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Implementation of 5S Methodology

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Bachelor Degree

Double Degree in European Management

Thesis

27.4.2016

Author(s) Title	Niko Immonen Implementation of 5S Methodology
Number of Pages Date	39 pages + 9 appendices 27 April 2016
Degree	Bachelor Degree
Degree Programme	Double Degree in European Management
Specialisation option	Double Degree in European Management
Instructor(s)	Kaija Haapasalo, Senior Lecturer in Logistics Juha Piirainen, Project Manager
<p>In this thesis, the researcher will explained the fundamental meaning of 5S by taking the reader through the implementation process in practice. The concept “5S”, is part of Lean management. Its main function is to eliminate non-value adding processes, by standardizing working methods and creating a well-organized working environment. 5S is formed from five Japanese words that are translated into English as Sort, Set, Shine, Standardize and Sustain.</p> <p>The idea for the thesis topic was presented to the researcher in January 2016 by Transval Group. Today, as Lean and 5S has a strong influence in the entire world of logistics, the choice of the thesis topic was reasonable and interesting. The thesis was an action based research, in which the researcher was placing theory into practice. 5S seminars and meetings, related to the project, build a base for the researcher to understand the importance of a well-organized and safe working environment. As the knowledge of the researcher grew during the process, he was able to guide the participants during the implementation.</p> <p>The implementation was carried out in Transval Groups’s Customer’s warehouse. The entire project itself, was divided into nine different sub-groups. The thesis mostly focuses on the first two sub-projects.</p> <p>The overall success of the first two sub-projects were measured with a survey, held before and after the implementation of 5S. The researcher asked eight employees from different positions to answer the survey once before the implementation and once after. All eight respondents answered the survey. The analysis of the survey proofs that the 5S implementation project was a success. The change between the first and second survey increased from a total average of 3.46 to 4.54.</p> <p>The researcher has also included before and after figures for the reader to get a better understanding of the changes made during the implementation process.</p>	
Keywords	5S, Lean, Waste, Safety, Warehousing, Logistics

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1 Introduction

In this thesis, the researcher will discuss the benefit of being “Lean” in logistics by implementing theory into practice in form of a 5S project, together with Transval Group. The idea for the project came from the researcher’s employer in the beginning of year 2016. Four years lasting employment relationship had proven the researchers ability to work in such a project.

5S is one tool of Lean Management and its main function is to eliminate non-value-adding processes. This is done by developing standardized working methods. It can also be considered as a tool of organizing and cleanliness. 5S comes from five Japanese words that begin with the letter “s”. These words that form the 5S system are Sort (Seiri), Set in order (Seiton), Shine (Seiso), Standardize (Seiketsu) and Sustain (Shitsuke). The 5S system saves time wasted and reduces the walking distances and most importantly increases safety. Implementing the system into the working environment, enables the opportunity for continuous improvement (Visco 2016: 1).

The idea for 5S project began in spring 2015, when Transval Group implemented their first small scale 5S project for their customer company. The outcome was highly appreciated by the customer and now in 2016, the customer wanted to implement 5S into the entire warehouse.

Lean concept was created by Toyota in the late 1980s. Toyota’s internal production philosophy, world widely known as the Toyota Production System (TPS), has been developed over a century and has become a role model for manufacturing and other similar organizations in the service sector. Many believe that lean and TPS are the same concept, when in fact, they are not. Even though both concepts were created with Toyota, lean and TPS are different concepts (Modig & Åhlström 2015: 75).

Lean is a part of Toyota Production System. TPS focuses on the non-value adding time between the customer’s order and receiving money. The aim is to constantly eliminate the non-value adding factors to make the timetable of production shorter. Whereas lean is a management philosophy for companies to build their own internal philosophy by using the tools that lean provides (Modig & Åhlström 2015: 75-76).

Lean and 5S has been in use in many car repair shops, manufacturing and other companies in different business fields, such as hospitals. Nowadays lean and lean man-

agement is gaining popularity, which is why the topic makes a great research subject for a thesis. As mentioned before lean has been in use for years in different businesses, but now the challenge is to implement lean and most importantly 5S into the world of logistics, moreover warehousing.

The reader will get a better understanding of lean in logistics and understand the importance of a well-organized, safe and efficient working environment. The research will demonstrate and measure different steps of lean process with figures and different measurement tools.

1.1 Objectives and research questions

The researcher's main objective of the thesis is to succeed in implementing 5S into a customer company's warehouse. The target is to make 5S and lean part of every employees daily work routines. Lean can be understood in many ways, but to succeed in the implementation, you need to fully understand the meaning of lean.

How to form a lean working environment?

How to make lean part of every employees daily working routines?

How to involve employees in creation of 5S and make it last?

What benefits does 5S bring to the company?

Which one to choose: resource or flow efficiency?

Can lean improve the throughput time?

How to eliminate waste and bottlenecks?

1.2 Methodology



Figure 1. Project overview

The methodology used in the creation of the thesis is action based, as theory is put into practice at the same time as theory is learned. The idea for the project came in January 2016, when the researcher was seeking for a thesis topic. In the end of January the idea for the project was presented to the customer and the response was positive. The researcher together with the 5S specialist got acquainted with the destination right away.

The 5S specialist of Transval Group held a 5S seminar for the researcher and other stakeholders concerned. This seminar helped the researcher to understand the fundamental meaning of 5S and how to implement this system into the warehouse environment. The creation of the project organization started in February, together with the creation of the project plan.

The researcher began his research of the subject in good time and was assigned to create stakeholder chart and a SWOT analysis of 5S. Even though the practical part was based in 5S, it was necessary to do research on lean, to gain a better understanding of lean thinking and other tools that it has to offer.

The 5S project was divided into nine sub-projects, since the size of the warehouse was too big to be considered as one project. This made the implementation of 5S more efficient and enabled the project manager to include different employees into the entire project. The first and second project started in the end of February 2016. These two projects were implemented at the same time. The first two projects were finished in April 2016, after which projects three and four began. The entire project should reach the end by the end of year 2016. The thesis main focus is on the first two projects.

As the project proceeded the researcher was working together with the different project groups, planning and implementing the plans. As the researcher knowledge of the topic

had increased towards the end of the first projects, he began to give presentations to employees, who were not familiar with 5S.

For the measurement of success, the researcher kept survey before and after the implementation of 5S. Transval Group, together with the client, had developed a floor check, which has been in use for couple of years now once a month, to measure the overall image and cleanliness of the warehouse.

1.3 Company description

Transval Group was found in 1994 and since that year it has been developing internal logistics services for customer companies. The company started its operations from terminal services, but now has expanded more in the field of logistics. In 2014, Transval Group was involved with Vindea company acquisition. This allowed Transval Group to expand into the industrial side also.

The company nowadays has split their service offering into four different categories.

- Warehouse services
- Terminal services
- Industrial services
- Consultant and HR services

Transval Group offers warehouse services for warehouses of all size. All the warehouse solutions are planned and build at the customer's facilities, by tailoring the required amount of staff and equipment needed. The pricing method used in Transval is based on the transactions, meaning the customer only pays for the goods that are moved.

Transval Group has been working in the market for over 20 years and has the longest experience of the core operations and production processes of logistics in Finland. The company offers their customers' expertise from receptionist to packaging. Continues improving is part of Transval's business model. Transval provides their customers' solutions to speed up the logistical flow-through of the operations and to minimize the delivery times and throughput times.

In the future, the company's goal is to further expand their offering in the internal logistics, according to customer needs. The current customer base consists of small and big businesses in the commercial, industrial and logistic sector.

Transval Group employs over 3 600 professionals in logistics and industry. The company operates in more than 20 regions in Southern, Western and Central Finland. In the future the operations will expand to other regions in Finland and abroad. Transval Group has been growing during the past years, and now the annual turnover of the company is over 150 million euros, increasing every year (Transval Group 2016).

2 Lean

In this section the meaning of lean and lean concepts are discussed. The researcher will also evaluate the different functions and solutions that lean brings to the organizations.

2.1 Lean thinking

Lean can be understood in many different ways. In logistics, lean strategy is used to bring down costs, but as we are dealing with logistics, it is impossible to completely cut the costs. This means that lean aims to lower the costs by using efficient operations and minimum amount of resources. The strategy is not only for minimizing costs, it also focuses in maintaining good customer service, while using only the required amount of resources (Waters 2009: 81).

Lean strategy also aims at reducing waste. Companies in the service and manufacturing sector have been doing this for long already, but the formal systematic way of reducing waste, started in the motor industry, with Toyota. Toyota's first vision was to change the manufacturing process to lean production by eliminating waste, but soon they formed an entire lean enterprise with lean operations (Waters 2009: 81).

Overall, lean is an operations strategy, which emphasizes flow efficiency over resource efficiency. To gain a better understanding of lean, it is important to understand the different concepts and tools of lean (Modig & Åhlström 2015: 117). Flow efficiency focuses on the unit that is processed in the company. When considering warehouses, the orders, to be delivered to the customers, can be described as the flow unit. The collector receives the order, collects the products, and transfers it to packing and then packing forwards it to the departure area. Flow efficiency measures how much the flow unit is processed within a certain time frame. If orders are considered as flow units and the entire process of completing the order takes 20 minutes from the collection to shipment, but the value-adding time is only 15 minutes, due to queueing, the flow efficiency would be 75%.

<i>Customer need:</i>	<i>Products</i>
<i>Value-adding time:</i>	<i>Products collected, packed and shipped (15 minutes)</i>
<i>Time period:</i>	<i>For the order to go through the process (20 minutes)</i>
<i>Flow efficiency:</i>	<i>15 minutes/20 minutes = 75%</i>

Flow efficiency is more customer orientated and focuses on the customer's wants and needs.

