it. The whole strategy is embedded in Hilti´s corporate culture, which accumulates and develops people who share

the same values as the company itself. Company´s high expectations from people are thus levelled by the opportunity to act as entrepreneurs, propose own ideas, develop them and overtake the responsibility for them.

Fig. 4: Hilti Corporate strategy Champion 2020 Tower, Hilti (2014b)

Hilti strategy stands on 4 pillars that represent the unique value of Hilti – Product & service differentiation, Direct customer relationship, Operational excellence and High-performing global team. Logistics and SCM mainly contribute to Operational excellence pillar success.

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1.3 Hilti Corporation and Lean Management

As already mentioned in Hilti corporate strategy Champion 2020 as well as in Global Logistics strategy GL2020, Lean Management is an important element contributing to Operational excellence of the company. Lean management operates within Hilti under strategic name Lean@Hilti.

The 5 principles of Lean Management are in Lean@Hilti adapted to Corporation and leadership, Avoiding mistakes, Flow, Rhythm, Pull, which leads to continuous improvement – the driver of corporate development. Company tends to develop its employees via on the spot coaching, which is approached consistently and sustainably. Avoiding mistakes is identical to Perfection principle, where the emphasis is put on quality and focus on early detection of mistakes. Hilti Integrated Planning (HIP) project focused on sales & operations planning brings holistic view on the Hilti SC. It aims to deepen the cooperation between sales, marketing and logistics departments to ensure linkage between processes in order to create one-piece flow. Moreover, it sets a goal to unify the planning and forecasting and steer one number across the SC pulled by the customer. It involves cross-departmental synchronisation of workflow calendars and restructure of responsibilities and methods of forecasting. As a result, Hilti will be able to build flexibility into its SC via eliminating waste and production levelling, and thus creating free capacities and react more promptly to changes in the market. This will lead company to continuous improvement and ensure its position as a market innovator in construction industry.

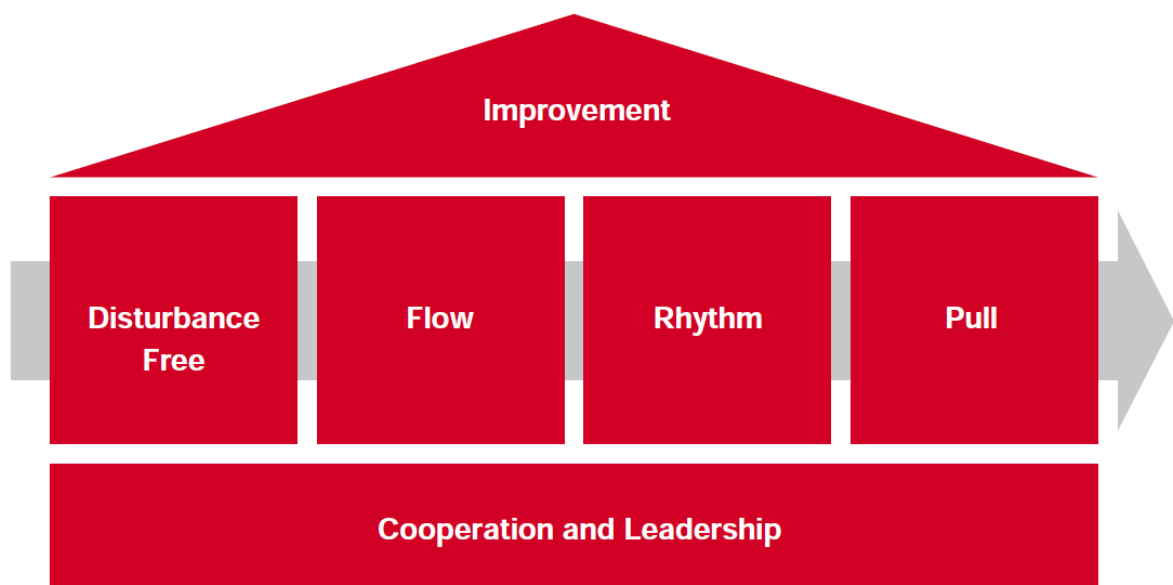Fig. 6: Lean@Hilti 5 principles, Hilti

The program was introduced in 2011 primarily in the production and warehouse areas. In 2 years, it brought its first results displayed in the increased productivity of Hilti warehouses worldwide (*productivity is measured as the number of order lines processed per man-hour). Overall, availability to service increased above the target and inventory levels got

reduced both in regional warehouses and market organisations. In the picture below, Lean impact on productivity can be seen.
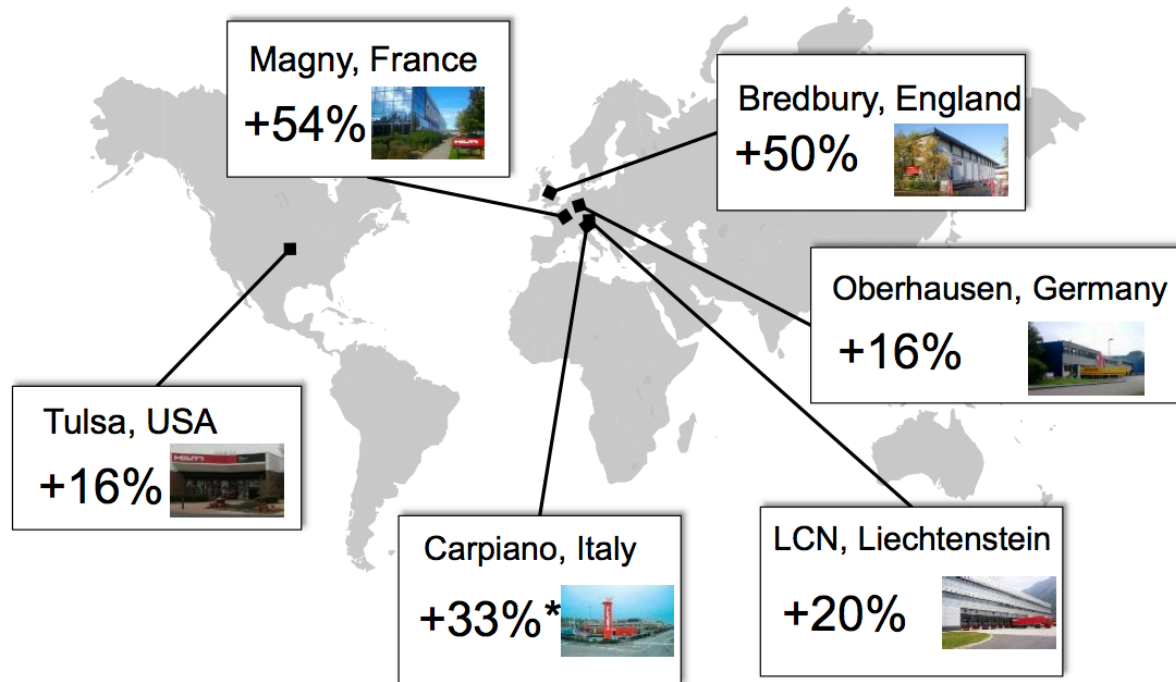
Fig. 7: Lean impact for Hilti Warehouse productivity, Hilti (2015b)

Once, measures were in place in warehouse and production, standardisation phase of best practices started in early 2012. The Best Practice Process Management (BPPM) was introduced, which functions as a checklist for all regions, they can score their practices and see their space for improvements. The checklist benchmark consists of current best practices in Logistics in Hilti worldwide. It is regularly used in Global Logistics Operations Management Experts Meeting (Glomex) to review performance of regions and set next goals for them in order to get to standard level of practices used and performances reached in Hilti worldwide. Furthermore, pilots for entire value stream projects were introduced under the leadership of Lean experts´ team.

In 2014, Lean@Hilti started to widen its application to Materials Management and Transport Management. Pilot regions from Materials Management department were Logistics Europe Central (LEC) and Logistics Southern Europe. Regions started with the application of the 5S method, which is a basis for further process optimisation. Teams were lead to 5S thinking and embedding it into their everyday activities. They set into order their working areas including desks, drawers, shelves and closets. 5S principles are currently also translated into Logistics reporting. Schemas and graphs are more easily readable for end-users, and colour-coded differentiating between the above-target (Green) and below-target (Red) performance is a quick indicator for defining successful or unsuccessful performance. In the picture below, one can see the state of reporting graphs before and after the implementation of 5S. We can conclude that group targets are easier to orient in, since the performance is separately analysed for every group. Moreover, since graphs are grouped, no legend is needed, reducing the time of understanding the information.
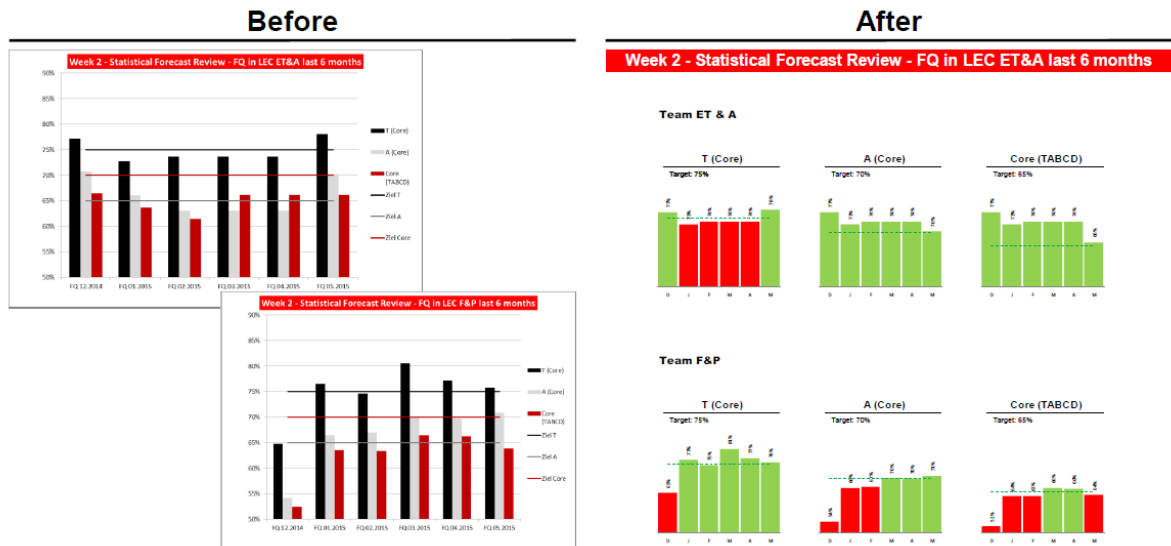
Fig. 8: Reporting graph Lean design, Hilti

Once 5S sank in place, Materials Management department in LEC (LECMM) introduced Shop-floor management (SFM) in different thematic modules, namely Team, Service, Forecast, INP & Events, and Bad Goods & Obsolescence. Themes for SFM are aligned with the BPPM. All modules were developed internally by team members, which increased the team's buy-in. First three mentioned were introduced in 2014; the last two in June 2015 and are currently in pilot phase in LECMM team. Via SFM tool team meets daily at a certain time to discuss Service module topics such as availability KPIs, backorders, supply issues and news. Other modules are discussed regularly on weekly or monthly basis. SFM implementation in LECMM has helped to integrate the team, enhance communication, experience exchange, brought visibility to the problems and offered space for brainstorming and advice of solutions.

Fig. 9: Shop-floor management board in LECMM – Service module, Hilti

Fig. 10: Shop-floor management board in LECMM – Inventory module, Hilti

1.4 Problem description

This study is done in the Materials Management Logistics Europe Central (LECMM) department. It is therefore necessary to provide a short introduction to this department. LECMM consists of 2 teams based on the product portfolio they are handling: ET&A (Electronic Tools & Accessories) and F&P (Fastening & Protection). Altogether both teams comprise of 15 people, 2 team leaders, a process expert and a project manager.

LECMM operates the second biggest logistics region in the Hilti world in terms of turnover supplying 14 countries in Central, Eastern, Western and Southern Europe. LECMM is supplying over 25% of global sales with the highest Availability to Standard (ATS) from all logistics regions. It operates over 12.000 active DFUs. A distribution network for the region consists of 4 regional distribution centres (RDC) in Germany, Austria and Poland and one central national warehouse (CW) for Switzerland. These RDCs / CW are supplied from headquarter warehouses in Liechtenstein and Austria, directly from suppliers, or directly from internal production plants.

Fig. 11: Hilti LEC region, Hilti

Corporate strategy Champion 2020 and Global Logistics strategy GL2020 was in the LECMM transformed to particular targets for this department. Based on the Operational Excellence pillar, further application of Lean methodologies in LECMM team is scheduled for 2015. 5S principles and SFM as mentioned above are in place. In March 2015, HIP project unified and adjusted the time frames for execution of planning and forecasting processes by planners within every month, thus starting slight standardisation of process time frames. Lean methodology says that the basis for every improvement is standardisation of current best practice, which is in the department. Only after the standardised processes are in place, one can start the cycle of continuous improvement. Then there will be always a reference point stabilised by the standard. If the outcome of the improvement circle will bring real improvements to the processes, then the current

standard will be overwritten to match the improved process, which will subsequently become a new standard everybody has to refer to.

Currently, there are no standardised processes in place in LECMM. Therefore, there exists no reference point one could refer to when improving the process. Moreover, once there is an improvement of the process, it is highly probable to deteriorate over time because it was not fixed by the standard. Thus, the effort of improvement team will vanish over the time or with the turnover of the employees, who were responsible for the change. Standardisation of processes is therefore inevitable in LECMM in order to successfully continue the implementation of Lean initiatives in alignment with GL2020 strategy.