Then on the other hand, resource efficiency, is planned and organized to use all value adding resources efficiently in the company. In warehousing this can be described again as customer being the unit, but instead of placing customers' needs as priority and serving the customer in efficient time, the company puts its focus into maximizing the use of the value adding resources in the company. Resources can be different depending on the field of business. In warehousing resources that affect the efficiency are physical resources such as buildings and machinery, not to forget human resources, including employees, such as sales personnel and warehouse personnel. Resource efficiency measures how much a resource is used in respect with a certain time period. For example if forklifts resource efficiency is measured and the given time period is 24 hours:

<i>Resource:</i>	<i>Forklift</i>
<i>Time resource is utilised:</i>	<i>6.5 hours</i>
<i>Time period:</i>	<i>24 hours</i>
<i>Resource efficiency:</i>	<i>6.5 hours/24hours= 27%</i>

If the given time period would be considered in respect with the employees daily working hours, assuming it is 8 hours on a daily basis. Then the resource efficiency of the forklift would be 81%. (Modig & Åhlström 2015: 7-13). In logistics, the main goal is to find a balance between both flow and resource efficiency.

The researcher has modified a Lean house figure (see Figure 1. on page 7) for the reader to understand the different concepts and tools of lean. Lean house is formed from various different tools and visions to improve organizations performance (Lean Blitz Consulting LLC 2016).

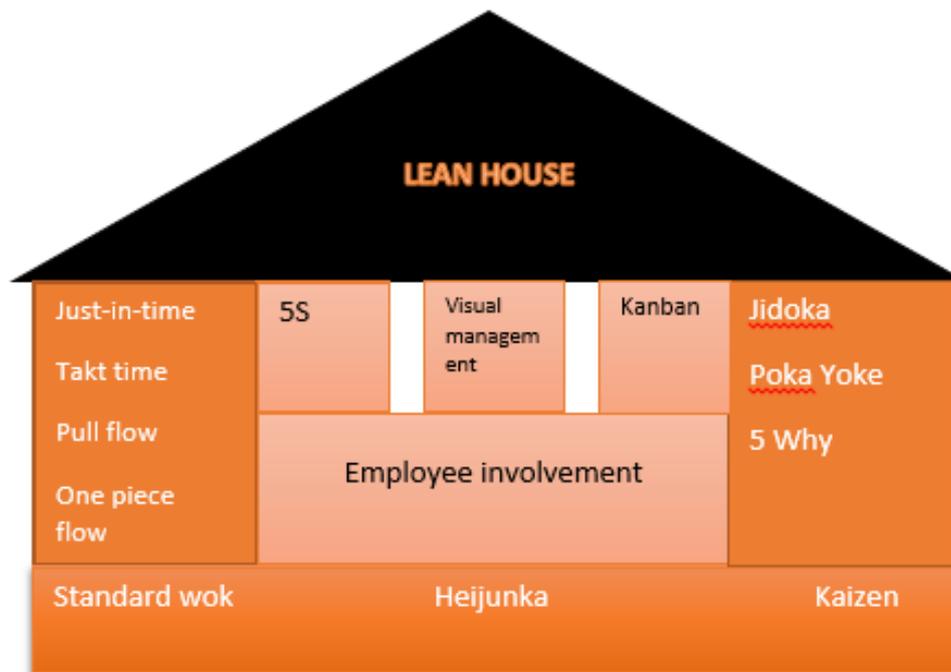


Figure 2. Lean house modified from Lean Blitz Consulting LLC

Just-in-time (JIT) vision is to serve the customer according to the customer's wants. Meaning that the customer's demands are fulfilled, amounts are met, within the time the customer requires. One piece flow is one strategy that supports just-in-time vision to meet customer wants and needs (Liker & Convis 2012: 214). Takt time is another important concept, which supports just-in-time vision. Takt time describes the rate of customer ordering. In warehousing, takt time can be simply explained. Considering, if a customer makes an order every ten minutes, the takt time is ten minutes. Pull flow, on the other hand, means that the flow unit is moved forward only when the next process is ready (Liker & Convis 2012: 91). Heijunka is used to facilitate just-in-time production vision. It is used in production leveling to find out and maintain the average volumes of production.

Jidoka focuses on stopping and fixing any problems or issues as they appear. Visual management and Poka yoke is used together with Jidoka to create high quality and to lower defects and other errors that form problems in processes (Liker & Convis 2012: 92). 5 Why, is a tool to investigate the fundamental reasons, why problems occur. When a problem occurs, the main function is to ask 5 times why (Visco 2016: 28).

Kaizen is a tool for continuous improvement on a daily basis. The Kaizen system aims to point out problems and act on these problems urgently and immediately. Kaizen also

encourages into team work and employee involvement, which is one key factor of lean thinking (Like & Convis 2012: 123-124). Kaizen vision is supported also by Kanban and 5S. Kanban is a Japanese word that is translated into English as signboard. Kanban's is, so to say, a controlling tool for scheduling, inventory and finding materials. Kanban is usually some sort of a signboard with information that helps to keep track when materials need to be ordered or moved (Visco 2016: 32). 5S, on the other hand, is a tool to eliminate non-value-adding processes by implementing new standardized working method that increase efficiency. 5S comes from five Japanese words that are translated into English as Sort, Set in Order, Shine, Standardize and Sustain (Visco 2016: 1).

2.2 Throughput time and bottlenecks

Before organizations can start to measure the throughput time, they have to decide, what their process is and set certain system boundaries for the process. Organization can choose on their own, what is their process, when it starts and when it ends. After the process and system boundaries are set, the organization is able to measure the throughput time of the process. Throughput time is simply the time that takes from the beginning of a process till the end of the process (Modig & Åhlström 2015: 22).

Bottlenecks appear in every field of business. Lean helps to recognize and solve bottlenecks that slows down operations or processes. Bottlenecks are factors that slow down or stops work. In logistics good examples of bottlenecks are; long walking distances, unclear markings, queuing, missing products and poor instructions. Bottlenecks increase the throughput time of processes. Processes that usually are involved with bottlenecks, have two features. The first typical feature is that there is usually a queue right before the bottleneck, whether the subject going through the process is material, people or information. In warehousing this type of bottleneck could be lack of information for special packing from superiors to employees. This stops the process flow, as the packing personnel needs to go and ask how the special products should be packed. Another good example from warehousing is unclear markings or missing products, which increases the process throughput time, when the employee has to start looking around for the missing items. The second typical feature is the factor when the other operations right after the bottleneck needs to wait. For example, when the packing line is forced to stop working, no packages are going through the conveyor belt to the dockworker (Modig & Åhlström 2015: 37-38).

2.3 Waste and different type of waste

In this topic we will deepen into the concept of waste and understanding waste elimination.

It is extremely important for organizations to understand what it waste and how to eliminate it, in order to create a successful lean organization. Wastes are rather classified productivity related than quality related. Even though these two walk closely side by side, we believe that improved productivity is the key to lean operations, which then highlights the quality matters in the operations. Toyota Production System has developed the list of seven different form of wastes, which the researcher will discuss in more detail below (Brunt & Taylor 2001: 80-81). The definitions for the seven different wastes, also called as the Seven Muda's, are respectively modified from the book: *Manufacturing Operations and Supply Chain Management by Brunt and Taylor*.

When transportation is discussed as waste, we try to reduce the excess moving factors, such as conveyors, busy forklifts, stacking and unstacking of components. It also important to eliminate any widely spread equipment.

Inventory as waste, on the other hand means factors such as work in process and finished goods that are not processed. This leads into old dates in materials, deteriorating materials, meaning materials that are getting worse, which leads into exceeding the storage volume.

As considering motion, we should focus on eliminating all excess movement. All tools and other components should be easily reachable, the layout of the facility should be standardized and double handling should be not appear.

All waiting that is possible to eliminate, should be eliminated. Waiting between process steps should not appear. Operators waiting for another operator and operators that are slower than the process, line are considered as waste and should be eliminated. In logistics a good example of waiting is missing products, lost materials or delayed order due to poorly organized operations.

Overproduction is a huge waste in logistics, as well as in manufacturing. Overproduction makes smooth flow of goods challenging and forms excessive lead-time. This ap-

pears when production is ahead of demand, which means that the work in process is piling up.

Over processing appears when certain methods are not being standardized. When there is variation between operators methods over processing appears. Methods should be standardized and make statistically capable to avoid over processing.

Defects are part of daily logistics. High number of customer complaints, high inspection levels and broken products are good examples of defects. Defects should be minimized. These cannot be totally eliminated, as we are working with human beings (Brunt & Taylor 2001: 80-81).

3 5S methodology

This section will discuss 5S and its different phases in more detail. After this section the reader will understand the fundamental meaning of 5S and the benefits that it brings to organizations.

3.1 5S phases

5S come from five Japanese words that are Seiri, Seiton, Seiso, Seiketsu and Shitsuke. These five words are translated into English as Sort, Set in Order, Shine, Standardize and Sustain. These five terms form the 5S program. Below, the reader is able to find a figure of the 5S circle and the fundamental meaning of the 5 s (Visco 2016: 1-2). The phases are based on the learned theory of David Visco's book: *5S Made Easy*.



Figure 3. 5S Circle modified from David Visco's book *5S Made Easy*

The first phase of 5S is Sort. In this process the main idea is to sort all the unnecessary items that are not needed in the area, mark all the items and then dispose these items or re-place them into another work station. Of course before disposing the unnecessary items, one should consider, who has the final say of the disposal. A folder should be

created for all the 5S documents, that anyone related can access these later during the process. During this phase, plenty of before pictures, should be taken, as pictures presents more than words. Then after implementation, it is time to take the after pictures, so when the final project report is made, the improvement can be easily seen from the pictures. The first phase should follow several different steps. The first step is to carefully consider the attending people, who takes part in this phase and write all the names of people attending the event down. The second step, is to ensure that the benefits of the Sort phase is well reviewed with the attending team. The length of event should be set and the plan should carefully be explained to all, what is done during this phase. All must be aware what is going to be gone through in the entire area, opening all closets and going through all corners from top to bottom. All the participants of the team should also be reminded to consider the safety factor and work ergonomics, meaning lifting, reaching and bending. The next step is to hand out a red tag with different fields to be filled in to everyone. Everyone should have one of these tags, while going through the area and discussing the sort phase. The idea is that the people attending all would highlight the most important factors of the area. The fourth step is to mark all the items with a red tags that mentions, what is needed to be done to the item. After this step the team should discuss their thoughts about the event and possible improvement factors for the future.

The second phase of 5S is Set in Order. After all the unnecessary items are disposed, it is time to start organizing the area to increase the work ergonomics and overall safety in the work area. This phase usually takes the majority time of the entire 5S program, since all the markings, taping and labelling are done during this phase. These actions are considered as 5S materials, from which the reader will get a better understanding in chapter 4.

Third, likely similar phase to the set in order phase, is shine. Much of this phase has been already implemented during the second phase. This phase has basically three different steps. First one is simply cleaning. As the set in order phase may have included painting or taping, some excess tools or dirt may still be laying around. The second step is to create a schedule to maintain the cleanliness and order. Also employees should be involved by making them responsible of certain areas and the maintenance of the area. The third step of Shine is to have a picture, how the area should look like every morning when coming to work and when leaving work. This help spotting broken machines, excess items and factors harming the working safety.

The fourth phase, standardize, focuses on maintaining the clean and safe working environment. Prior to this phase, all sorting and cleaning has been performed. This phase is there to set simple, visible guidance, how the area should be kept on daily basis. Different organizations have different ways to measure the maintenance of 5S. One of the most popular tool for standardizing is a 5S audit. These audits are kept after different time periods, for example once a month. The audit has set standards that are evaluated during the audits. Afterwards the results of the audit will be posted for everyone to see. This also helps to point out some problem areas and take actions to these.

The last, but not the least phase, is sustain. Many consider this phase to be the most difficult to implement of all the five phases. When talking about sustaining, the core meaning is to maintain the current, improved status. After successfully implementing the 5S program, it is extremely important to not go back to the way it was before. The management has an important role in this phase, as they need to make it part of every employees daily working habits (Visco 2016: 17-58).

3.2 Implementation of 5S

The implementation of 5S requires the understanding of all the employees, supervisors and managers related. The program might seem simple, but it requires a lot of planning, even though it is not considered as project, since project has an beginning and ending, whereas 5S is a program for continuous improvement.

The planning phase is important when considering the success of 5S implementation. First of all, the entire implementation begins with choosing a proper project leader. The project leader should have a thorough understanding of 5S and experience of leading such a project and managing personnel. After choosing the project leader, a 5S champion should be chosen. This person is the one, who is responsible of the area, in which 5S is implemented. The 5S champion is the person, who provides guidance and instructions to the project team. In some situations there might be more than one 5S champion, depending on the size of the area. As 5S is part of lean, employee involvement plays a significant role in the implementation. The team members should be a mix of employees that work in the area, performing different tasks (Tuominen 2010: 18-20).

After choosing the team, it is extremely important to train the team, in order for the 5S program to fully succeed. The training should also be kept for all employees and other staff working in the area, where the implementation takes place. The project leader has the responsibility of educating the employees and to make sure each and every one truly understands the meaning of the 5S program. A good way of presenting the idea of 5S is to use the What, Why, Where, When and How strategy. Simply presenting what 5S is about and what does the five “s” mean. Why is the program implemented, highlighting the benefits it brings. Where is it implemented, mentioning the area chosen to be worked in. When, answers to the question, which implementation plan has been chosen, whether the facility is shut down for a certain time or a little bit is done two to three times a week. Finally How, answers the question how is it implemented, this is when you show the project plan and explain there will be short training sessions, but most of learning is done by doing. For the training, a well prepared PowerPoint presentation and different 5S games, should be enough, ensuring there is suitable time for answers and questions (Visco 2016: 13-14).

The size of the area is crucial. Some consider that the implementation of 5S can be done at once into a big area, let's say a huge warehouse. This is clearly not the right way. The area should be divided into different sub-projects, to be efficient in the entire area. This brings us into scheduling. The timeframe the project is implemented can be executed in two ways. The first way is to close down the facility and do everything at once. Unfortunately, in logistics this cannot be done executed, since all orders have to be delivered. The second way, is to work on 5S implementation a few hours on daily or weekly basis, which is more suitable for logistics (Visco 2016: 7-9).

Before starting the implementation process, it is important to set the ultimate goal for the project. The organization should decide whether 5S is just a quick clean up, or a continuous improvement to manage work process, improving the safety factor and ease the workflow.

3.3 5S benefits

5S certainly brings numerous benefits for the organizations that chooses to use the program. Once it is implemented and planned carefully by following all the steps, the benefits surely will affect the organizations overall cleanliness, safety and quality.

All the different phases of 5S offer different benefits. When the sort and set in order phase is well implemented and developed, more space for working is ensured, which then positively affects the safety measure of the organization. Also the fact that employees are been involved with the decision making and the actual implementation, increases the employee satisfaction. The quality is more likely to increase, as these phases are implemented, when each article has its own place and work is standardized. This also leads to customer satisfaction, since no more time is wasted in searching for missing articles (Tuominen 2010: 85-86).

5S offers the organizations a foundation for continuous improvement. It also frees up floor space, which once again leads to increased safety among the employees. The work ergonomics is improved, when part of stretching, bending and reaching has been eliminated. Re-locating tools and reserve articles also reduces the amount of walking, which leads into more efficient work flow and saves money as each article has its own place and inventory is easily executed. Employees are given more responsibility, which enables easier and more dynamic cross-training (Visco 2016:18-23).

4 Case Study: Transval Group

The thesis topic was inspired by the researcher's current employer, Transval Group. The idea for the thesis was presented for the researcher in January 2016. The project planning began in the beginning of February and by the end of February the implementation of the first two sub-projects began. The entire project was too large to be implemented at once. This is why the project was divided into nice sub-projects, which also enabled the project organization to involve even more employees into the project.

The case study is based on a real life example, where 5S is implemented into practice. The researcher, together with Transval Group, began the project with Transval Groups current customer. Due to confidentiality, the customer will be referred us "Customer", throughout the case. Also the employees of the Customer, took part in the planning and implementation of 5S.

4.1 Goals and expectations

The fundamental goal of the 5S project is to make it work, last and part of every employees and supervisors daily working routines. In order to succeed in the implementation of 5S, everyone related should be aware what it is and why it is implemented. Everyone should be aware that 5S is not only a tool for the management level, but for everyone working in the facility.

The goal is to get all employees involved with the implementation and more importantly in the maintenance. By implementing 5S, the project organization aims to increase the overall safety in the area, not to forget eliminate waste and improve the work flow. This can be executed by following the 5S program phases. As time is money, the expectation is to follow the set timetable and succeed in the implementation on time.

As there are many foreign employees working in the Customer warehouse, both on Transval Group's and from the Customer's behalf, it is important to ensure that the meaning of the project is understood by everyone, even though the operating language is Finnish. The goal is to involve different employees from the area, in which 5S is implemented, so cross-training among different employees from different nationalities is enabled.

The project team designed a SWOT analysis for the project, highlighting the main strengths, weaknesses, opportunities and threats of the project. The project team considered the previous 5S project with the customer that was performed a year ago, as a strength, since it was strongly appreciated by the Customer and the employees. The existing person responsible of 5S, also known as the 5S champion, was considered as a strength also, since this person had performed well in his duties and in sustaining 5S. What comes to the weaknesses, the team considered poor information flow and language barriers between supervisors and employees, as major weaknesses. These are however, factors the team aims to eliminate.

As opportunities, it is safe to say, there is extremely good customer relations between Transval Group and the Customer, which makes working together effective and easy. Also the fact, that part of the employees are already involved with sustaining the previous 5S project, helps making 5S part of the rests daily working routines. Threats are always there and these are factors the project team needs to eliminate. Opposition of 5S from the employees is a factor that needs to be worked on and eliminated. This can be done by involving as many employees into the implementation as possible. There is also the risk that 5S fails, which the team aims to eliminate by simply involving employees and training them.

Project "Customer" 2016	
Strengths	Weaknesses
5S partly implemented in the area previously Already existing person responsible of 5S (5S champion)	Poor information flow Language barriers with employees
Opportunities	Threats
Make 5S part of everyones daily working routines Good co-operation with the customer	Opposition of 5S from employees 5S fails

Figure 4. SWOT Analysis of the Project "Customer"

4.2 Project and project organization

The researcher has created a project figure (see appendix for a bigger picture) for the readers to get a better understanding how the project was divided and implemented. The figure below identifies the main project, the nine sub-projects and the nine different project organizations working in the nine different areas. The nine different sub-projects and nine different areas, represents one big warehouse that is divided into nine pieces.