Furthermore, a global need of systematic knowledge creation resulting from GL2020 strategy – "Highly performing global logistics organisation" pillar raised the question of organisation of local knowledge documents in LECMM as well. Currently, there exist no unified collection and organisation of relevant knowledge documents. The knowledge documents including working guidelines to transactions and processes as well as educational materials and excel tools are then stored in various different locations, such as SharePoint, MyKL platform (a navigator for documents in SharePoint), Intranet, team shared drives and planners' individual drives. It also happens that documents are multiple times stored both in team's shared drives and planners' individual drives. Because of the impossibility of remembering all particular locations for important files, the current common practice in the team is that the personal mailbox serves as a navigator with the links to locations where these files are stored. Therefore, the question of knowledge management has to be effectively tackled.

1.5 Methodology

This master thesis is written in the systemic approach. Theoretical frameworks and background explanations are chosen and described based on the relevance for the practical application to the problem and the study.

The structure of the master thesis is organised in the project style. There is no clear distinction between theoretical and practical part. The master thesis is organised in the consequential project steps as the study was performed. Every process step includes relevant theory and frameworks, based on which practical project steps are executed. This master thesis is divided into 5 chapters:

1. Introduction to the subject
2. Standards and Knowledge Management in context of Lean
3. Standards for processes in Hilti LECMM department
4. Knowledge Management for processes in Hilti LECMM department
5. Recommendations for the future

The first chapter familiarises readers with Lean concept, Hilti Corporation and its strategy, describes the problem and states the aim of the study. Chapter 2 gives the theoretical

background to the standards and knowledge management importance in Lean. Chapter 3 documents the whole process of standards development, testing, implementation and maintenance in the LECMM department based on the structure of PDCA and SDCA cycles. Chapter 4 structured according to the PDCA cycle gives an overview of knowledge documents creation, testing, implementation and maintenance in the LECMM department. Finally, Chapter 5 provides the LECMM department with further recommended steps and points for improvement.

Methods that were used in the research part of this study include in-depth interviews with planners, process expert, project manager and the Head of the LECMM team; process shadowing of LECMM planners, process comparison to process expert's knowledge and global and regional guidelines. All processes were reviewed by the Head of the LECMM department to fit the tactical and strategic course of the Hilti Global Logistics and the LECMM department.

1.5.1 Aim of the Master Thesis

The aim of this Master thesis is to develop standards for processes belonging to the Inventory Management module. Furthermore, it seeks to establish Knowledge Management and create relevant Knowledge documents for Inventory Management module. The aforementioned is created for Material Management department of Hilti – Logistics Europe Central (LECMM).

1.5.2 Hypotheses of the Master Thesis

This master thesis seeks to verify the following hypotheses:

Hypothesis 1: Standards creation for processes in Inventory Management in Materials Management team in Hilti Logistics Europe Central will increase effectiveness.

The observed indicators for verification of this hypothesis are:

- Transfer from implicit knowledge to explicit
- Compliance of processes execution with global and regional policies and guidelines
- Using current best practice in the team
- Creation of a reference material for planner and a basis for further processes improvements

Hypothesis 2: Development of Knowledge documents for Inventory Management module with working guidelines and educational parts in Materials Management team in Hilti Logistics Europe Central will make knowledge documents more accessible and sustainable for planners.

The observed indicators for verification of this hypothesis are:

- More transparent organisation of knowledge documents
- Easier access and orientation in knowledge documents for planners
- More sustainable storage of knowledge documents
- Increase of erudition of decisions while executing processes and overall knowledge level in the team

2 Standards and Knowledge Management in context of Lean

Chapter 2 gives the theoretical background for standards and knowledge documents and explains their role in Lean Management. Section 2.1 focuses on the importance of standards for Lean and the relevant frameworks that support standards creation and maintenance. Section 2.2 focuses on Knowledge Management, its benefits and correlation to Lean Management.

2.1 Standards importance in the Lean Management

"Without standards there can be no Kaizen"

~Taiichi Ohno

The above-mentioned quote comes from the father of the TPS, Taiichi Ohno. Even though this quote was said decades ago, it is still valid and currently even increases its relevance as more and more companies try to get Lean and implement its practices.

When is the right time to implement Lean and which tools and practices to implement? Kristi Huls (2005) suggests that if the company/department asks itself these five questions and there is "no" answer to at least one of them, it is advised to consider implementation of lean practices:

- "Do you have standardized procedures?
- Do you implement best practices?
- Does every process have an owner?
- Do employees understand how their role affects a process?
- Do people communicate the right information at the right time to the right people?" (Huls, 2005, p. 37)

In focus on the LECMM department, it was previously mentioned that currently there exist 5S and SFM practices in the team. Creation of the SFM implies that the team in the recent past undergone and with some modules is still undergoing changes and improvements. However, as said by Taiichi Ohno, without standards there can be no Kaizen. Without standards in place, the return to the initial situation is foreseeable, which hinders continuity of the improvements. Standards act as a block that prevent returning
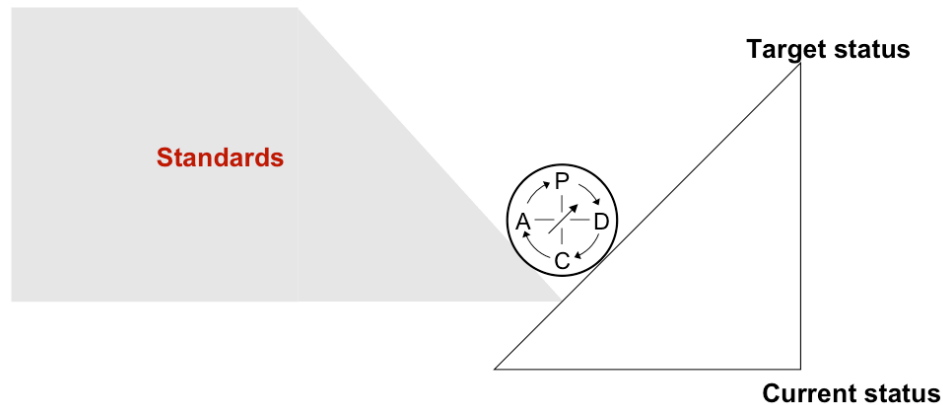
Fig. 12: Schema of a standard as a basis for continuous improvement, Hilti

Therefore, when analysing the 5 questions of K. Huls, it can be concluded that there are no processes supported by standards in place in LECMM. It is therefore difficult to implement best practices. Moreover, it is not made transparent what the current best practices in the team are. Equally, there is no process owner in place and the team relies solely on their process expert. His absence may therefore result in the team being stuck.

First steps in solving the non-existence of the process owners were already established in LECMM by introducing the Key user structure in April 2015. Key user structure was built based on the Best Practice Process Management structure (BPPM) globally agreed within Hilti Logistics. Furthermore, it is in line with SFM modules organisation. The main idea behind the Key users' concept is that over time they shall develop expertise in the assigned area and be the first ones to be approached by other planners in case of unclarity, problems or, on the other hand, suggestions for improvement.

The primary tool for standardization within Toyota is Standardized work. It defines who, what, when and where needs to be performed (Liker & Meier, 2006). By definition published by P. Dennis (2007, p. 51) "Standardized work is defined as work in which the sequence of job elements has been efficiently organized, and is repeatedly followed by a team member". Dennis also explains that standard provides a clear image of the desired process. With lining the desired process flow down, abnormalities are made visible and corrective actions can be implemented.

The aim of the standard is to document the process in simple and easy to understand steps, to see the current best practice of the flow of the process in order to deliver desired results. In Liker & Meier's words (2006, p. 123), "After the most effective work method is established, the documented process is used as a visual reference to ensure adherence to the standard."

As in this study we are dealing with the office environment, Lean practices may need to be adjusted from the production usage; however they are still valid also for the administrative environment (Nash & Poling, 2008). Mehta (2015, p. 40 – 41) states that "80 – 90% of all processes that offices perform are repetitive". The repetitiveness promotes standardisation

and eases it. As majority of the workload gets revised and improved, standards deliver higher productivity and greater impact per process, resulting in less work for employees.

Compared to manufacturing settings, standards in office environment should not be however, too detailed. Firstly, the processes in administration are more complex with higher variation in inputs and considered data than in production. Therefore, global and regional guidelines and policies applicable for processes should be made transparent and accessible to performers in order to teach them think "correctly" when performing particular processes. Secondly, certain level of freedom should be maintained for performers, since the educational level in the team is usually higher with office employees compared to manufacturing (Rüttimann et al., 2014). Moreover, these people can more probably get offended if somebody tries to control and command them. As Chopra (2009, p. 155) says, "Strict adherence to a system makes it inflexible and unworkable. A system should essentially leave something to the discretion and judgment of the personnel responsible for its application", especially, when it does not affect the result of the process.

2.1.1 Benefits of standards

Standards **align process execution in the team**. As long as rules necessary to use when performing given processes are made visible and planners follow them, process execution is getting more unified and based on the same principles, which **reduces the variation of outputs**. Therefore, if the processes execution is correctly defined to reach pursued targets, with standards implementation, desired results shall be more easily delivered.

Standards shall not collect and document any kind of process performance, but the **current best practice** of process execution in the team. Thus, current best practice is revealed and made available to the whole team. Based on the Toyota's example (Liker & Meier, 2006, p. 10), "by standardizing today's best practices, they (Toyota) capture the learning up to this point. The task of continuous improvement is then to improve upon this standard, and the improvements are then incorporated into the new standard."

As previously mentioned standards are **the basis for Continuous Improvement Process (CIP)**. In order to allow CIP, standards cannot be rigid. They have to be perceived as temporary records of best practice. As Henry Ford said, "Today´s standardisation, instead of being a barricade against improvement, is the necessary foundation on which tomorrow´s improvement will be based. If you think of "standardisation" as the best that you know today, but which is to be improved tomorrow – you get somewhere. But if you think of standards as confining, then progress stops." Therefore, once conditions change and the hypothesis that standards record the best practice is disproved, new improvement cycle (PDCA) shall be initiated, resulting in standards update by documenting a new best practice.

Revealing the best practice, standards creation stimulates **learning from each other** and **transfer from implicit knowledge to explicit**. Once the best practice is documented, the team can learn from it and there is no danger of knowledge evaporation. According to

Rüttimann et al. (2014) standards assures reproducibility of the process therefore, it limits the impact of employee turnover (which is in Hilti quite high due to the HR strategy of rotating majority of personnel to experience different departments once they master their current position) on the performance of the department. Liker & Meier (2006, p. 10) support this claim by saying that "without this standardization process, individuals can make great improvements in their own approach to the work but no one will learn from them except through impromptu discussion. When an individual moves on from that job, all of the learning is lost. Standards provide a launching point for true and lasting innovation."

Furthermore, as best practice is built on previous experience lessons were learnt from the mistakes once made. Thus, standards **prevent errors from reoccurring**. Both old and new employees can benefit from standards as they make **processes** more transparent and **easier to execute**, since they eliminate unnecessary process steps in the process flow. As Chopra (2009, p. 155) says "Systems and routines help in training office personnel in the efficient performance of their work without supervisors and bring about an economy in office operations, because unnecessary operations are eliminated and wastage of any nature is controlled. " Thus, planners have room to focus on other challenges.

Last but not least, **responsibility** for all process steps is assigned, which makes the team more organised. Moreover, with standards in place, as Chopra (2009) claims, team members can perform their task more **independently** and with more **confidence**.

2.2 Knowledge Management importance in the Lean Management in Hilti

Before discussing the topic Knowledge Management, it is necessary to properly define, what Knowledge Management encompasses. One of the most accepted definitions by Duhon (1998, p. 8) says, "Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers." In the same logical steps, the study for knowledge management development is organised in Chapter 4.

Knowledge Management and Lean Management are inevitably interwoven with each other and create a synergic effect of best practice documentation and application. Therefore, knowledge documentation is tightly linked to standards. The aim of the standard is not for a newcomer to understand the process to details just by looking at the standard. As was previously said, it would involve too many details, which would make the standard cluttered and difficult to orient in. To provide detailed information on job performed, it is the duty of Knowledge documents, which should be linked to the standards for further reference if standards themselves are not self-explanatory enough for the employee.

Referring to the **SECI model** firstly introduced by Nonaka, Takeuchi & Umemoto (1996) this study applies 3 of 4 ways presented in the model, in which the knowledge can be shared and developed. This model assumes that there are 2 types of knowledge, either explicit or implicit. **Explicit knowledge** is documented knowledge, written down in manuals, procedures, working guidelines, stored in databases. It is conscious, therefore possible to explain and relatively easy to document. On the other hand, **implicit knowledge** is rather unconscious, therefore difficult to explain and document. It involves practical know-how and procedural knowledge developed through day-to-day practical performance of processes (Kirsh, 2009). Various techniques, such as operators' shadowing or focus groups need to be implemented to get the spontaneous, and thus, mostly, right answer. Because of implicit knowledge results from the potential of individual employees and it is difficult to document them, it is the best source of long-term competitive advantage and innovation (Frost, 2013).

SECI model, or in other words **Knowledge Conversion Cycle**, consists of 4 types of knowledge transfer, as displayed in the picture below.
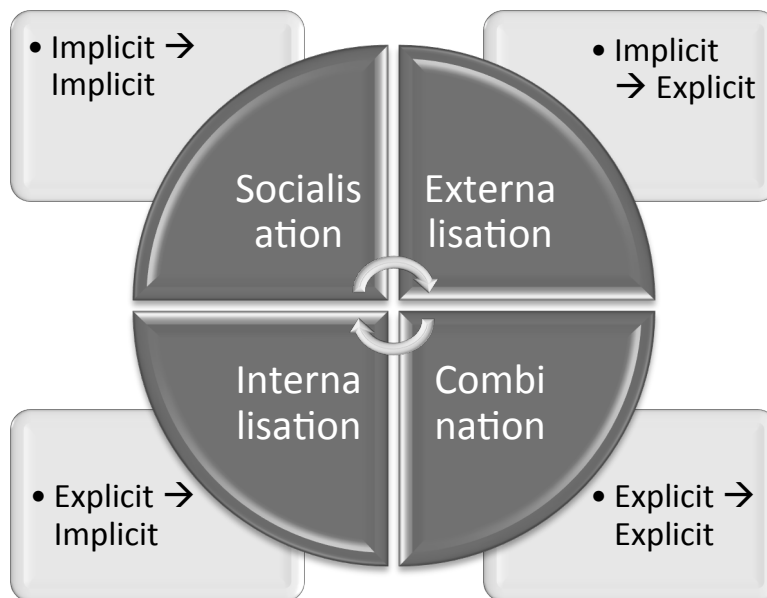
Fig. 13: Knowledge Conversion Cycle, author's adjustments of Nonaka, Takeuchi & Umemoto (1996)

This study applies latter 3 means of knowledge transfer for knowledge management development. As the implementation of the knowledge management aims to make information transparent and accessible, socialisation is not considered a relevant concept for storage of knowledge. The aim of the knowledge management is to transform implicit knowledge to explicit and make them visible and widely accessible; and to organise and transparently store already existing explicit knowledge. Externalisation is due to the coverage of implicit knowledge considered as the most demanding part, involving the close interaction and relationship with process performers in order to find the best practice in the team. This method is primarily covered by the standards development and the shadowing of planners. Combination method mainly represents the collection of

knowledge documents in the practical study of this work. The internalisation method of knowledge sharing, transferring knowledge from explicit to implicit, will be realised spontaneously over the time, once the standards and knowledge documents are accepted, used and learnt. Then learnt knowledge is further re-applied for other tasks/areas, modifying the previous explicit knowledge and creating individual implicit knowledge again. That stimulates the improvement process and emphasises the importance of standards' and knowledge documents' regular reviewing.

Based on the definition of knowledge management mentioned at the beginning of this sub-chapter and the Botha et al (2008) model of **Knowledge transfer**, this study aims to perform knowledge **repository** and **sharing** for creation of a solid and organized knowledge base. It may result in knowledge **discovery** for some team members, but it is inevitable for them to know/learn this information since they need them for their work. Once the organised management of knowledge is widely implemented, it will enable inter-regional experience sharing. Different regions within the organisation will discover already existing knowledge in other regions, and thus avoiding double work. Knowledge that is unknown, either to the region or the entire organization does not possess, and they are necessary for the processes performed in the department, shall be part of points for improvement. After standards' and knowledge documents´ establishment the focus shall concentrate on these points for improvements. The author recommends initiating projects with intention of gaining this missing knowledge and subsequently implementing it to standards.

Knowledge	You have	You do not have
You know	Knowledge Repository	Knowledge Sharing
You do not know	Knowledge Discovery	Exploration, Research, Creation

Fig. 14: Knowledge transfer, Botha et al. (2008)

2.2.1 Benefits of knowledge documents

Knowledge Management contributes to creating a learning organisation within Lean philosophy. As well as standards, Knowledge Management helps companies and individuals to **learn from both their mistakes and successes** (Frost, 2011). However similar to standards, without thorough organisation of already created and gained knowledge, there is no basis existing. As a result, knowledge is not shared and transferred equally to everybody and double work is highly probable, which results in "muda" (Japanese – waste).

One of the most important functions of the Knowledge Management is therefore to **share information** accumulated in the organization. As Manohar points out (2013, p. 476) "Properly stimulated, knowledge and intellect grow exponentially when shared." Thus, up-to-date knowledge documents shared across the organisation stimulate organisational performance and professional development of individuals. Moreover, "intellectual assets increase in value with use" (Manohar, 2013, p. 476). Therefore, it is important not only to

create and maintain documents, but to actively use them in the daily work life of employees. This is aimed to be addressed by the symbiosis of standards and knowledge documents in the LECMM department.

Furthermore, sharing the knowledge makes it available beyond particular department and accessible to the whole organisation. On one hand, it stimulates out-of-the-department thinking, allowing broader perspective, instigating new ideas, and thus innovating. On the other hand, previously created knowledge can be re-applied (with or without necessary modification) in other departments for similar purposes (Frost, 2011).

Secondly, as environment in which employees work changes, employees must be prepared to quickly adapt to these changes and flexibly copy the market situation. Up-to-date knowledge documents therefore make it easier for employees to stay experts with less time consumed for their update. Manohar (2013, p. 476) confirms it by saying that "Because knowledge can quickly become irrelevant in light of changes external and internal to the organisation, it is critical that individuals, who have unique bundles of competencies, can adapt their competencies to new situations as rapidly as possible."

Thirdly, knowledge management creation and maintenance support the corporate strategy aim of developing potential of their employees. Via up-to-date relevant knowledge shared among their employees, company can stimulate development of particular skills and competencies that are important for the certain development stage the company and its individuals are currently in (Frost, 2011). Last but not least, similarly as standards, documentation of knowledge helps the company protect its knowledge against loss with people´s turnover.

2.3 Frameworks used for building standards and Knowledge Management in the LECMM department

As the execution of the practical part of the study has to be rooted in the theoretical basis, the author based his project steps concerning creation of standards and knowledge documents and the implementation of standards on the three below-mentioned frameworks, namely PDCA cycle, SDCA cycle and the principles of 5S, which are fundamental elements of the Lean concept.

2.3.1 5S concept

Plenert (2006) points out that the goal of the 5S framework is to "create an organised, safe and productive work environment". Despite the primary focus of the framework on the physical working environment, meaning the arrangement of desk, ergonomic layout of seating, arrangement of documents, etc.; it is possible to apply this framework also to the virtual organisation and storage of knowledge. Therefore, when creating standards and

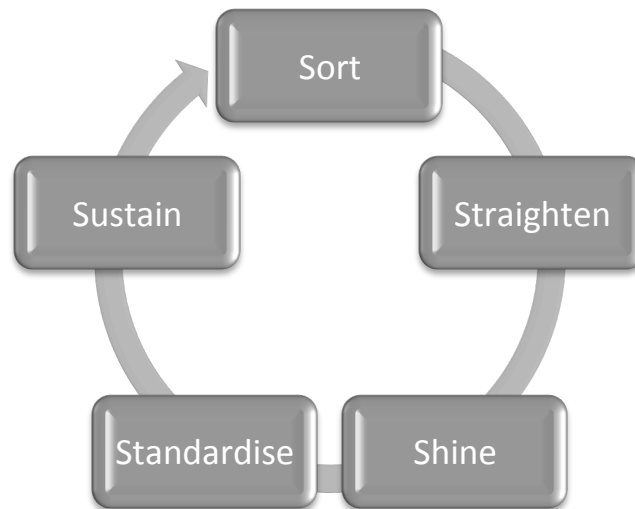knowledge documents, the process will always take into account the following 5 principles of 5S concept:

Fig. 15: 5S model, Liker & Meier (2006)

Starting with the **"Sort"** principle, firstly, the portfolio has to be divided into needed and unneeded items. The portfolio can represent a set of objects, information, processes, etc. Since the aim is to create transparency in the portfolio, all unnecessary items shall be removed. It is to prevent information overload, ease information maintenance and hinder accumulation of outdated information sources.

Once the portfolio is sorted, the need of clear organisation is expressed by **"Straighten"** principle. Its motto is "A place for everything and everything in its place!" (Plenert, 2006, p. 253). Therefore, in this phase we need to figure out the answers to: "Where to keep the portfolio?" and "In which form to keep the portfolio?". For the practical study it implies to systematically arrange processes and knowledge to thematic groups for more effective usage and orientation in the portfolio.

Thirdly, the **"Shine"** principle takes place. The aim is to finalise the task/portfolio so that it is clean, transparent, easily orientable in and to remove or minimise reasons for getting cluttered again. Therefore, in our study, we want to create clean standards and knowledge documents filtered for LECMM needs. Once the first three principles are completed, the process/information should be simple and easy to follow. The comparison below shows the difference between possible current situation and the potential future situation after applying the 5S framework. The second situation is a fitting example of one of the targets of the project in the LECMM. The aim of the revision of processes by regional process experts is to simplify processes to single process stream and to eliminate any unnecessary extra steps that occurred during the shadowing phase of planners.
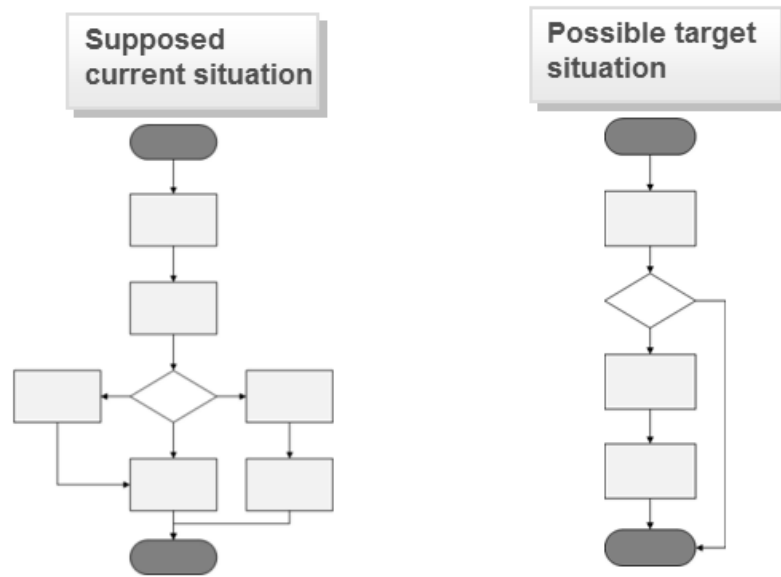
Fig. 16: Comparison of pre-5S and post-5S process map state, Hilti

After the cleaning-up process is done, the time for **"Standardisation"** comes. Once the processes are cleaned, they need to be documented for making this state persistent. This is the purpose of standards for LECMM. Processes and knowledge documents need to be visible and accessible to planners. It is important that the users understand the process; therefore planners need to be trained and coached to actively use the documentation.

Lastly, the **"Sustainability"** of the whole loop needs to be established. It has two dimensions: 1. Sustainability of the documentation itself; 2. Sustainability of outputs resulting from the documentation and performed by planners. For the sustainability of the documentation measures have to be in place to control and maintain the quality of the current documentation. Therefore, we have to ask following questions: "How to keep the documentation on up-to-date level?" and "Who will keep it there?". To ensure the "How" aspect, the continuous feedback for standards from operator's needs to be collected, new knowledge collected and documented. Regularity must be set up. To address the "Who" aspect, the responsibility has to be clearly assigned to somebody.

Concerning the sustainability of outputs performed by the planners, one of the key factors is the commitment from everyone involved in the work. Motivation is inevitable, but habit for standards use has to be created. Process execution needs to be periodically guided and reviewed in order to deliver desired results in optimal way.

2.3.2 PDCA and SDCA cycles

PDCA is one of the two cycles, which complete each other on the way to CIP. PDCA cycle is responsible for developing the improvement to the process on the basis of practical trial and error (Merrill, 2009). Cycle is repeated until satisfactory results are obtained. Once the process is changed and the improvement is in place, the development of standard in the

form of SDCA cycle may happen. According to the graph below, however, one must be aware that the process has to be stabilised and variation limited before the standardisation. Subsequently, once the standard is created and implemented, periodical review will ensure its maintenance and topicality. Moreover, reviewing the standard and finding out imperfections will further instigate another PDCA cycle. Thus, the creation of a continuous improvement loop is completed.
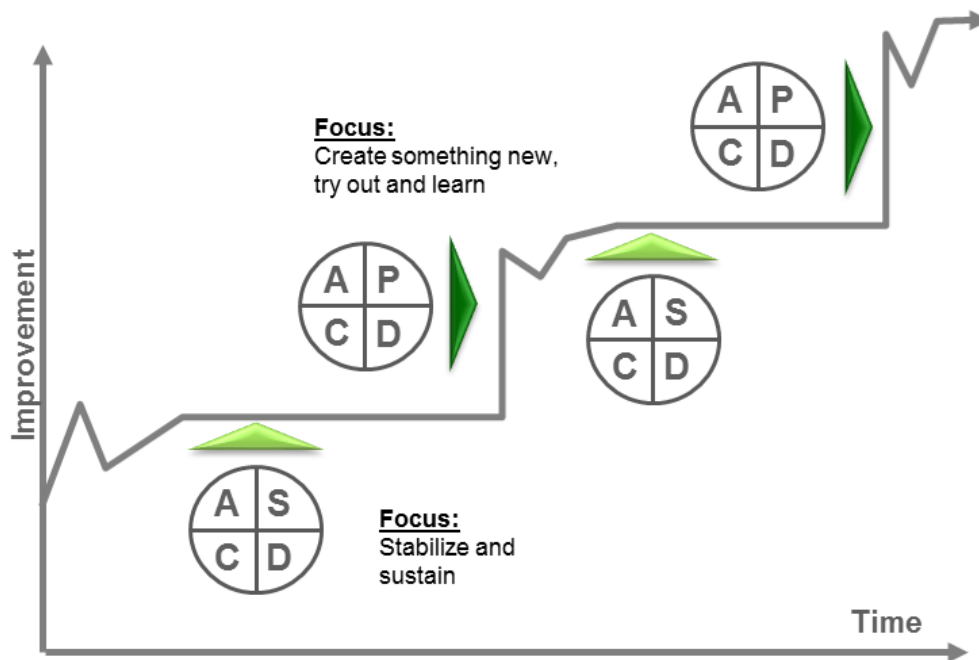
Fig. 17: Standards and improvements lifecycle, Hilti (2014 c)

Having a closer look at the **PDCA cycle**, it is the backbone of the Lean management. Lean is based on continuous improvement and the PDCA cycle is the framework, by which to develop an improvement. It consists of 4 phases, as seen in the picture below.
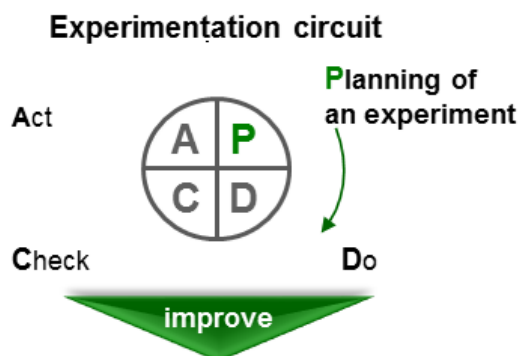
Fig. 18: Experimentation circuit – PDCA cycle, Hilti (2014 c)

The first phase of the process is to **"Plan"**. The PDCA cycle is initiated because of the missing information or a problem was detected. In the plan phase "the situation is defined, studied and analysed" (Campbell & Collins, 2010, p. 65). Once a problem occurs, brainstorming for solutions how to eliminate this problem takes place. With the final idea

for change on hand, the hypothesis, which shall be evaluated in the pilot project, is formed. Project stakeholders are named, responsibilities redistributed and project timeline is defined.