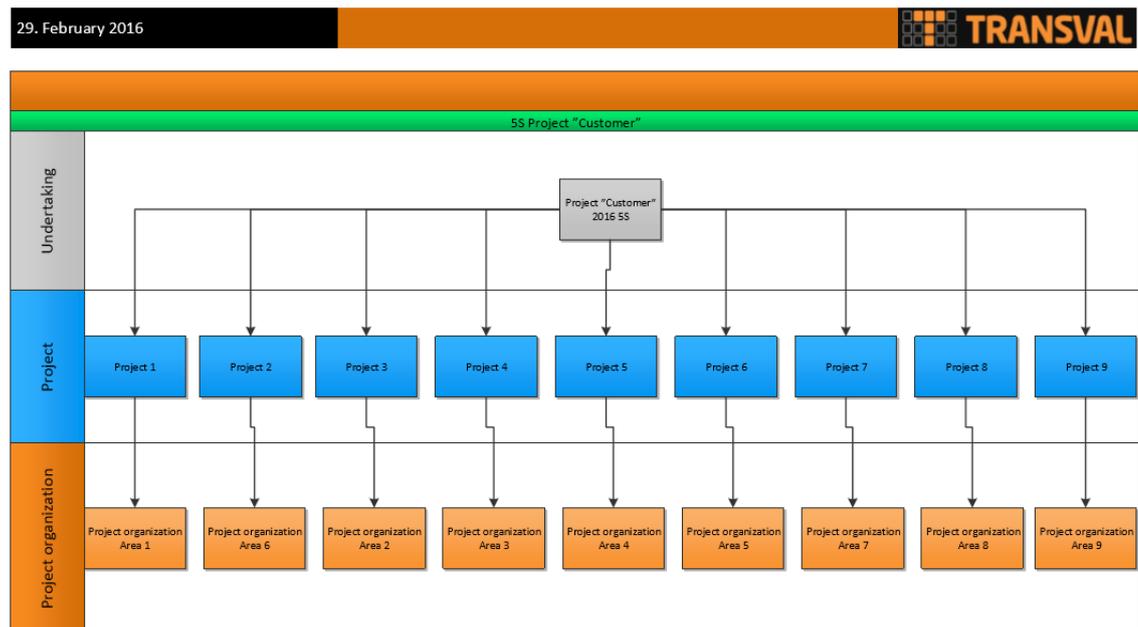


Figure 5. Project "Customer" 2016 5S

The first two sub-projects, Project 1 and Project 2, were the first projects that were taken under investigation and implementation. The Project 1 processes the area one, a large area, which included five smaller areas; the delivery area, cash-and-carry, forklift parking, assembly and packing area. This sub-project, together with the sub-project; Project 2, began in the end of February 2016. The project 2, area six, was an entirely new expansion area that was just opened for use. These two projects were finished in the mid-April. The project organization also began to work on the Project 8 in the beginning of April and finished the implementation process also in the mid-April.

The sub-projects, Project 3 and Project 5, began in April and are scheduled to be ready by the end of May. The remaining sub-projects are scheduled to be executed right after the summer vacations, starting again in August and the entire Project "Customer" is scheduled to be complete by the end of year 2016. However the main focus of the thesis will be on the first two sub-projects, Project 1 and Project 2.

Below, from the figure 6, the reader may investigate the project organization for the first project, describing the function of each member (see appendix for a bigger figure).

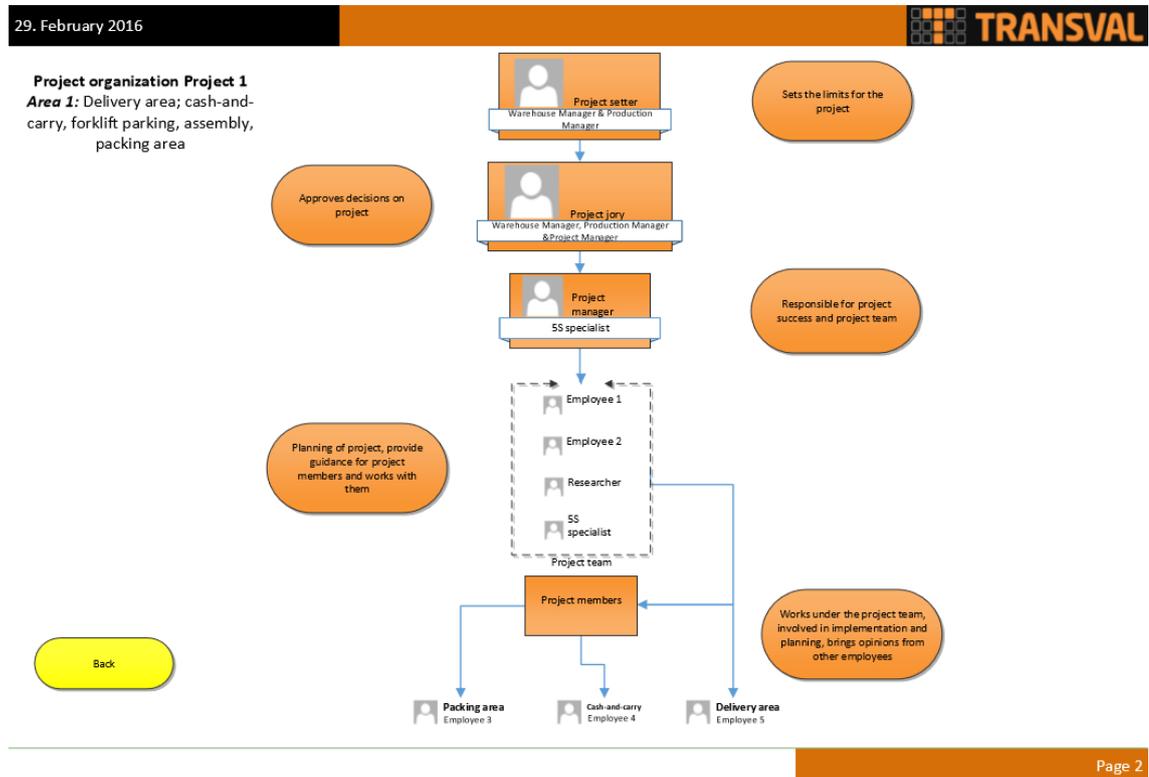


Figure 6. Project organization for project 1

The project consists of different members that are; the project setter, project jory, project manager, project team and project members. The project organization is formed from a mix of Customer's employees and Transval Group's employees.

The project setters' are the ones, who set the limits for the project. The project Jory approves the decisions on the project. The person responsible for the project success and the project team, is the project manager. The project team is responsible for the planning of the project, providing guidance to the project members and working closely with them. The project members work under the project team and are involved in the implementation and planning of 5S. They also bring opinions from the other employees that are then taken into considerations and implemented.

4.3 Process description: The Transval Way

Transval Group has developed their own process to implement 5S. The process is the same as in 5S, only the name has been changed into 5T. The process description is shown below in figure 7. 5T Implementation process (see appendix for a bigger figure).

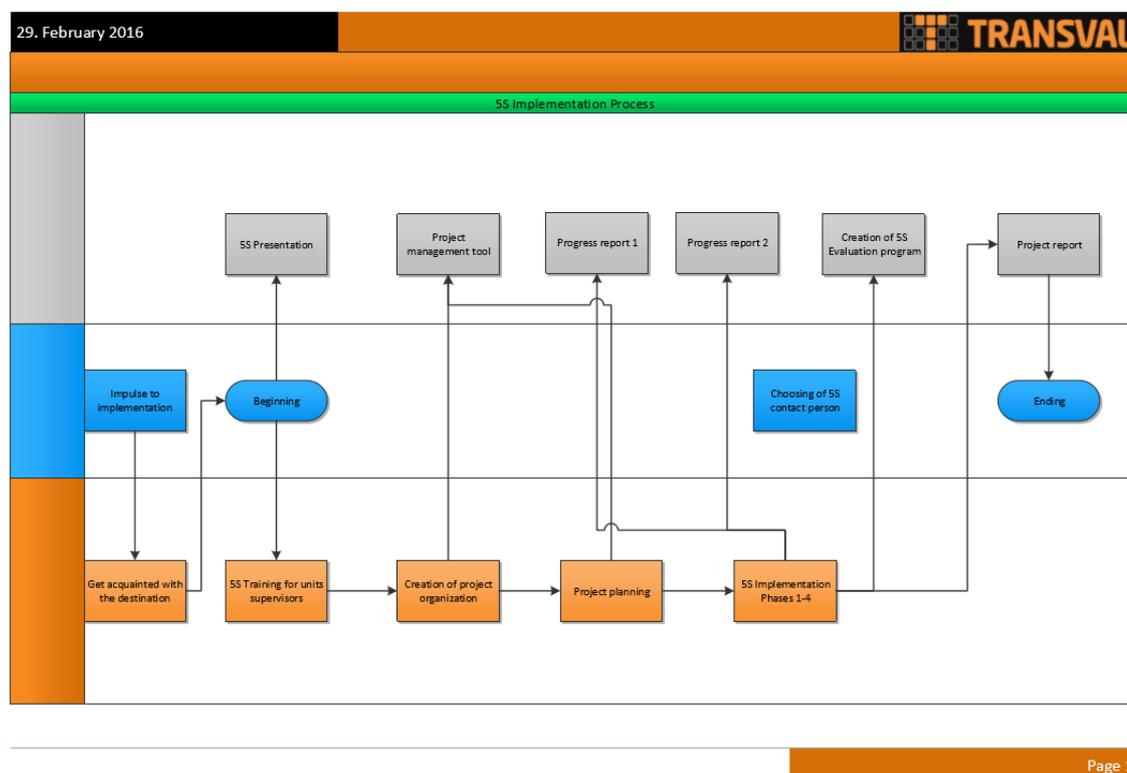


Figure 7. 5S Implementation process

The process starts with the impulse to implementation. During this phase the customer requests for such a project, or Transval offers the customer a 5T project. After the impulse to implementation has been taken into action, a team from Transval Group gets acquainted with the destination and takes a look what could be done. After this the actual 5T process begins. At first the 5T specialist gives a presentation for the unit's supervisors about 5S, what it is and what has been done elsewhere. Then the project organization is created and the project management tool is taken in use. The members in the project organization is carefully chosen thinking about the bigger picture, to involve as many employees from different areas with different positions. Once the project organization is formed, a short presentation about the subject is given for the members. After this the project team together with the project manager begins to work in the project plan. If the unit does not have a 5S contact person, a person is chosen to fill this

position. After the plan is ready a short progress report is made by the project manager and the plan is approved by the project jury. Once the project plan is approved, the project team, together with project manager and project members starts the implementation of 5S phases 1-4. When these phases are complete and all changes have been implemented, the 5S evaluation form program is created. This evaluation program measures the changes and sustain the changes that were implemented. Once all the five phases have been implemented and a 5S culture is formed, a thorough project report is formed and then presented to the managers, who set the project in motion.

In below the researcher has created a more thorough process description of implementing 5S phases one through four (see appendix for a bigger figure).

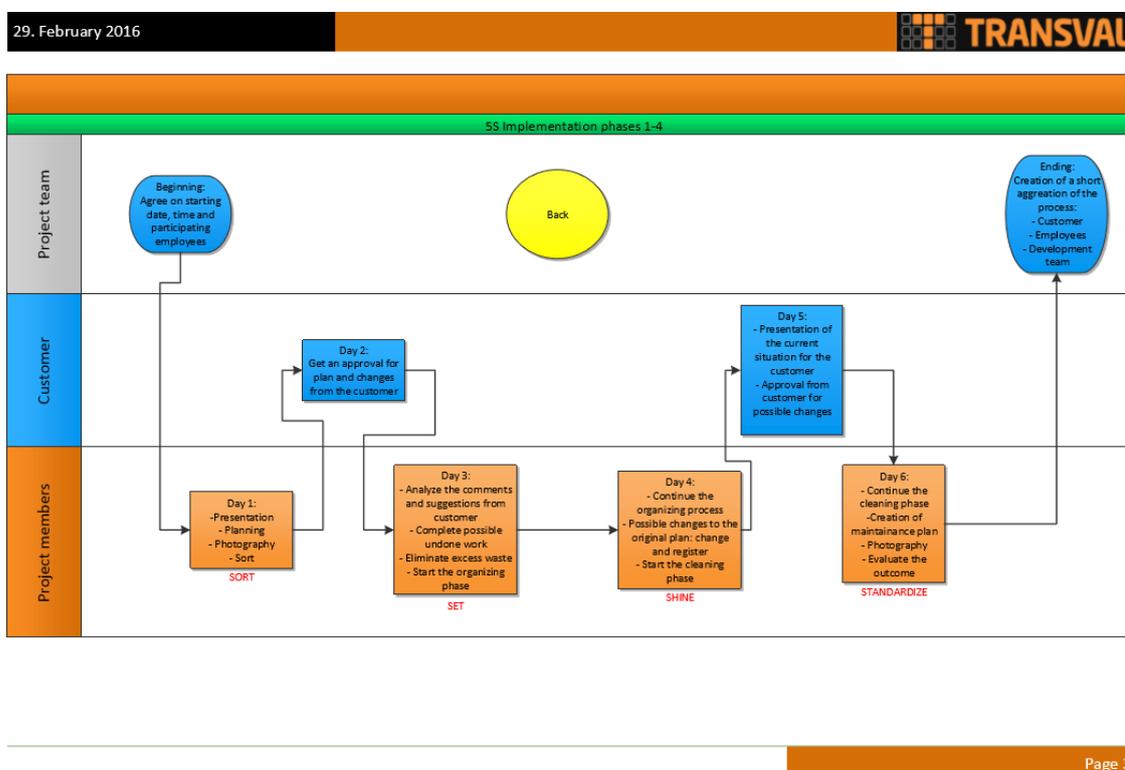


Figure 8. 5S Implementation process phases 1-4

The implementation begins with the project team. Firstly the team agrees on the starting date, time and the employees who will participate in the implementation. Transval Group has divided the phases into several different days. On day one a short presentation is given to all the project members, after which the planning starts. Before eliminating anything, photos are taken from the current situation. Once the photographing is

complete, it is time to sort and mark all the unnecessary items from the area and agree on what is needed to be relocated and what new is needed.

Once the sorting phase is complete, before removing anything, on the second day of implementation, the project team gets approval for the plan from the customer. On day three, the project team and the project members analyses the comments and suggestions received from the customer. If there is some undone work from previous days, these are completed also. After this all the excess waste marked during day one, are eliminated or relocated into other work stations. Once this is done, the organizing process begins and items are located on their set places.

During day four, the project team and members continues the organizing process. If any changes occur to the original plan, the changes are made and registered. Once all these tasks are complete, the cleaning process begins.

On the fifth day, the project team or project managers gives a short presentation to the customer about the current situation and gets approval for possible changes.

During day six, the cleaning process is continued, if necessary. After the shine phase, when the area is clean and organized, after pictures are taken and posted into the area, so everyone is aware, how the area should look every day after work day ends. Once the pictures are taken a maintenance plan is created and the outcome is evaluated.

On the last day of the process, the process ends with a short aggregation for the customer, employees and for Transval Groups development team. After this the ending, sustaining phase begins. The reader may investigated the ending process figure on the next page (page 23).

Once the first four phases, sort, set in order, shine and standardize are complete, the project team begins to create a 5S evaluation program. When the 5S evaluation program is completed, a group of different employees from different positions, keeps the first 5S evaluation. Then the project team collects the project results and the project manager creates the final project report, which is then analysed with the project team. As the final project report has been analysed, feedback is given among the project organization.

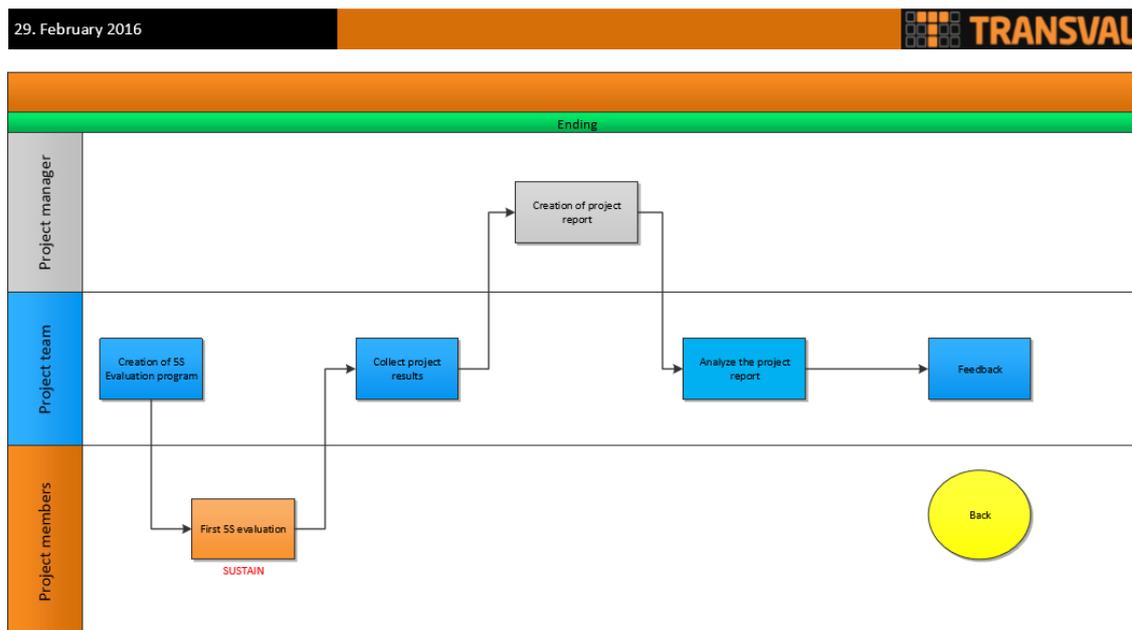


Figure 9. 5S Implementation of ending process

4.4 Project implementation and outcome

The project organization began the Project “Customer” 2016 5S, in the beginning of February 2016. It was decided that the first two sub-projects would be implemented at the same time, since the Project 2, area six was an entirely new expansion part that was just opened for use at the same time.

Once the project organization was formed, the project team began the project plan. The team worked hard on the creation of the plan, walked around in the area, made research and asked opinions from different employees in different positions. Going back to the SWOT, as mentioned in threats, there might be oppositions of 5S among the employees. Unfortunately this was the situation with some employees, but once the implementation began and these employees were involved with the project, their minds were changed.

After the project team got the approval for the plan from the customer, the sorting phase began. In the Project 1, area one, the team and members had a lot of sorting to do, where as in the Project 2, area six, not so much, as it was a brand new more or

less empty area. The main focus of the implementation process focuses on the Project 1. During the first day of the implementation process, the project team, together with the project members, went through the entire area one from top to bottom, from corner to corner, evaluating and marking what is considered as waste, are there any bottlenecks that appear, what is needed and what is unnecessary.

Area one, was a big area, consisting from the departure area, cash-and-carry, forklift parking, assembly and packing area. All these areas had a lot of unnecessary items, broken computer equipment, broken pallets, dirt, shelf's and packing equipment. Once the members had discovered their findings, on the next day the set in order process began and the elimination of these unnecessary items was set in motion. Some of the unnecessary items, were relocated, such as trash cans and packing equipment. The team also noticed that there were a few work stations that lacked instructions, which really needed these. Once all the unnecessary items were either eliminated or relocated, the members began the organizing process. Some new parking slots were created with tape for carts and forklifts and other warehouse machines. Reserve shelves were created in the packing area, assembly and for departure area.

Once all items had their standardized places in the area, the shine phase began. The project team, together with the project members made the last changes to the area, still implementing some minor changes that were approved by the customer. Once all the cleaning was complete, the after pictures were captured.



Figure 10. Before and after cash-and-carry 1

The first two before and after figures (see figure 10. and figure 11.), are from the cash-and carry area. As the figures describes, the excess shelves were removed into another work station and the unnecessary printers and other computer equipment were moved into another area. After the sorting, the project team was able to form a parking area for kick scooters, which before, were located wherever there was room.