In the second phase **"Do"**, pilot project is executed. The aim of the pilot project is to test the proposed change on a small scale (Sabri & Shaikh, 2010). The objectives of the project are monitored and results documented. As Campbell & Collins (2010) interpret, this phase is about observing and learning; what is working and what is not working.

The third phase is to **"Check"** the results of the pilot test. To analyse the results and compare them to the hypothesis we originally had in the Plan phase. To dig to the root cause of the problem by cause-effect analysis (Hutchins, 2008). Moreover, it is about understanding, what effect are current changes we were testing in the pilot phase having on the process effectiveness and outputs.

The result of the "Check" phase affects the course of the fourth phase – **"Act"**. If the hypothesis and expectations from the Plan phase are confirmed in the Check phase, the 30tandardization loop starts, in order to capture the improvement achieved. However, if the expectations were not met, the improvement team shall repeat the PDCA cycle with adjusted hypothesis. The PDCA cycle shall be repeated until the desired solution correcting the original failure/imperfection is found (Sabri & Shaikh, 2010).

Once the improvement is in place, the development and revision of standard in the form of the **SDCA cycle** happens. As Liedtke (2014, p. 3) said, the SDCA cycle is the "basic sequence of steps that must be followed to maintain the current status". Standardisation circuit, as seen in the picture below, has also 4 phases similar to the PDCA cycle.
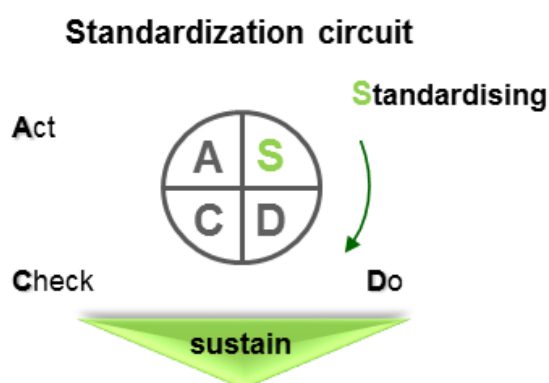
Fig. 19: Standardisation circuit – SDCA cycle, Hilti (2014 c)

It starts with the **"Standardise"** step, which is identical to the "Act" phase of the PDCA cycle in case of successful improvement, which aims to be documented and standardised. Once the standards are created, **"Do"** phase comes. In this phase it is necessary to firstly try out standards in the form of a small-scale test (Liedtke, 2014). In other words, do a small pilot project in the team with a preselected small group of future users. When the

pilot is successfully finished and the relevant feedback from users is implemented in the standard, the full team roll-out may take place. The successful team implementation of standards may involve training of users on standards, individual sessions for providing further explanations, etc. Successful implementation of standards is the basis for practical usage of standards in daily business.

As standards shall be a living organism, it is necessary to regularly review them in the **"Check"** phase. Liedtke (2014, p. 5) expresses that "A formal check (review) is conducted once the item related to the standard has been in use for a period of time." Even though this is a control phase of standards, users should not fear that they are going to be judged and strict consequences will be drawn. On the contrary, a rather relaxed atmosphere shall be induced with the intention of learning from each other and moving the organisation as a whole forward. By this phase, new ides can be created, captured and spread, which can be subject to further analysis and initiation of the new PDCA cycle (Liedtke, 2014).

Lastly, the maintenance part of the standard takes place in the **"Act"** phase. Based on the information received from users in the Check phase, action is decided, whether to run the PDCA cycle for the new ideas suggested by users or not developing them further.

3 Standards for processes in Hilti LECMM department

Chapter 3 narrates readers the course of the study for establishment of standards performed in Hilti LECMM department. First section clarifies the project steps and their content for creation of standards based on the structure of the PDCA cycle. For the next sections project steps are based on the SDCA cycle logic. Section 3.2 speaks about testing and implementation of standards in the LECMM department. Third section explains ways of control of standards and team's performance. Section 3.4 contemplates on the maintenance of standards within the team. Lastly, the process improvement within the LECMM is described, applying the PDCA cycle.

3.1 Creation of standards

> *"In the future, others can learn from our mistakes and build upon our successes."*
> *~Campbell & Collins, 2010*

In the quote above, Campbell & Collins nicely point out the importance of the collective thinking within the organisation aiming for better good that is the basis of Lean. In this spirit also standards are created so that the company can learn from its mistakes and move forward not repeating them again. This is also the aim of the LECMM department within Hilti. They assumed the role of the pioneer in creation of standards for administrative environment in Hilti, in order to be able to build organised CIP with the solid basis in standards. In the next sub-chapters, let us, therefore, have a closer look on process of creation of the prototype of standards for LECMM.

3.1.1 Plan

Analogically with the PDCA cycle, when developing the standards, firstly there was a "Plan" project phase. As Tischler (2006) says, "Certain prerequisites are needed before implementing lean, such as getting support from the top manager and the process leader, … and identifying a need for change." In case of the LECMM department, the need was identified by the Head of the team. He is an advocate of Lean principles and openly supports their implementation in the team. This creates a good environment and atmosphere in the team for further Lean implementation. Based on the past positive experience with Lean tools such as SFM or 5S, team members look at the Lean practices in a rather positive way, even though it may bring changes to their habits of work.

Having support from the head of the team and team leaders, it is important to **define the scope of the project**. As Nash & Poling (2008) emphasise, the team has to decide, which value stream/part of the value stream is going to be analysed, as shown in the picture below.
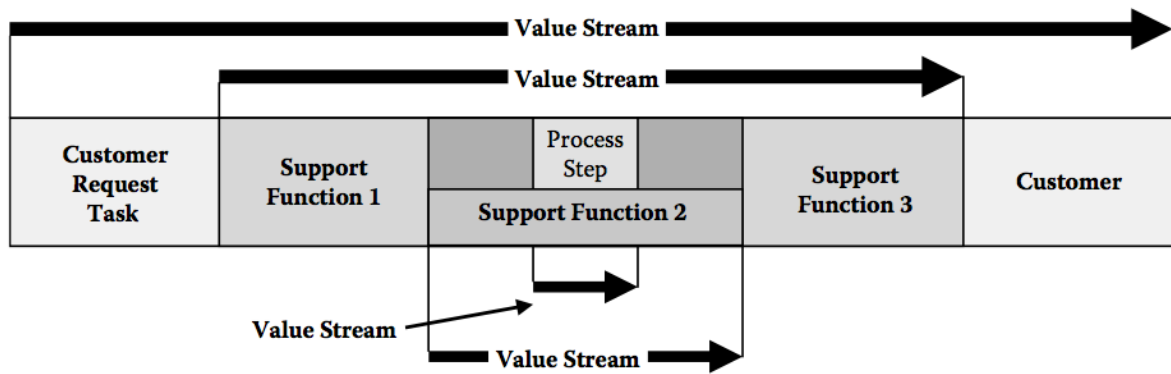
Fig. 20: Defining the scope of value stream mapping, Nash & Poling (2008)

In this project, together with the head of the team and team leaders of both ET&A and F&P teams, we decided to currently focus on standardising processes within the LECMM department only. Firstly, we **categorised processes into 4 modules**, thematically identical with the SFM boards and the Key user structure. The 4 modules are displayed in the picture below. The subject of this project is to develop standards for Inventory Management module and set the strategy and guidance for developing the remaining 3 modules.
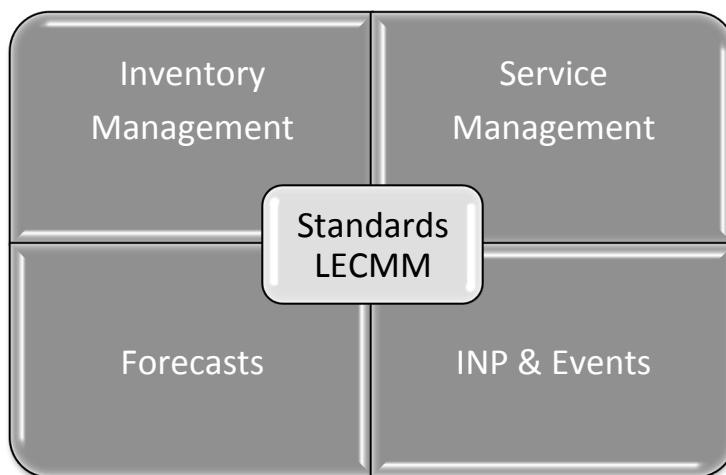
Fig. 21: Four process modules in LECMM, Hilti

*INP – Introduction New Product

As Nash & Poling (2008) point out, it is necessary to **decide on the level of details of the processes' documentation**. The aim in the LECMM is to document processes in a "very finite level", meaning every process separately despite being a part of a greater value stream.

Having a scope of the project narrowed down to Inventory Management module, it is necessary to further cluster processes based on the topic they are tackling. Therefore, the Inventory Management module was further broken down to **4 sub-modules**, as suggested in the picture below. These 4 sub-modules represent the 4 standards that will be developed within Inventory Management module.

Fig. 22: Inventory Management module structure, author

Once the processes are grouped and the standards area in this project is defined, it is inevitable to **get familiar with the processes** involved and collect preliminary information about them (Nash & Poling, 2008). In the LECMM team the author was broken into daily and weekly business processes by more experienced planners. Concerning the monthly processes, in March 2015, the HIP intermediate workflow calendar was introduced. It brought significant changes and limitations in the frequency of monthly processes execution. Therefore, to better grasp the reasoning of this change, the author contacted the regional HIP project expert to get further clarification on the topic. To understand also less frequent processes happening once or twice a year, the author got into contact with the LECMM process expert seeking clarification.

The last part of the planning phase aims to **identify relevant planners for shadowing** while performing given processes. The author decided to always shadow the portfolio of planners; a planner with the most knowledge about a given process, a new planner in the team, and key users from both ET&A and F&P teams.

As a result of the Plan phase, **Business Opportunity Description (BOD) report** was constructed, defining the aim, scope, stakeholders, opportunities, threads and timeline of the project.

3.1.2 Do

The aim of the "Do" phase is to "Go and See". In order to learn about the "as-is" state of execution of processes, it is necessary to go among the planners and see how they are performing given processes. This phase is therefore about **shadowing** planners and understanding how they perform processes step by step. As Kirsh (2009, p. 398) points out "to successfully prompt or elicit information, it may be necessary to give subjects tools or artefacts they normally use when in their normal context". Therefore, it is important to observe planners when they actually perform the activity, not just simulating it or only speaking about it. The real trial is needed to see the actual performance of processes by planners.

When shadowing the planners, it is important to **stay objective** and not let the information previously gathered about the processes affect your perception and judgement. Therefore, when shadowing, document what you see, not what you should see (Nash & Poling, 2008).

It is also necessary to realise that the employees are the ones with the most information about the processes. Nash & Poling (2008, p. 203) are not the only ones who believe that "Employees have answers, even if they may not know about it." Therefore, shadowing involves two types of knowledge transfer: (1) **combination** of knowledge from explicit to explicit – documenting already documented and known knowledge; (2) **externalisation**, when tacit knowledge of individual planners are collected and transformed to explicit by documenting it. In order to obtain also tacit knowledge from planners, they may be challenged by the observer and 5 Why analysis can be used for digging the true reason of certain planner's behaviour.

When performing the shadowing in the LECMM department, the author came to the following conclusions. **Majority of the processes**, which belong to the Inventory Management module, **are stable and regularly performed**. These are possible to standardise with the predictably little future alteration. Only if the complex improvement project such as HIP occurs, which restructures the logic behind current activities within Logistics department with cross-departmental impact; the processes may change and documentation will need a fundamental update. Small projects planned to run in the near future shall, in author's opinion, only change part of the process at most. Some processes, however, are introduced only lately and they relate to projects currently running in the department. For these processes, the documentation of "as-is" state is captured in standards at the moment. These processes are marked for revision to document after-the-project-as-is state once the projects are finished. The author believes that once the processes get to regular usage, after some time, certain level of standards for these processes can be documented and waste spotted and removed.

Concerning the execution of processes by individual planners, it varies. One of the reasons is the team composition. Team ranges from experienced long-term planners to half of the team newly boarded. Due to the short time they are part of the team, they still lack the knowledge about the processes' background, details on global and local policies, which should be taken into consideration, when performing processes. This is also one of the reasons, why standards are seen beneficial by the Head of the team. On the other hand, newcomers in the team always question *why,* which helps more experienced planners who perceive these processes as a routine to also stop and think, why they perform the process in this way and not in the other way. Newcomers are a valuable source of new ideas, which may bring a different angle of view on the matter and initiate a new bottom-up PDCA cycle for the process improvement.

3.1.3 Check

Once a clear picture about the "as-is" state of the processes is obtained, they are **compared to global and regional guidelines and principles**. Together with **regional process experts and secondly by the Head of LECMM** we review every process step by step and analyse its relevance and correctness. If the process step or the whole process is useless, it is omitted from the standard. If the process step is not performed in line with guidelines, it is modified to correspond to the guidelines and recommended to be checked and learnt by

users. If the reviewing team is not sure about the correctness of the guideline or guidelines are missing, it is suggested as a **point for improvement**. That means, it needs to be further reviewed in more details, a project can be established to develop new guidelines or analysis needs to be done to support or disprove correctness of current guidelines. It is a responsibility of Key users to organise the project. In the meantime, a remark is made in the given process step, that the guideline is under review/construction at the moment.

Deviations of every planner from the desired process course, as suggested after the review, are different in extent as in topic. Therefore, they shall not be communicated in a group but rather individually analysed in the one-to-one sessions of planners and key users, who will be responsible for standards' control and maintenance.

It needs to be said that these standards are compatible with local LECMM team processes. However, they may not be applicable or need to be modified for other regions, based on their practices and individual market conditions.

3.1.4 Act

"A good standard is simple, clean and visual."
~Dennis, 2007

The "Act" phase of the project is about physical design and creation of standards in the LECMM. As Dennis points out in his claim, a standard shall be **simple, transparent and visual**. This correlates with the aim of standards created in the LECMM department. Butterfield (2005, p. 18) confirms the importance of the visual form and on top supports it with the idea that "if you create visual controls, like posting your VSMs and documenting and posting standards procedures, it is much harder to ignore them." The strategy of standards building is therefore to visualise as much as possible.

When deciding about the particular form of standards, Mehta's claim is quite fitting. Mehta (2015, p. 41) believes that processes should be documented in the visual form, either as process flowcharts or process maps. He claims "Clarity in a process can be achieved only if office people take the time to capture the process as a visual map. Making a flowchart or process map creates a baseline of how the process is conducted and allows everyone to perform the process the same way."

After several proposals, **process flowcharts and process maps** were chosen to be the basis of LECMM's standards over the written form of standards. Representatives of all stakeholders took the decision; from planners, to process experts, to team leaders and the Head of the LECMM team. Despite the initial bewilderment from the complexity of process maps, everybody stated, the visual form of standards is more transparent and better to orient in, after the initial explanation of the logic behind the process map.

The whole standard is in the PowerPoint form, since majority of knowledge materials in LECMM and Hilti generally are accessible in PowerPoint. Furthermore, from PowerPoint they do not need to be transformed in order to become visible checklists hanging on the

walls of the department in case of need. The final structure of the standard looks as shown in the figure below. Detailed view on the standard created for LECMM can be found in the attachment.
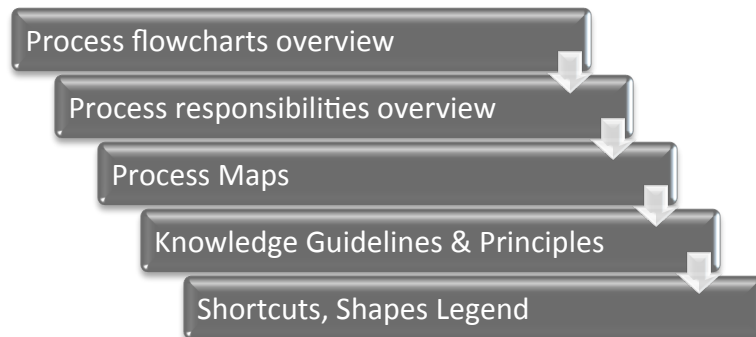
Fig. 23: The structure of a standard in the LECMM Inventory Management module, author

On the introductory slide of every standard document, such a table as shown below is present. It appoints the **owners** of the standard, one representative from every team, ET&A and F&P. These owners always correlate with the Key user structure, therefore the Key users for Safety stock will be responsible for Safety stock standard maintenance, review and updating/upgrading and so on. Furthermore, **last update** date is displayed, so that the user is informed, whether the current version of standard he is referring to is up to date or outdated. Lastly, there is a **review date** for key users to remind them, how often and when particularly shall they review the correctness of process steps and other information present in the standard.

Owners	ET&A: F&P:
Last update:	14/08/2015
Review date:	April / October

Fig. 24: Standard's introductory responsibility and review table, author

3.1.4.1 Flowcharts

The first part of the standard is the Process flowcharts overview. According to Trent (2008, p. 147) "a flowchart is a graphical model of an existing or proposed process that uses simple symbols, lines, and words to display the activities and their sequence throughout a process".

This Process flowcharts overview encompasses all processes within the given thematic sub-module as explained above. Every flowchart consists of **(1) Inputs** necessary to start the process; **(2) Process course** – the sequence of process steps following one by another; **(3) Outputs** – desired results of the process if executed correctly; and **(4) Follow up** actions, if there are any actions/processes, the output of the given process affects.

Fig. 25: Structure of the process flowcharts in standards in LECMM, author

The flowcharts are **colour-coded based on the frequency of processes' performance**, starting from daily processes to yearly ones, that are executed once or several times a year. Lastly, there are occasional processes. Their occurrence is conditional to the given event, which occurs irregularly and is specified in the process Inputs column. The legend with colour-coding explanation, as seen below, is displayed in every standard in Process flowcharts overview slide.

Process	Daily	Weekly	Monthly	Yearly	Occasional

Fig. 26: Legend for colour-coding of processes, author

The **shapes** used in the flowcharts are based on the standard shapes for flowcharts used in Visio and PowerPoint. They also proceed from the American National Standards Institute (1971) and IBM's data processing techniques (1970). The reason is the maintenance and user-friendliness for the Key users. Because once they overtake their responsibilities for standards and their maintenance, it would not be financially feasible to buy licenses and install special process-mapping programs on every planner's computer.

Potential existence of standard flowcharting shapes within the company was checked with the Global Lean team. It was found that no standardised shapes for Hilti are used at the moment. However, when somebody in the company does process mapping, the standard Visio shapes are used, since there are still some employees with licence to this program. Overall, as expressed by the member of the Global lean team; up to great extent it is on the team to define the shapes they are going to use. However, it is important to notice that once these shapes are defined for the department, the team has to stick to them and **use them uniformly** to all processes. For the purpose of LECMM processes' documentation in standards, the following shapes, as seen in the picture below, were defined and characterised. Detailed characteristics of shapes can be found in the attachment. Since the LECMM department is the first one to develop and implement standards for the office within Hilti, there is a great possibility that the global office will overtake these standardised shapes and continuously start applying them globally.
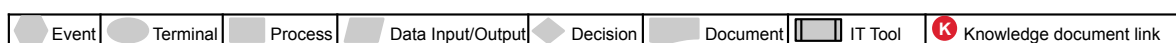
Event	Terminal	Process	Data Input/Output	Decision	Document	IT Tool	Knowledge document link

Fig. 27: Legend for flowchart shapes, author

3.1.4.2 Responsibility Assignment matrix

The second part of the standard consists of the RACI matrix – responsibility assignment matrix, which clarifies responsibilities of all stakeholders for every process mentioned in the standard. According to Lareau (2010, p. 124), RACI matrix is the inevitable part of standardised work and "each activity on a detailed process flowchart or VSM would have a corresponding activity line on a RACI chart." The 4 roles in the RACI matrix are shown in the picture below.

Fig. 28: RACI matrix, author's modification from Lareau (2010)

Responsible person defined by the RACI matrix is the one, who is performing the process manually. He is the executor of the task. For transparency and no misunderstandings, there shall be always just one person assigned to be responsible for process to be done. However, if the processes are further subdivided to e.g. purchasing groups, as in case of material managers, it is possible that multiple people perform the same process for their own groups. **Accountable** person is the one, who "ensures that the work gets done and takes actions if not" (Berman, 2014, p. 127). It should be only one person, because it needs to be transparent who gets contacted in case of escalation issues. **Consulted** people are the experts, who contribute with valuable information necessary for the process to be performed. It may be more than one person. However, it is important to point out that as the number of consulted people throughout the process increases, process gets slower and less efficient. Therefore, it is necessary to consider only people with information who must be consulted during the process (Lareau, 2010). **Informed** people are the ones, who must be notified when work is done, because their work is somehow affected by the result of the process. The same rule applies as for consulted people: less is sometimes more.

The Bridgespan Group (n.d.) sees the main benefits of the RACI matrix in assigning real responsibility and accountability to the right people. On one hand, RACI matrix increases clarity in roles both intra- and inter-departmentally; on the other hand, it saves time and make processes more efficient. It prevents information overload by naming only relevant people for information transfer. The power becomes explicit, which adds to transparency and eventually increases efficiency.

Hilti is already familiar with the RACI concept. They use similar matrix developed by the strategy consulting company – Bain & Company, Inc., named **RAPID®**. It names 5 roles for process execution, as seen in the picture below. The roles in the RAPID® matrix are similar to the RACI matrix, therefore it is not necessary to describe every role particularly.
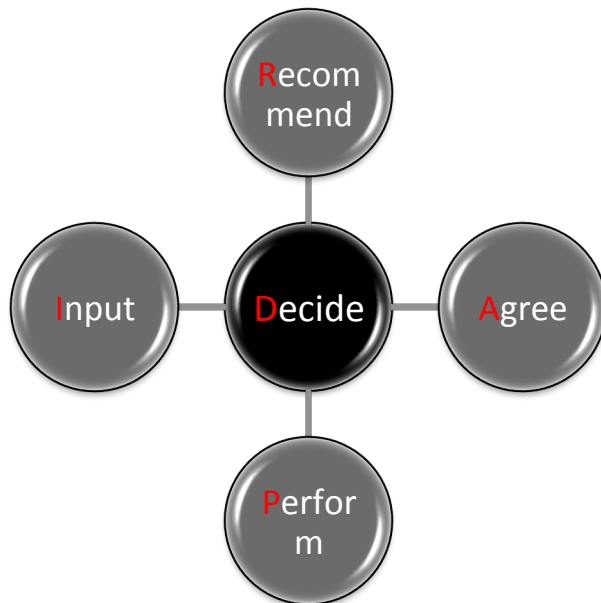
Fig. 29: RAPID® matrix, Bain & Company (2011)

In the standard, the graphical form of RAPID® matrix is overtaken from Inventory SFM, for which it was developed only lately (June 2015). In author's opinion it is better for the team to stick to already designed form of the responsibility matrix, in order not to create confusion in the team by two designs of one model. The example of the RAPID® matrix used in standard documents is displayed below.

HILTI   Hilti. Outperform. Outlast.

RESPONSIBILITY MATRIX

Stock Positionig		MM	TL MM	HUB PM	HAG MM	LLE	Time Horizon
1	Core / Non-core portfolio review	R/ P	D	A/ I			**3 CW**
2	MRP type systematic review	R/ P/ D		I	I		**2 CW**
3	MRP type monthly changes	R/ P/ D		I	I		**4 CW**
4	Upstreaming*	R/ P	D	I	I	I	**12 CW**

Fig. 30: Responsibility matrix in standards in LECMM Inventory Management Module, author

3.1.4.3 Process Maps

The third part of the standard consists of process maps for every process within the given sub-module. The aim of these process maps is to provide user with relevant information for process execution and guide him when performing a given process. With the links to the educational sources, it is also a source of knowledge for the team. It may also serve as a checklist for experienced planners to check, whether they are performing processes in current best way accessible. For new planners, it is a good learning and recapitulating source.

When designing and creating the process map form, the main idea is that "it be drawn in such a way as to be understood by anyone. … the viewer should be able to look at the map, and within a relatively short time frame with minimal explanation, understand the value stream." (Nash & Poling, 2008, p. 41). They also stress the importance of structuring and applying the same basic layout to the entire documentation to create unity. That involves also the standardisation of icon usage.

One process map is usually displayed on one slide. On the top of the slide, there is always a **title block**, as called by Nash & Poling (2008, p. 32). It can be seen in the picture below. It shows the process name; organisation and department, for which it is created; process owners, who are identical with the entire standard owners shown in the standard's introductory slide. They are always relevant Key users for the given sub-module. Lastly, it shows the last update date and the required review date. Its function is mainly identification for such cases as process map slide being excerpted from the standard, printed and hanged on the wall for visualisation purposes.

HILTI				**Hilti. Outperform. Outlast.**
Process: **Process Name - Template**	Company: **Hilti Deutschland AG LECMM**	Owners: Key Users ET&A, F&P	Last update: Date	Review date: Next review date

Fig. 31: Title block for a process map, author

The structure of the process maps in standards of LECMM roots in the **SIPOC model**. It stands for **Supplier-Input-Process-Output-Customer**. As Berman (2014, p.114) points out, it is necessary to start building process map with the process itself. Then identify desired outputs and name customers who depend on the process outputs. To inputs include both, those that will be changed by the process as well as those that will be just used but not changed in the process. Lastly, consider suppliers who deliver the inputs and name them in the process map.