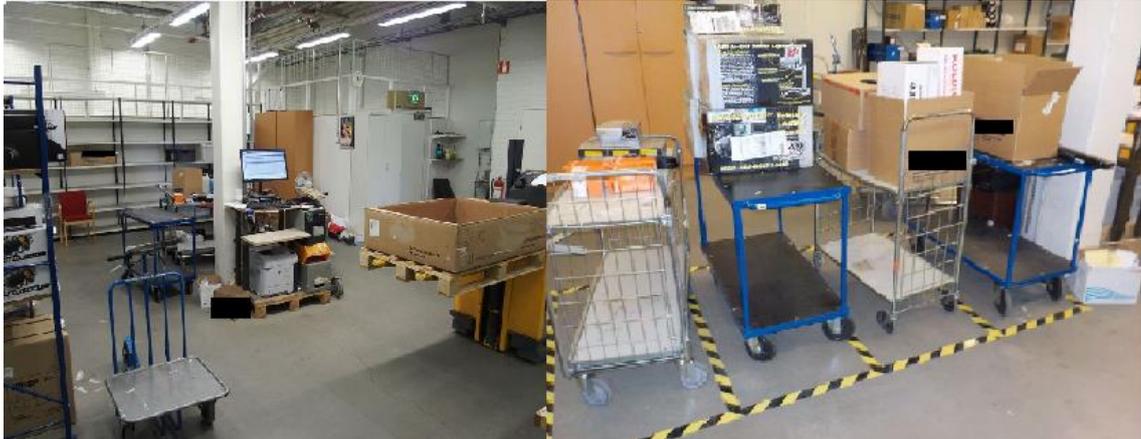


Figure 11. Before and after cash-and-carry 2

In the second figure from the cash-and carry area, the reader is able recognize that in first picture the carts are not organized and unnecessary items are located in the area. After picture describes the work implemented during the set in order phase, when the project members designed a parking area for the carts using special tape, now the carts can be easily accessed and all the employees know where the kick scooters and carts are located. This eliminated the time wasted in searching for these tools and enabled more working space in this small area.



Figure 12. Before and after packing material

In figure 12. the reader can see the changes made in the packing material shelf. Before implementing 5S, the packing materials were located in different locations. Now all the packing materials are located next to the packing area, so the employees working in the area, do not have to go searching for the materials any more. This also increased the safety measure, as the employees do not have to access the area, where other employees drive different warehouse machines. Now the person, who keeps inventory of the packing material, is able to see just by one look, which material is running out and needs to be ordered.

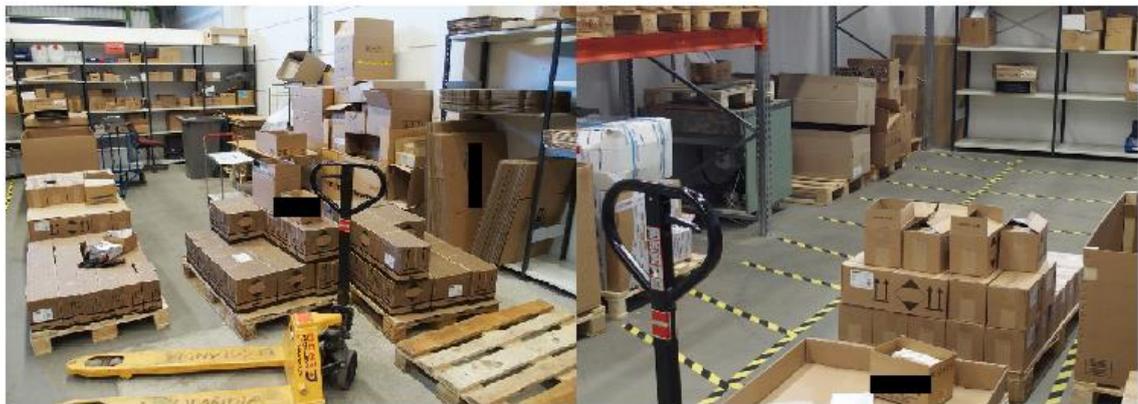


Figure 13. Assembly before and after

Figure 13. on page 29, describes the changes implemented in the assembly area. The project members used special tape to demonstrate where pallets are allowed to be placed and which areas should be left free from pallets and other items. Now employees have more room to work and move around in the work station, not to mention they are able to find material faster and easier.

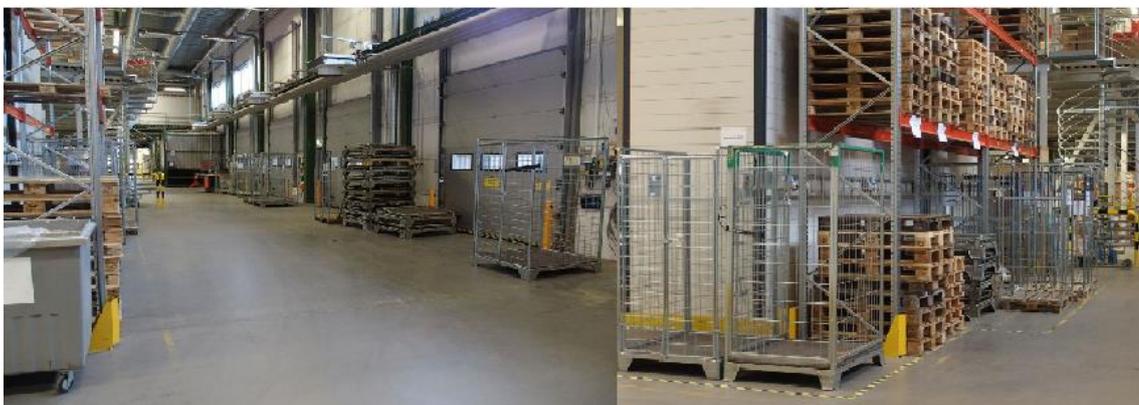


Figure 14. Departure area before and after 1

In the departure area a lot of changes were made. In the first figure (figure 14.) the researcher is demonstrating the usage of the departure area. All pallets and cages have been relocated and given a named spot, where they are easily accessible. This also opened a lot of free space for ready pallets that are waiting to be loaded in the truck. This also helps the transportation companies, when they bring new cages, since now each article has its own spot.



Figure 15. Departure area before and after 2

In the customer's warehouse there are 18 different transportation companies collecting orders daily. In total there are over 38 pallets and cages in the departure area. Before 5S, the area did not have any instructions on how to sort the orders on right pallets. During the 5S process, the project team came up with an idea to use colour codes for the different transportation companies. Now after the implementation process, there is 18 different coloured pallet slots, for all the different transportation companies (see figure 15 and figure 16). The project team also made a colour code sheet, where all the different colours are connected with the represented transportation company and the amount of pallets or cages there are for each transportation company. This visual management, is believed to decrease the amount of sorting mistakes.



Figure 16. Departure area before and after 3

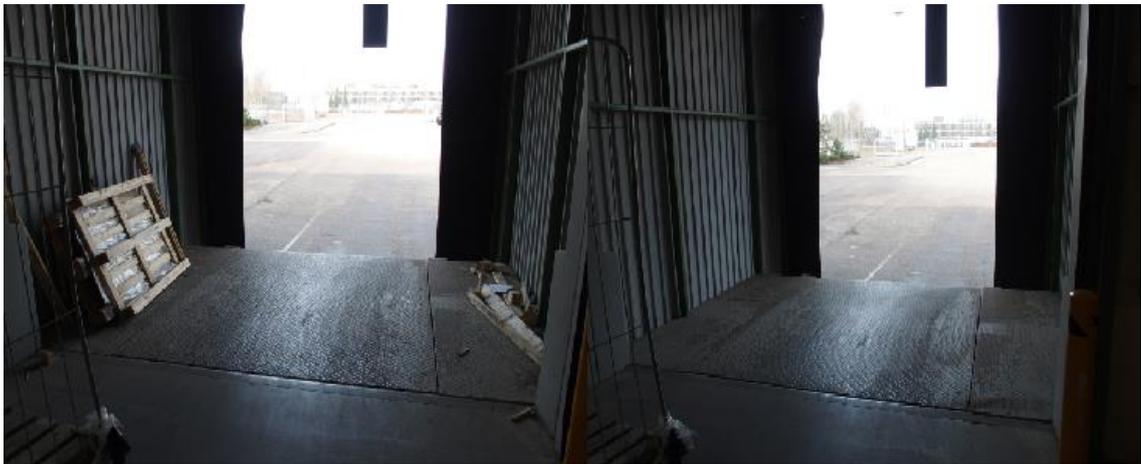


Figure 17. Loading platform before and after

All loading platforms were disposed of waste and cleaned thoroughly. This is the first impression the truck driver gets from the company, when they are coming to collect their orders. With simple sorting and setting in order, the customer now have clean, spacy and safer loading platforms.

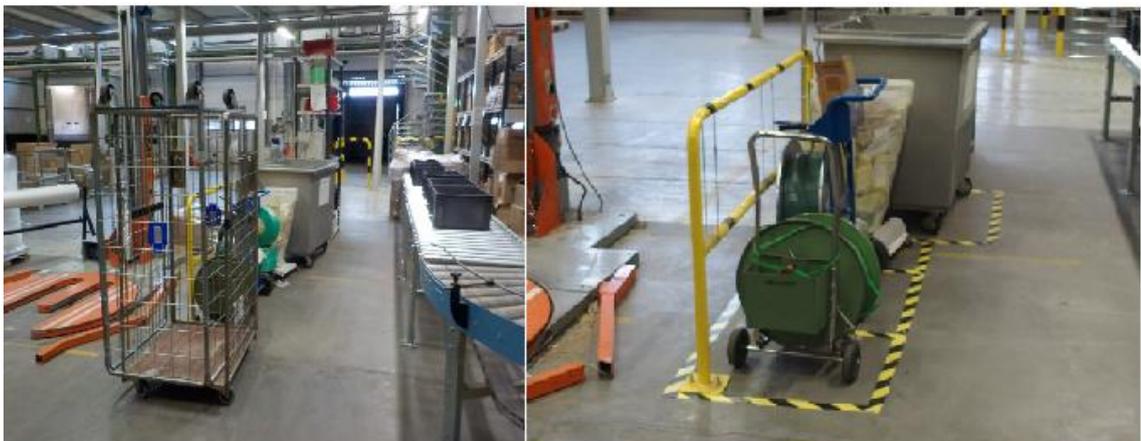


Figure 18. Acknowledgement area for pallets before and after

In the acknowledgement area for pallets only minor changes were made (see figure 18). Before the implementation of 5S there was unnecessary items in the area that did not belong there. Now as the picture demonstrates, the trash cans and other tools have set places and the other items are relocated into another place, freeing more space for the employees to perform their work.