The exact structure of the process maps designed for standards in LECMM is as shown in the picture below. In the centre is the **(1) Process course** proceeding vertically from top to bottom (also suggested by Sugai, 1997, p 37). It is identical with the process flowchart created for the processes overview. Mostly process steps are in the **rectangular shape**, because involving the task execution. On the left, there are **(2) Inputs/Outputs** that are necessary to consider in every process step. They are aligned horizontally with the

particular process step. The **parallelogram** shape prevails in this column, as most of the inputs are data inputs. At the end of the process, there is a Terminal shape with the desired result of the process. Further left, there is an **(3) IT** column, which encompasses transactions in SAP/APO, queries and tools necessary for execution of the given process step. It always uses the standardised shape of a **rectangle with a stripe** on every side. On the right from Process Course, there are **(4) Options**, the planner has to decide about and choose one of them. His choice shall be based on the global and regional guidelines and policies, which are displayed in the latter part of the standard. Since this column represents decisions to be taken, the standard shape used is a **diamond**. Further right, there is a **(5) Who** column, which assigns responsibilities for particular process step execution. Usually, responsibilities for performing a given process step are either on all planners, who are individually responsible for their own planning groups, or on Key users, who are generally required to prepare documents for revision by planners and upload the revision results of planners to the system. Last to the right is the **(6) When** column, which assigns each process step the time period, when it needs to be executed.
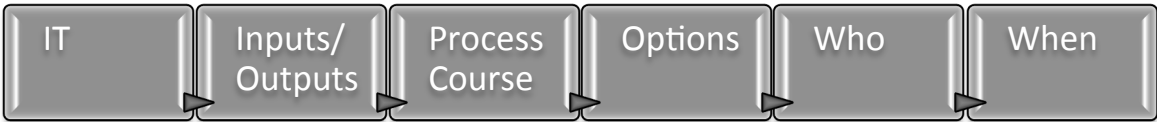

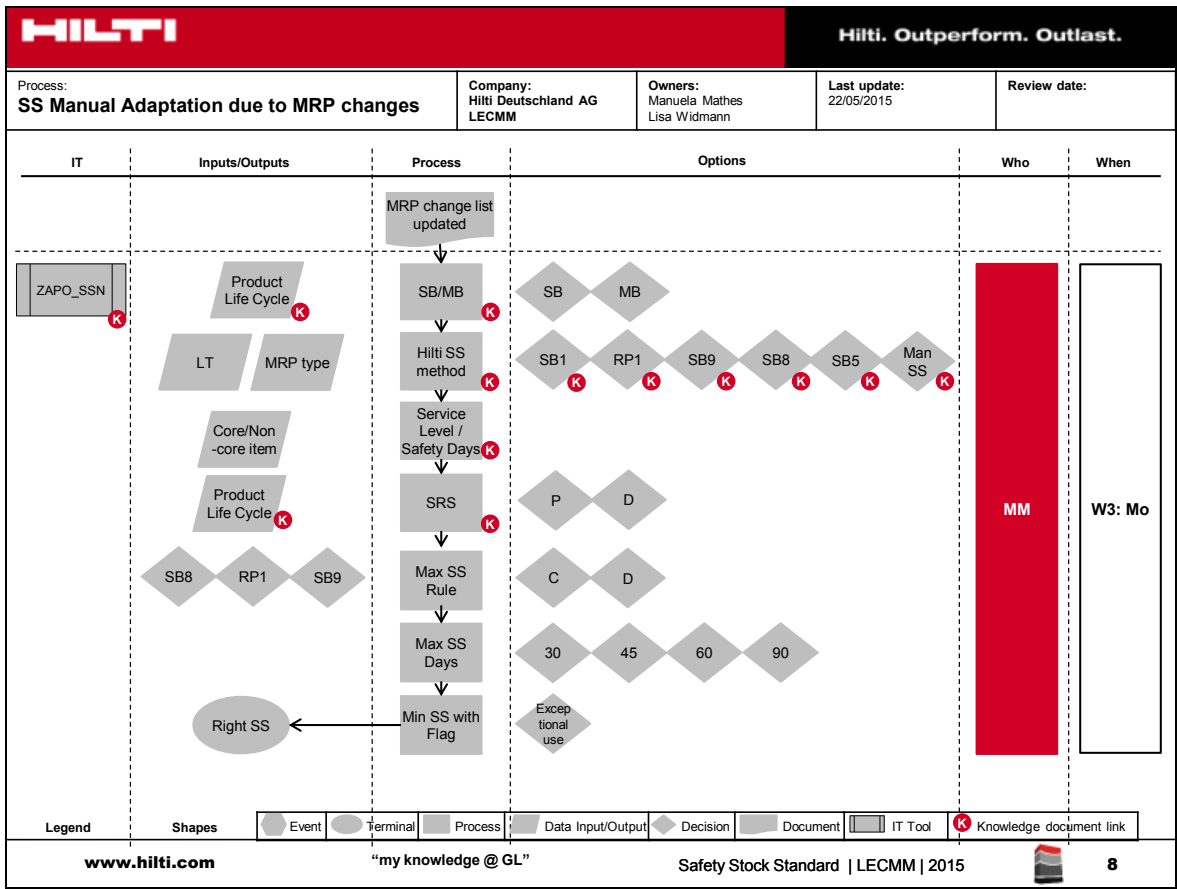Fig. 32: Structure of the process map in standards in LECMM, author

Fig. 33: Process map in standards in LECMM, author

The shapes in the Process course column are **linked to the working guidelines** of the knowledge document. These working guidelines contain print screens of every process step in the relevant transaction where it needs to be performed. It is aimed to help those who are newly employed as well as the old ones, who are not clear on how to perform the particular process step. Furthermore, there are red "K" bubbles near some shapes. That is the **link to the educational part of the knowledge document**. It contains more detailed information about the process step background than present in the standard. It aims to further clarify and educate users about the logic of methods used for the particular process step. For example, when dealing with safety stock methods, a planner has to decide, which one is the correct one to use for the particular item. The system based on the chosen method calculates proposed level of safety stock. However, it is important for the planner to know, where does this number come from, what is the given method taking into consideration, and which factors affect the calculation; in order to set parameters correctly and the system can in future months reliably calculate safety stock levels.

When creating process maps, it is important to stress the aim for transparency, clarity and cleanliness of process maps. They cannot be cluttered with text or symbols. One must consider displaying only relevant information to the process. For better guidance in creation of standards, the author interlinked his experience with the best practices in the flowcharts area suggested by the Creately blog (2011), and assembled some **basic principles**, the creators should stick to:

1. Use appropriate shapes according to their meaning.
2. Build consistent flow direction.
3. Use only Hilti colours when creting flowcharts, to maintain the unified look.
4. Use shapes with consistent sizes.
5. Make spaces between shapes equally-sized within one slide.
6. Stick to one level of details in all boxes in the process.
7. Scale the text into the shapes.
8. Refer to people by position, not by name.
9. Do not use adjectives in process steps.
10. Use as little shortcuts as possible.
11. Do not leave room for any inaccuracy.

3.1.4.4 Knowledge Guidelines & Principles

The fourth part of the standard assembles main principles and rules, based on which the users should perform the processes. It encompasses correct parameters usage in reference to global and regional guidelines; restrictions and limits one must consider when deciding for a specific action/option; basic knowledge behind calculations such as EOQ, obsolescence, logistics depreciation, etc. Presence of these guidelines and principles in the standards aims to increase visibility of these rules and raise knowledge and awareness about this information in the team. The selection of information is limited to **inevitable information, the user has to know**, when performing given processes within the

particular sub-module. The example of these Guidelines & Principles for Safety stock standard can be seen in the attachment.

3.2 Testing & Implementation of standards

Confidential Part

Confidential Part

Confidential Part

Confidential Part

3.3 Control of standards

"A standard that has not been revised is a standard that is not being used."

~Ishikawa (1990)

As Mr Ishikawa, the creator of the fishbone diagram and quality circle, says in his quote above, standards without control are not valid standards. Therefore, it is necessary to establish a sustainable control mechanism to standards. In the SDCA cycle terminology, we are in the "Check" phase. In the LECMM department the management of the team has decided to control standards in the form of Reviewing and Coaching, as seen in the picture below.
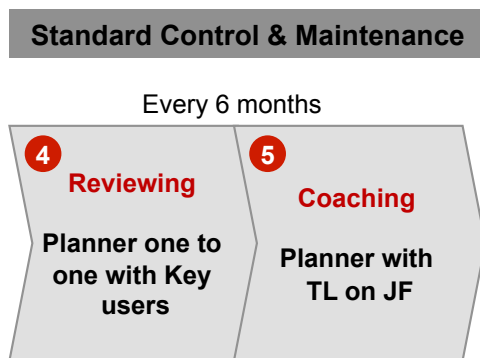
Standard Control & Maintenance

Every 6 months

4 **Reviewing**

Planner one to one with Key users

5 **Coaching**

Planner with TL on JF

Fig. 35: Control & Maintenance strategy of standards in LECMM, author

3.3.1 Reviewing

Reviewing standards is a useful tool also for controlling and improvement initiation. The concept of the reviewing is built on one-to-one shadowing meetings between a key user and a planner. The **aim** of the standards' reviewing is simply a double-sided teaching – learning relationship, where on one hand key users become experts by shadowing the other planners and collect best practices among the planners; on the other hand planners may adopt best practices possessed by other planners in the team and learn more about the process background. On top, planner's adherence to standards is checked.

Shadowing, however, seeks not only to control but also to stimulate **bottom-up** improvement cycle, where planners come up with improvements based on their daily experience. As Lean Enterprise Institute (n.d. b) states "standardized work is also a learning tool that supports audits, promotes problem solving, and involves team members in developing poka-yokes". Therefore, key users' responsibility will be on one hand to **control and teach planners** on the correct process execution, on the other hand listen to their **ideas for improvement**, pool them, discuss them with team process experts, run the PDCA cycle and in case they are approved, incorporate these improvements into next version of standards. The LECMM plan is to develop standards containing best practices in 2-3 years. Review is therefore crucial to continuously search for the best practice in the team and update standards.

The reviewing meeting consist of 4 parts. Detailed **agenda of the meeting** can be found in the attachment. At the beginning of the meeting, the planner in reality goes through the process and the key user observes planner's steps. He tries to find out as-is state of the process of the planner. Along the process key user may question planner's steps and engage in discussions. After the as-is state, planner tries to go through the process once more according to the standard with the help of the key user. After the completion of the process, they shall return to process steps, where planner's execution deviated from the standard, and discuss and analyse reasons behind these deviations. It may also happen that new best practice may be found among the team members and standards will have to be updated. The fourth part of the meeting is devoted to the improvement process and feedback from the planner that key users note and further analyse.

The designed concept of reviewing aims to create **a loop of feedback and continuous improvement from planners to the key users**. Key users will accumulate knowledge and expertise within the team. The role of key users is very significant also from the perspective, that together with team leaders they influence the motivation and approach of the rest of the team to standards. Therefore, they set the trend whether standards will be self-sustainable by planners initiating their review and deliver inputs for discussion and improvement to SFM meetings, or will there be constant push for continuous review needed from team leaders and key users.

3.3.2 Coaching

Second part of standards' control and directly linked to reviewing is coaching. Coaching by definition is "designed to provide an employee with a content expert who works with that individual in assuring that employee learns a particular skill or piece of knowledge." (Management Mentors, 2013, p. 2). Coaching by team leaders in individual Jour fixes (JF) of planners concerning standards aims to develop their expertise and working knowledge, and help them further internalise standards in the individual approach. Their development in knowledge management may determine their next career move.

For team leaders' overview about planned meetings between the key user and a planner, the reviewing calendar for Inventory management module maintained by key users was created. It can be found in the attachment. This calendar shows exact months when which standard needs to be reviewed. Key users schedule their meetings with planners and display it in the calendar. Team leaders can check, when is the meeting for review with which planner scheduled. Possessing this information, they may prepare planners for the review on the JF before the meeting, introduce the purpose of the session, support the role of a key user and create positive mindset of the planner. After the meeting, team leaders will follow up on the review in their next JF. They may try to find out what they have learnt from standards, what is the adherence to standards, what are the points of struggle, where planners are unable to internalise standards and together try to come up with a solution. These coaching sessions shall take place on the regular basis depending on the occurrence of standard's review meetings.

3.4 Maintenance of standards

With standards' maintenance, the SDCA cycle gets to his last "Act" phase before it starts all over again. Maintenance of standards is tightly linked to the control of standards, since once standards are reviewed and feedback gathered from the planners, standards can be updated. For purposes of standards maintenance, the author created a guideline for key users. Its part is also the standards creation guideline for the next modules, in order the standard documents are built in the same logic and the format also gets standardised. The Standard Creation & Maintenance guide can be found in the attachment.

In order to properly maintain standards, the **training for key users** was done. The maintenance document was presented as a guideline for them. The **responsibilities** for standards' maintenance were assigned to key users, because as Liker & Meier (2006) emphasise, for sustaining current results and continued improvement of the issue, responsibilities have to be assigned.

Furthermore, as Liker & Meier (2006, p. 133) point out "If you do make standardized work a controlled document, create a simple system that allows it to be "a living document" and makes it easy to change (e.g., one level approval process)." Aiming for the "living document" in the LECMM as well, the **approval process** involves only the process experts. If **minor change** to standard is proposed, it is changed by the key user and optionally reviewed by the process expert. The team is informed about the change in the SFM meeting. **Major changes** to standard, such as a need to proof the correctness of process course, development of a new process or a significant redefinition of the old process; team must be assembled and project/analysis done with proposed solution. The results are approved by process experts, who may consult with the Head of LECMM. Because of the significant change to the process, pure information in the SFM meeting is not enough and training for the team has to be organised to learn new process/guidelines/updates. These new processes/guidelines and updates shall be cumulated and every 6 months the training for users shall be provided with highlighting all the changes in the Inventory module and their impact on end-users.

Lastly, **points for improvement** were discusses in the key users' training. For every standard, topics for future improvement or development were collected. Liker & Meier (2006, p. 372) call them "loose ends" and they advice to "Describe plans for wrapping up any "loose ends" pertaining to the current activity. These are planned items that may not have been implemented yet, or items that require some modification." The list of points for improvement was provided to every key user, who shall review them and propose actions to be taken.

3.5 Improvement of a process

In this sub-chapter the course of process improvement done in the LECMM and subsequent inclusion into standard will be depicted. The aim of every company should be to improve its processes in the first place, which will in a result add to standard's improvement as well. Doing the change only for the sake of standards improvement is pointless because sufficient motivation is missing. Therefore, in this sub-chapter we will speak primarily about the process improvement based on the PDCA cycle.

As Liker & Meier (2006, p. 135) point out "Before running off and making improvements, however, we should first understand what will be done with the gain. It is important to always make improvement based on need, rather than because improvement is possible. Improvement will always be possible!" In the LECMM team the need was identified at the beginning of March. The analysis of the current stock was carried out and it showed that the department is below the ICLe* target (*ICLe – Inventory Coverage Logistics – shows number of days of consumption current stock covers). The management of the team decided to "Plan" a task force to reduce overall inventory in all RDCs and CW by 3% in order to meet the target. For every RDC and CW the list of top 50 items per planner with the highest average stock value in the previous months was prepared. The task force started with the analysis of the biggest RDC in the LEC region based on the number of processed order lines - Oberhausen.