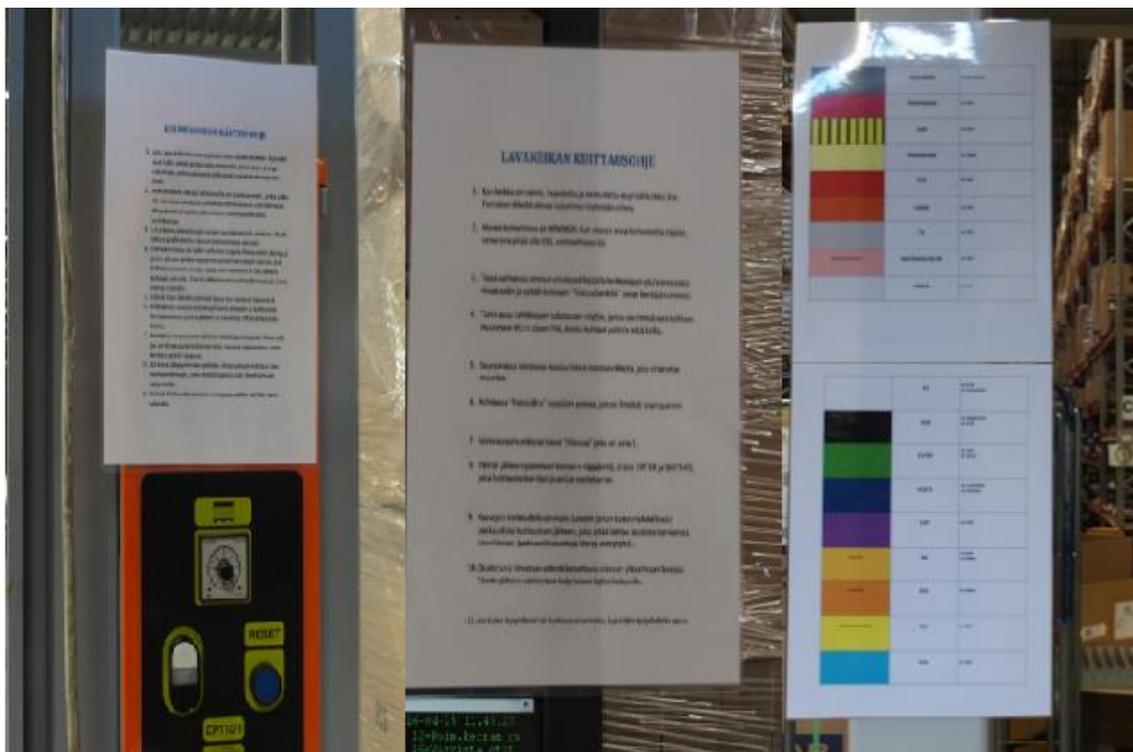


Figure 19. Instructions for work stations

As the implementation process was about to reach its end, the project team with the help of employees realized that there was no instructions in certain work stations that required them. Now after the implementing 5S, all the work stations that require instructions, has instructions. In the departure area there is colour code sheet for all the different transportation companies, instructions for acknowledgement of pallets and instruction for the use of plastic wrap machine.

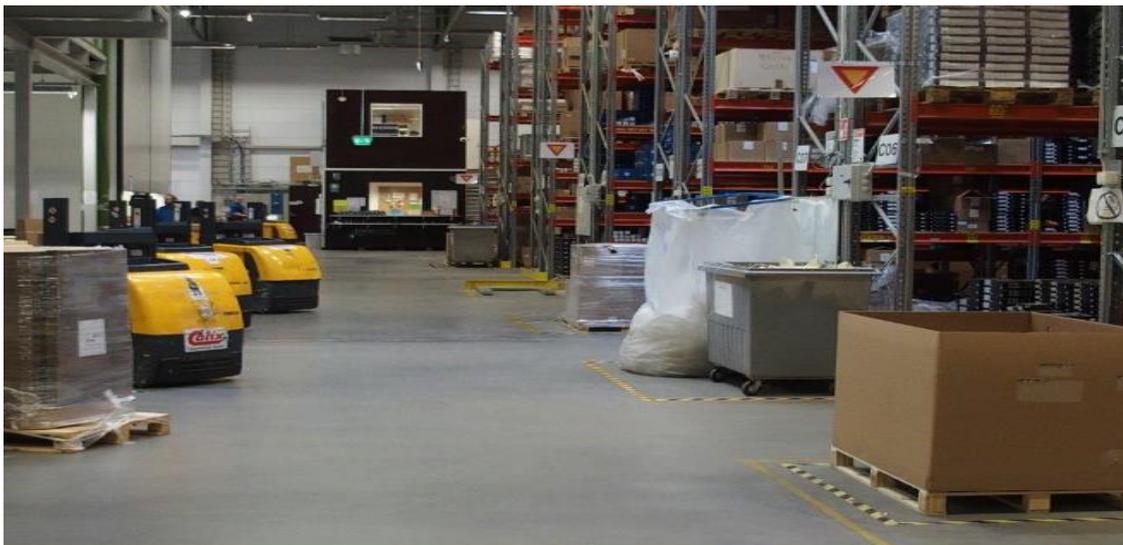


Figure 20. Traffic guidance

Also guidance was provided throughout the entire warehouse. Now there are set rules for the machines operating in the warehouse. These set rules minimize the risk of possible accidents that may occur.

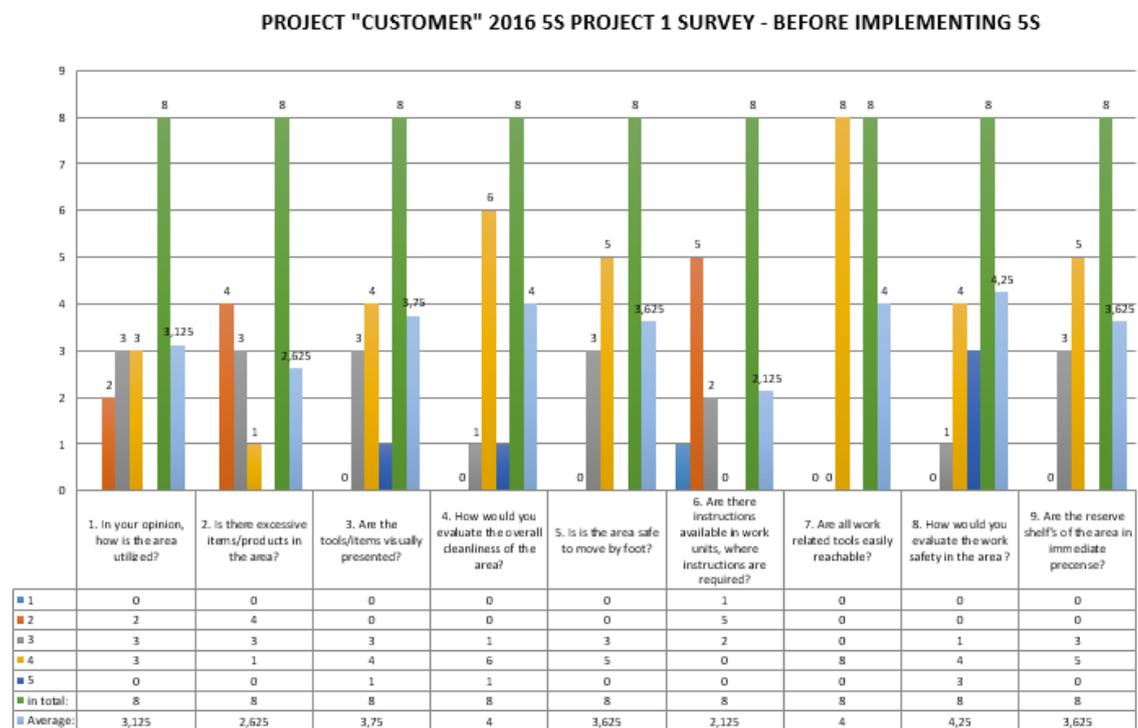
Even though the changes seem small, these changes have increased the overall safety and atmosphere within the organization. The work flow has become more efficient, as all the materials and equipment have their own, named spot. Due to the implementation of 5S, bottlenecks in the areas without instructions, has now been eliminated, together with reduced walking to complete tasks.

Transval Group has created an evaluation form to measure the maintenance of 5S (see appendix for the evaluation form). It is a simple tool called floor check. This tool is used once each month and the results are presented to all the employees. The evaluation form has all the areas and corridors of the warehouse listed. The evaluation form follows 11 different questions, which then determines whether the area is in shape or not in shape. If the area is not in shape, a short comment is required. After the floor check, the results are entered into Excel, which then calculates the percentage of approved and non-approved areas. The areas that are discussed in this project so far, has a current figure of 92%, which means the area is in great shape. This figure does not present the real percentage, since there is another area that is linked in the same category that has not been yet in the 5S implementation. If we ignore this area and

concentrate only in the areas, where 5S was implemented the actual percentage would be 100%.

4.5 5S employee survey

The researcher held two surveys for employees, one before implementing 5S and another one after implementing 5S. The respondents were randomly handpicked from different positions within Transval Group's and Customer's employees working in the facility. By analysing the results of the surveys, the project seems to have been a success.



(1= Unsatisfactory 2= Poor, 3= Satisfactory, 4= Good, 5= Excellent)

Figure 21. Employee survey – Before implementing 5S

The first survey was kept before implementing 5S into the Customer's warehouse. In both surveys eight respondents were asked to answer the survey. During both surveys, the response rate was 100%. There was nine questions in the survey and the rating scale was from one to five, one being unsatisfactory and five being excellent.