In the "Do" phase, meetings were scheduled for every planner to analyse his/her portfolio of products with a team leader and from the beginning also the Head of LECMM department. By the analysis, the Inventory Monitor tool – Hilti internally developed – was used to show the stock development of last 6 months. During the analysis, participants pooled ideas and suggested actions for execution, mainly in planner's responsibility. From April to the beginning of June, RDC Oberhausen and CW Adliswil were analysed.

After 2-3 weeks the analysis took place, the "Check" phase was initiated. Its aim was to check action status of items analysed by planner and find out, how many actions are still pending. At the end of June, the effect of the task force was analysed. More than 600 actions in both ET&A and F&P teams were taken (see picture below), resulting in the 19,8% decrease of stock level in RDC Oberhausen and CW Adliswil. In total stock levels, the value decreased by 11%, meeting the target for ICLe. The simulation of the stock development for the next half a year prognosticates to achieve the yearly target with current reduction in stock, taking into considerations also the stock piling for introduction of new products and Christmas closures.
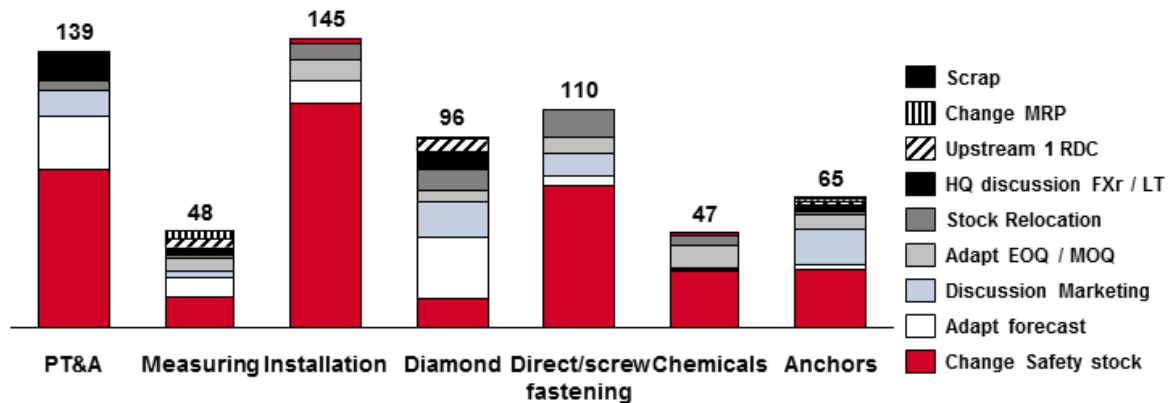
Fig. 36: Type of actions taken in the Dead Stock Analysis in LECMM, April-June 2015, author

Because of running around 30 meetings with planners concerning the analysis of dead stock, it may be concluded that the process got stable over the course. It was also perceived both by planners and the management of the team that the process should not only be used for a task force in a reactive approach, but it should be proactively adopted into processes of the team and performed on a regular basis. In a result, the process was standardised and incorporated into the overstock standard. Thus the development and the improvement process contribute to the improvement of standards as well.

The ultimate goal of the improvement process is to establish continuous improvement. As Kosturiak & Frolik (2006, p. 119) say it should be resulting from bottom-up initiative of employees who are closest to the processes and know them the best. Then they are better perceived and overtaken by employees. However, for bottom-up proactivity, appropriate corporate atmosphere must be created for employees to have space and willingness to come up with improvements. That is in the LECMM department the task for Head of the department, together with team leaders and key users. Moreover, changes directly imposed from outside are less stable and more opposed by employees. Therefore, the best option for the company is to initiate continuous incremental improvement cycle initiated by suggestions of operational employees.

4 Knowledge Management for processes in Hilti LECMM department

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5 Recommendations for the future

Chapter 5 provides readers with the project status update dated to the mid August 2015. In the following sections the recommendations concerning standards and knowledge management are given to the LECMM department. These recommendations are divided into 3 categories, based on the time horizon they tackle and significance of change they shall bring: Strategic, Tactical and Operational.

5.1 Project status update & feedback

Standards & Knowledge management project in the LECMM is currently in the Try out phase. Therefore, it is not possible to evaluate the full impact of the project on the team as well as the success rate of the remaining phases of Implementation, Control and Maintenance. Since this is a long-term project planned to develop for next 2-3 years for the best practice to be truly acquired in all documented areas, it is too early to assess the fruitfulness of the project. However, it may be said that up to now, the project meets with **positive perception** from LECMM team members, team leaders, process experts and the Head of LECMM team. The **Launch training** can be **considered as success**, since planners already spontaneously gave their feedback and suggested points for improvement. That confirms that they grasped the topic, the logic of standards and knowledge documents and they know how to technically operate standards and are aware of their functionality. Furthermore, it may be concluded that the establishment of the future standards and the way of processes documentation was successful based on the **team's acceptance**. They do not only passively accept standards, but they **actively start creating process maps** for the processes they develop in their project teams. The **awareness about existing standards and knowledge documents was properly raised** as planners themselves refer to the information contained in the documents and recommend e.g. new intern to check the standard and working guidelines in case of his questions concerning processes in Inventory Management.

The project was also **presented to the steering board** consisting of the EB-2 level, namely the Head of LEC region and the Global Head of Materials Management; and the EB-3 level, with a positive feedback and supporting approach. At the end of October 2015, the **project shall be presented in the Glomex conference**, which accumulates and shares best practices among Logistics regions within Hilti. From the strategic perspective for the LECMM department, the participation in the Glomex conference is a breakthrough. It gives the team the opportunity to present their work. As pioneers in the area of standardisation in the office environment within Hilti, there is a great possibility of moving the already created LEC concept of standards to the **global tier**.

Until then, in mid September 2015, the feedback meeting of key users with the team shall take place, as scheduled in the implementation phase. From this point on, the regular reviewing meetings shall be planned by key users in alignment with coaching sessions by

team leaders. Once these measures are in place, it will be easier, more valuable and sensible to assess the success of the project.

5.2 Strategic recommendations

From the strategic point of view, **the result of the Glomex conference** will in the long-term affect the LECMM department's future direction of standards' development, design and content. As the utmost goal of the Lean initiative is to unify the standardisation process across the entire company, **the management of the LECMM team shall closely cooperate with the global team**, so that the global standards resemble the LECMM ones as much as possible, to prevent double work.

As was previously said, there are in total 4 modules representing SFM boards and key users' division in the LECMM. With this project the first one of them – Inventory Management module – was developed. However, there are still 3 more modules remaining. Therefore, the LECMM should **proceed with the creation of standards for other modules**: Service, Forecast, INPs & Events. The other key users may thus deepen their expertise and have all relevant information to it already available from standards and knowledge document.

By this project, as Liker & Meier (2006, p. 52) name it, the creation of **"Disconnected Stability" of individual processes has started**. These are the processes in the single department, which are not connected to the processes preceding or following this one outside the department. Once the processes are standardised within the LECMM department, the initiative should focus on building **"Multiprocess Connected Stability"** between the processes of different departments, which belong to the same process flow, such as LECMM and Business Unit Material Management teams; LECMM and Hub Product Management team; or LECMM and MO sales teams. When processes are joined, the process flow can be studied to reveal and eliminate the inter-departmental waste.

However, since Lean considers the entire value stream at once to find and eliminate the biggest sources of waste in the company, the ultimate goal of Hilti in long-run shall be to focus on its entire value stream from ramp to ramp and develop **"Value Stream Connected Stability"**. When the process flow is established, every time, the value stream process is revised, local process maps should be adjusted accordingly, to implement global changes to local policies and standards. On top, one useful advice from Nash & Poling (2008) when analysing the value stream process, always start backwards from customer and move up the value chain to the supplier.

As Manohar (2013) points out knowledge is distributed also via expert networks. Therefore, once standards are adopted in other regions, the LECMM department with the support from HQ shall initiate creating **virtual cross-regional key user groups**. They shall be specific for a particular module, the key users are part of, with HQ representative taking lead in managing the group within the internal groupware - Yammer. The aim is to share knowledge and best practices among key users from different regions with the

professional support from the HQ expert. In this way, both explicit and implicit knowledge can be shared via chats, forums or direct calls. The only precondition is that all regions have to have the same division of modules as the LECMM currently has.

5.3 Tactical recommendations

During the project, **points for improvement** were discovered and handed over to relevant key users. They are responsible for **their further deep dive, analysis and development**. Among points for improvement there are: development of guidelines for a specific process step or a process as a whole; based on the previous analysis, setting the threshold for necessary parameters; developing the whole new processes such as obsolescence pre-warning process or pruning executed on regular basis. Key users shall discuss proposed actions with team's process experts and major actions such as launching a new project, shall be before execution approved by the Head of LECMM.

To give **standards also a measurable aspect**, as suggested by Mehta (2015) and Nash & Poling (2012), once the SFM Inventory module is finalised, key users shall explicitly point out the impact of processes documented in the Inventory Management standards on KPIs visualised on the board. **Direct links between processes and KPIs** will create associations in minds of planners, who will realise the consequences of their actions on tracked KPIs more easily. It will also increase visibility and transparency of effects of standardised processes and their outcomes.

As suggested by Liedtke (2014, p. 5) "Two items should be investigated (in standards): **"Did the members of the work system comply with the standard?"** and **"What were the quality of the results."**" The first question is answered in the control phase of standards by reviewing planners' adherence to standards. The second question shall be addressed once the processes from standards are directly linked to SFM KPIs they affect. When key users are able to collect answers to both questions, **the Four-Student Model** explained by Liedtke (2014, p. 8) can be applied to the reviewing methodology of standards by key users.

Based on the answers, found by reviewing, to above-mentioned 2 questions, the Four-Student Model **analyses the quality of created standards**. The model works with the assumption that the answers to the both questions are simplified to either *"good"* or *"poor"*. Based on the combination of these answers, there are 4 possible scenarios of reviewing findings, as seen in the picture below.

		Quality of the Results	
		Good Results	Poor Results
Compliance with the Standard	Good Compliance	**Case A** Good Compliance Good Results	**Case C** Good Compliance Poor Results
	Poor Compliance	**Case B** Poor Compliance Good Results	**Case D** Poor Compliance Poor Results

Fig. 37: Modified Four Student Model for SDCA, Liedtke (2014)

In the Case A, good compliance and good results **confirm the effectiveness and the quality of standards**. Nevertheless, the search for improvements suggested by employees should still be covered in the reviewing session.

In the Case B, poor compliance and still good results **do not provide us with the feedback for the standard**. However, since the results are still good, key users shall examine planner's way of execution more closely. It may be found out that the planner possesses better practice as currently documented by the standard. It shall result in standard's update to this best practice.

In the Case C, good compliance and despite that poor results suggest that **standard may not contain a good practice and it shall be subject to further analysis**. The analysis should reveal, whether the standard should be changed or the conditions predicted in the standard were changed and the standard should adjust its assumptions.

In the Case D, the situation of poor compliance and poor results has **no information value about the quality of the standard**. The root-cause analysis shall still be done in order to find out the reasons for poor compliance with the standard.

Thus, the Four Student Model shall in the future increase the transparency and structuring of the reviewing session and provide more detailed feedback on standard's quality.

Within the knowledge management and organisational learning, **MyKL** newly provides **systematic learning via trainings.** To make use of this opportunity, local study plan shall be created in the LECMM, and discussions about the topic in study groups with process experts shall follow. Thus, via socialisation and opinions exchange all parties can further deepen their knowledge and at the same time they are motivated by the group to develop.

5.4 Operational recommendations

From the operational point of view, **the key role for standards' success lies on the key users**. Team leaders have the supportive function, however the key users are the ones in direct contact with both planners and standards. They are the ambassadors of the *"change for better"* and they have to make standards *"living documents"*. Therefore, they have to motivate their fellow team members to support this change and moreover, be initiative and come up with ideas of their own for potential improvements. Key users are also responsible for the documented version of standards and knowledge documents, so that they are up to date and reflect the real best practices in the team. Along the documentation of the best practices, key users shall be proactive and search for the best practices in other teams and regions via MyKL as well. Moreover, if the problem occurs, key users shall initiate an open discussion in the SFM meeting in order to collectively come to the common solution.

In the Lean mission, every individual has to start believing for himself/herself. It always starts with a couple of lighthouses in the team. In the LECMM we aim for key users to be these lighthouses. If they are shown the benefits of standards, they start to believe in them, and then with their agitation and personal example they will make the others believe as well. Together they will create a living organisation reaching for the sustainable CIP.

Conclusion

The aim of this master thesis was to build standards and Knowledge Management for the Inventory Management in the Materials Management department in the Logistics Europe Central region in Hilti Company. The project aims for the long-term increase in effectiveness, expertise and erudition in the team via creation of standardised basis enabling CIP within Lean principles. The project is currently in the Try out phase with planners individually reviewing the standards and knowledge documents. It is too early to evaluate the full long-term impact of the project on the LECMM department. Despite this fact, the author will assess the success of the project so far according to hypotheses stated in Chapter 1.5.2. To confirm/disprove these hypotheses, the indicators stated for their evaluation will be analysed. The assessment is primarily based on the feedback of planners from the pilot phase and launching training, the feedback from the steering board as well as in-depth interviews with the team members and the Head of the LECMM department.

The first hypothesis presumes that *"Standards creation for processes in Inventory Management in Materials Management team in Hilti Logistics Europe Central will increase effectiveness."* It shall do so by **transferring knowledge from implicit to explicit**. This practice was established during the process shadowing and subsequent reviewing by process experts, who transferred their expertise to explicit knowledge available for all team members. The transfer is on track with the feedback provided by key users in the pilot phase and by the experienced planners in the training.

For the **compliance of processes execution with global and regional policies and guidelines**, the compliance to standards will ensure the compliance to these guidelines. The control phase of the project was designed in order to review the compliance after the implementation phase. It is in the responsibility of key users and team leaders. Since the project is in the Try out phase at the moment, time will show the real results. The great emphasis put on the standards and knowledge management topic by the team authorities up to certain extent guarantees the compliance, though.

Standards shall ultimately bring **the transparency and usage of current best practice in the team.** The in-depth interview with the Lean Hilti specialist supports the fact of the best practice accumulation in standards under the condition of team engagement, sharing their own experience and providing inputs for improvement. Currently the team engagement has been set off successfully in the launch phase with first feedback already collected. In this light, the author has a reason to believe in the continuous positive trend.

The goal of **creating a reference material for planner and a basis for further processes improvements** has already been reached as key users start building gained suggestions for improvement into current standards. Moreover, standards and knowledge documents already serve as reference materials for new members of the team and planners themselves recommend the newcomers to refer to these documents.

The second hypothesis presumes that *"Development of Knowledge documents for Inventory Management module with working guidelines and educational parts in Materials Management team in Hilti Logistics Europe Central will make knowledge documents more accessible and sustainable for planners."*

The **organisation of knowledge documents shall become more transparent, and the access and orientation in the knowledge shall be easier.** It is confirmed by planners' feedback during the pilot phase and launch training. Planners find the organisation of knowledge beneficial for faster orientation in documents. Standards serve as a transparent navigator to deep-dive information, whereas the most important information is still summarised and visible in standards.

More sustainable storage of knowledge documents is ensured by storage of all documents in SharePoint, and standards in MyKL. The lasting placement in the SharePoint is ensured by the support of the initiative from headquarters and limited assignment of editing rights only to process experts. That prevents deterioration of data organisation, and unifies and controls the content placed in the SharePoint. Furthermore, it enables easy sharing of information among the regions, thus stimulating further knowledge development.

Last but not least, knowledge management shall **increase the erudition of decisions while executing processes and overall knowledge level in the team.** Some planners have already confirmed that they were not aware of particular policies applicable for given processes, and they are glad to have it summarised and available at one place. In long term, process experts are positive that the knowledge transparency will increase the erudition of the team.

To conclude, based on the aforementioned analysis of indicators for both hypotheses it can be concluded that this master thesis met the expectations raised at the beginning and fulfilled its goals.

Bibliography

Al Smadi, S. (2009). Kaizen strategy and the drive for competitiveness: Challenges and opportunities. Competitiveness Review, 19(3), 203-211.

American National Standards Institute. (1971). *American national standard flowchart symbols and their usage in information processing*. New York: The Institute.

Bain & Company. (2011). *RAPID®: Bain's tool to clarify decision accountability*. Retrieved August 4, 2015, from: http://www.bain.com/publications/articles/RAPID-tool-to-clarify-decision-accountability.aspx

Berman, P. K. (2014). *Successful Business Process Management: What You Need to Know to Get Results*. Saranac Lake, NY, USA: AMACOM Books.

Bhasin, S. (2013). Impact of corporate culture on the adoption of the lean principles [Electronic version]. *International Journal of Lean Six Sigma*, 4(2), 118-140.

Botha A., Kourie D., & Snyman R. (2008). *Coping with Continuous Change in the Business Environment, Knowledge Management and Knowledge Management Technology*. Oxford: Chandice Publishing Ltd.

Butterfield, M. (2005). Beyond the shop floor: 'Lean' in the office. *Enterprise/Salt Lake City*, 35(23), 18.

Campbell, C. A., & Collins, M. (2010). *One-Page Project Manager for Execution: Drive Strategy and Solve Problems with a Single Sheet of Paper*. Hoboken, NJ, USA: John Wiley & Sons.

Chopra, R. (2009). *Administrative Office Management*. Mumbai, IND: Himalaya Publishing House. Retrieved July 23, 2015, from http://www.ebrary.com

Cudney, E. & Elrod, C. (2011). A comparative analysis of integrating lean concepts into supply chain management in manufacturing and service industries. *International Journal of Lean Six Sigma 2.1*. 5-22.

Dennis, P. (2007). *Lean Production Simplified.* Second Edition. A Plain-Language Guide to the World's Most Powerful Production System. New York: Productivity Press.

Drew, J., McCallum, B., & Roggenhofer, S. (2004). *Journey to Lean: Making Operational Change Stick*. Gordonsville, VA, USA: Palgrave Macmillan.

Duhon, B. (1998). It's All in our Heads. *Inform*, 12 (8). 8-13.

Ehlers, U.D. & Pawlowski, J.M. (2006). *Handbook on Quality and Standardisation in E-Learning*. Heidelberg: Springer Berlin.

El-Homsi, A. & Slutsky J. (2010). *Corporate Sigma. Optimizing the Health of Your Company*. New York: Productivity Press.

Franceschini, F. & Galetto, M. (2006). *Benchmarking in Total Quality Management*. Bradford, GBR: Emerald Group Publishing Ltd.

Frost, A. (2010a). Building Knowledge Management Frameworks and Models. *KMT. An Educational KM Site.* Retrieved July 28, 2015, from: http://www.knowledge-management-tools.net/knowledge-management-frameworks.html#ixzz3hAUuBq1k

Frost, A. (2010b). Introducing Organisational Knowledge. *KMT. An Educational KM Site.* Retrieved August 8, 2015, from: http://www.knowledge-management-tools.net/introducing-organizational-knowledge.html

Frost, A. (2011). Why is knowledge management useful? *KMT. An Educational KM Site.* Retrieved July 28, 2015, from: http://www.knowledge-management-tools.net/why-is-knowledge-management-useful.html#ixzz3h0e8IvaE

Frost, A. (2012). Knowledge Organisation & Assessment. *KMT. An Educational KM Site.* Retrieved August 11, 2015, from: http://www.knowledge-management-tools.net/knowledge-organization.html

Frost, A. (2013). The Different Types of Knowledge. *KMT. An Educational KM Site.* Retrieved July 29, 2015, from: http://www.knowledge-management-tools.net/different-types-of-knowledge.html

Gladwell, M. (2008). *Outliers. The Story of Success.* USA: Little, Brown and Company.

Hilti. (2014a). *Hilti Global Logistics.* Schaan. Retrieved July 3, 2015.

Hilti. (2014b). *Champion 2020.* Schaan. Retrieved July 3, 2015.

Hilti. (2014c). *Lean@GL. Lean Basics.* Schaan. Retrieved July 30, 2015.

Hilti. (2015a). *Global Logistics Strategy GL2020. Communication.* Nendeln. Retrieved July 3, 2015.

Hilti. (2015b). *Lean@Hilti. The way to operational excellence.* Nendeln. Retrieved July 4, 2014.

Huls, K. (2005). The Antioch Company brings lean into the office. *Journal Of Organizational Excellence*, 24(4), 31-38.

Hutchins, D. (2008). *Hoshin Kanri: The Strategic Approach to Continuous Improvement.* Abingdon, Oxon, GBR: Ashgate Publishing Group.

IBM. (1970). *Data Processing Techniques.* New York: IBM, Technical Publications Department. Retrieved August, 4, 2015, from: http://www.eah-jena.de/~kleine/history/software/ibm-flowchartingtechniques-gc20-8152-1.pdf

Ishikawa, K. (1990). *Introduction to Quality Control.* Tokyo: 3A Corporation.

Juroff, K. (2003). Lean -- It's Not Just for the Shop Floor Anymore. *Automotive Industries*, 183(12), 45.

Keyte, B. & Locher, D. (2004). *The Complete Lean Enterprise. Value Stream Mapping for Administrative and Office Processes.* New York: Productivity Press.

Kirsh, D. (2009). Knowledge, explicit vs implicit. *Oxford Companion to Consciousness OUP*. 397-402. Retrieved July 29, 2015, from: http://www.academia.edu/744907/Knowledge_Explicit_vs_Implicit

Kosturiak, J. & Frolik, Z. (2006). *Stihly a inovativni podnik.* Praha: Alfa Publishing.

Lareau, W. (2010). *Office Kaizen 2: Harnessing Leadership, Organizations, People, and Tools for Office Excellence*. Milwaukee, WI, USA: ASQ Quality Press.

Lean Enterprise Institute. (n.d. a). *Principles of Lean.* Retrieved July 10, 2015, form: http://www.lean.org/WhatsLean/Principles.cfm

Lean Enterprise Institute. (n.d. b). *Standardized Work: The Foundation for Kaizen.* Retrieved July 23, 2015, form: http://www.lean.org/Workshops/WorkshopDescription.cfm?WorkshopId=20

Liedtke, Ch. A. (2014). *Applying the Four Student Model During the SDCA Cycle.* International Conference on Quality, Tokyo, Japan. Retrieved July 31, 2015, from: http://ci.printing.org/wp-content/uploads/2015/04/LIEDTKE_ICQ_2014_SHARE_FINAL_V2_PDF.pdf

Liker, J. K. & Meier, D. (2006). *The Toyota Way Fieldbook. A Practical Guide for Implementing Toyota's 4Ps*. USA: McGraw-Hill.

Maier, R. (2007). *Knowledge Management Systems: Information and Communication Technologies for Knowledge Management*. Leipzig: Springer Verlag Berlin Heidelberg.

Management Mentors. (2013). *Coaching vs. Mentoring. 25 Ways They're Different.* Retrieved July 26, 2015, from: http://www.management-mentors.com/resources/coaching-mentoring-differences

Manohar, E. (2013). The Role of Knowledge Management Practices in Organizational Performance: A Conceptual Study. *International Journal of Organizational Behaviour & Management Perspectives,* 2 (3). 473-476.

Masaki, I. (1986). *Kaizen: The Key to Japan's Competitive Success*. New York: McGraw-Hill.

Mehta, M B. (2015). Targeting Administration. Finally use lean metrics to fix office processes by following six fundamental steps [Electronic version]. *Industrial Engineer: IE.* 47 (2), 38-49.

Merrill, P. (2009). *Do it right the second time: Benchmarking Best Practice in the Quality Change Process (2nd Edition).* New York: ASQ Quality Press.

Morgan, J.M. & Liker, J.K. (2006). *The Toyota Production Development System: Integrating People, Process and Technology.* New York: Productivity Press.

Nash, M. A. & Poling, S. R. (2012). What do you measure in a lean organization?. *Quality*, 51 (3), 26-28.

Nash, M.A. & Poling, S.R. (2008). *Mapping the total value stream. A Comprehensive Guide for Production and Transactional Processes*. New York: CRC Press, Taylor & Francis Group.

Nonaka, I., Takeuchi, H. & Umemoto, K. (1996). The Theory of Organizational Knowledge Creation. *International Journal of Technology Management*, 11 (7/8). 833-845.

Plenert, G. (2006). *Reinventing Lean: Introducing Lean Management into the Supply*

Chain. Burlington, MA, USA: Butterworth-Heinemann.

Pollitt, D. (2005). Lean delivers savings for Siemens business services. *Training & Management Development Methods,* 19(3), 223-229. Retrieved August 15, 2015, from http://search.proquest.com/docview/202595718?accountid=17203

Rüttimann, B.,G., Fischer, U. P., & Stöckli, M.,T. (2014). Leveraging lean in the office: Lean office needs a novel and differentiated approach. *Journal of Service Science and Management*, 7(5), 352-360. Retrieved July 12, 2015, from: http://search.proquest.com/docview/1629616705?accountid=17203

Sabri, E. & Shaikh, S. N. (2010). *Lean and Agile Value Chain Management: A Guide to the Next Level of Improvement.* Ft. Lauderdale, FL, USA: J. Ross Publishing Inc.

Shook, J. (2009, October 20). Five Missing Pieces in Your Standardized Work. *Lean Enterprise Institute.* Retrieved July 25, 2015, from: http://www.lean.org/shook/DisplayObject.cfm?o=1319

Sugai, G. (1997). Using flowcharts to plan teaching strategies. *Teaching Exceptional Children*, 29(3), 37. Retrieved August 4, 2015, from http://search.proquest.com/docview/201154718?accountid=17203

Targeted Convergence Corporation. (n.d.). Lean Knowledge Management. Retrieved August 8, 2015, from: http://www.targetedconvergence.com/lean-knowledge-management.html

The Bridgespan Group. (n.d.). RAPID Decision-Making. Retrieved August 4, 2015, from: http://www.bridgespan.org/Publications-and-Tools/Organizational-Effectiveness/RAPID-Decision-Making.aspx#.VcC564v_TKY

The Creately Blog. (2011). *15 mistakes you would unintentionally make with flowcharts.* Retrieved August 4, 2015, from: http://creately.com/blog/diagrams/part-1-15-mistakes-you-would-unintentionally-make-with-flowcharts/

Tischler, L. (2006). Bringing lean to the office. *Quality Progress*, 39(7), 32-38. Retrieved July 11, 2015, from: http://search.proquest.com/docview/214792188?accountid=17203

Trent, R. (2008). *End-To-End Lean Management: A Guide to Complete Supply Chain Improvement.* Ft. Lauderdale, FL, USA: J. Ross Publishing Inc.. Retrieved July 10, 2015, form: http://site.ebrary.com.zdroje.vse.cz/lib/vsep/reader.action?docID=10520060&ppg=28

Trent, R. (2008). *End-To-End Lean Management: A Guide to Complete Supply Chain Improvement*. Ft. Lauderdale, FL, USA: J. Ross Publishing Inc.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world.* New York: Free Press.

Attachments

1. Safety Stock Standard - Example –Inventory Management Module, LECMM

2. Process Map Shapes – Meaning Description

3. Standard Creation & Maintenance Guide

4. Structure of the Review Meeting

5. Key Users' Review Meetings Calendar

1. Safety Stock Standard - Example –Inventory Management Module, LECMM, author

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