As the reader can see from the figure above (figure 21.) the green bar represents the number of respondents and the other colours represent the respondents' answers. The

total average of the “Before implementing 5S” –survey was 3.6. The employees seems to be satisfied with the overall cleanliness of the area, as it scores on average a 4, when on the other hand, employees consider that there are no instructions available in the work units, where instructions are required, since the score is as low as 2.12 on average. The safety measure is low considering that it is one of the most important factors in any work place. In the first survey, the safety factor when considering walking by foot in the area scored 3.6 on average, which is not acceptable, even though the work safety in the working area scores in total 4.25 on average. The respondents consider that there are somewhat too much excessive items and products in the area, as the score for this is as low as 2.6, this might also reflect to the safety measure. The overall opinion of how the area is utilized scores on average 3.13, which still leaves room for improvement. All respondents seems to be somewhat satisfied with the locations of the tools as they consider these are easily reachable. This question on average scores as high as 4 on average, followed with an average of 3.75 on the questions are the items and tools visually presented. The last question of the survey is about the reserve shelves, whether these are in the immediate presence and it seems this areas could also be improved, as the question scores just above the average, 3.62.

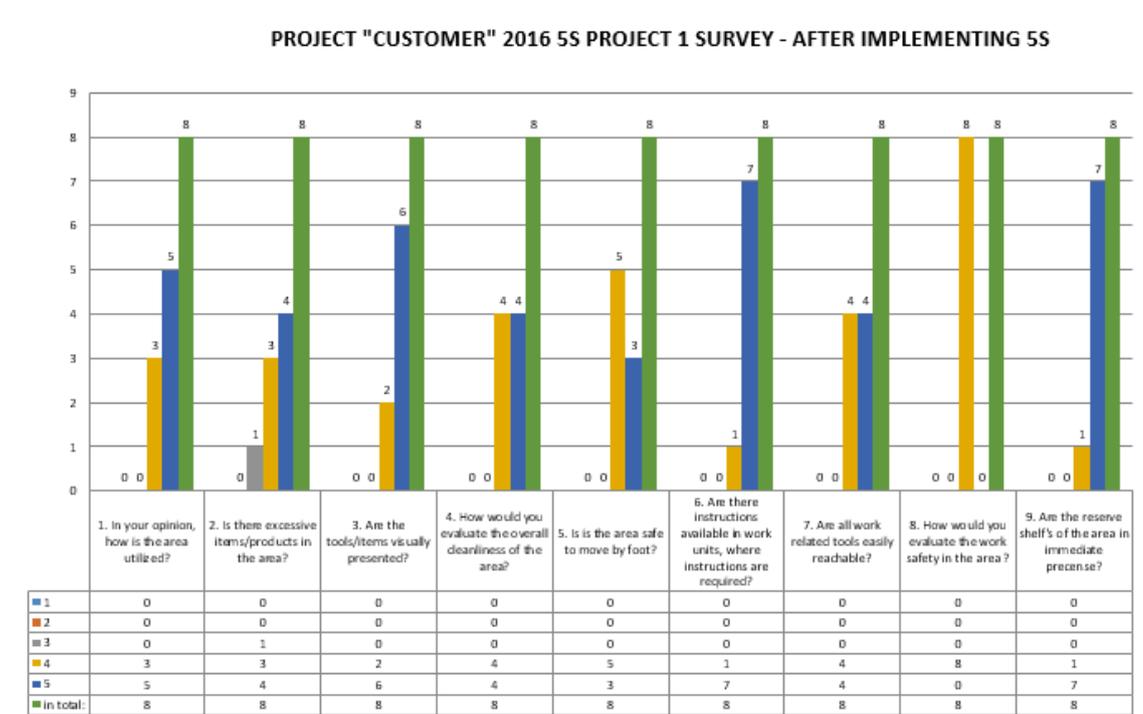


Figure 22. Employee survey – After implementing 5S

The figure on page 34 (figure 22.) shows the results of the respondents after implementing 5S. This survey was kept to the same respondents, to get as accurate results as possible. Like in the first survey, also in the second survey eight respondents, were asked to answer the survey and all respondents answered the survey. This means that the overall response rate for both surveys reached 100%.

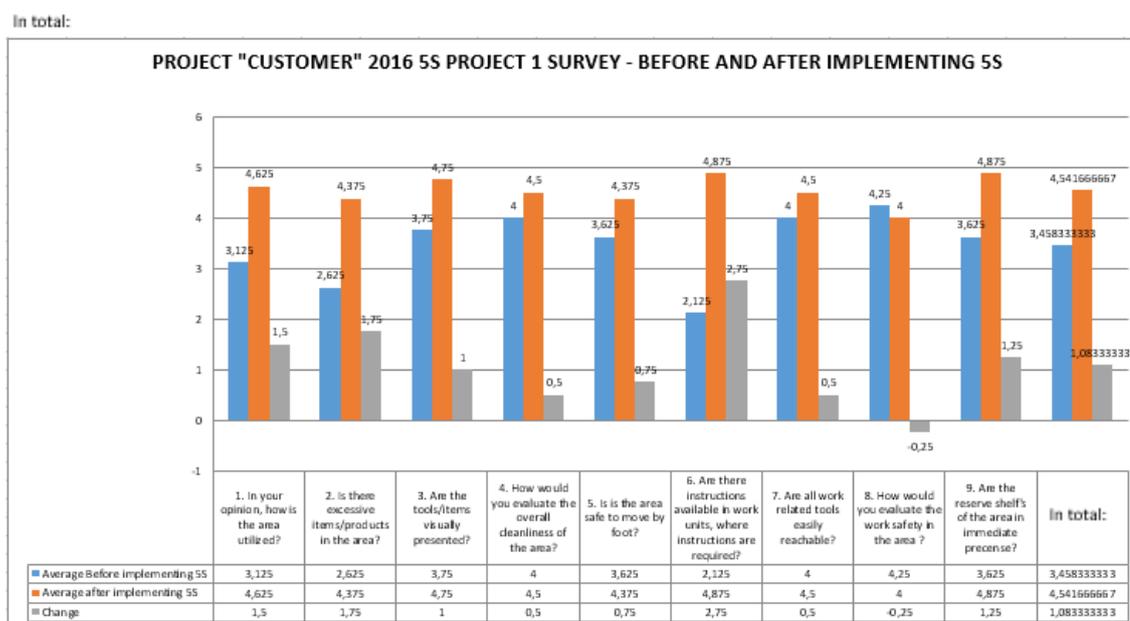


Figure 23. Employee survey – Comparison between before and after implementing 5S

The figure present the averages from both surveys, before and after implementing 5S. The orange bar presents the average after implementing 5S, blue bar presents the average before implementing 5S and the grey bar presents the change between the two surveys.

The total average of the first survey, before implementing 5S, was 3.46, when on the other hand, the total average after the second survey is 4.54. This means the change is positive. After implementing 5S the overall result increased by 1.08, which definitely demonstrates that the changes that were implemented during the 5S process, has received a positive reaction among the employees.

The most significant change is in questions six, are there instructions available in work units, where instructions are required. The change is enormous 2.75, which a significant increase. As the reserve shelves, were created and moved next to the packing area, the average increased by 1.25. This seems to have a positive effect on the safety

measure of moving by foot in the area, as this has also increase by 0.75. The average now is now 4.38, which is way better than it was before. The safety on the area question, however has decreased by 0.25, but still remains as high as 4. These figures related to the safety measure are acceptable now, as considering warehousing that include a lot of moving machines and heavy lifting. This still leaves room for improvement for the future, as 5S is part of continuous improvement.

5S has definitely worked, as the respondents consider that there is only very low amount of excessive items and products in the area. In the first survey the average was only 2.63, when in the second survey the average had increased up to 4.38, meaning there is a positive change of 1.75.

Overall, all the areas improved, except the work safety in the area decreased by 0.25. This means that the safety measure should be still focused and worked on afterwards, but the overall improvement before implementing 5S and after implementing 5S, clearly states that the project has succeeded.

5 Conclusion

The main goal of the thesis was to implement 5S into Transval Group's Customer's warehouse and to measure the success of the project. In addition, for the researcher, to gain more knowledge about lean, moreover 5S.

The actual 5S project began in the beginning of February and the researcher has been strongly involved in the project and the implementation since. The overall process went well, even though the schedule did not leave much room for delays, the project team managed to complete all tasks on time. The project organizations were formed in a way that as many employees, as possible, were able to be involved, both from the Customer's, as well as Transval Group's behalf.

A lot of valuable and important observations were made during the process and many of them were implemented in order to have a complete 5S environment. The area, in which the implementation was taken into action, was already clean, most of the issues were related to organizing. For now it seems 5S became a part of employees' daily working habits, but it is still too early to state this for sure, as only the first sub-projects are complete. Some employees and other staff members still, so to say, are somewhat against the idea of 5S, which is of course understandable. However, the possibility of ignoring the changes and going back to the way it was before, still appears.

The changes that 5S brought, according to the survey, was mostly positive. None of the areas reached the total score, but the improvement was remarkable in each area. The survey was given only for eight respondents, which of course does not give a thorough opinion of the entire staff. The most remarkable change was related to guidance and instructions. This factor increased by 2.75 from the survey held before, which proves that the respondents are satisfied with the instructions. However, the overall safety measure decreased from the survey held before and the survey held after, by 0.25. The safety is the most important part of any working environment, so there still remains room to improve. Now that the employees are getting more familiar with the concept of 5S, improvement ideas are more likely to arise.

On the researcher's opinion, he gained a great amount of knowledge about lean, especially about 5S. The best way to learn, is to learn by doing. This action based research

definitely helped the researcher to understand the different concepts of lean and the meaning of involving employees in such projects.

All in all, the overall success of the project was really good. Some areas still need improvements, but that is what lean is about, continuous improvement.

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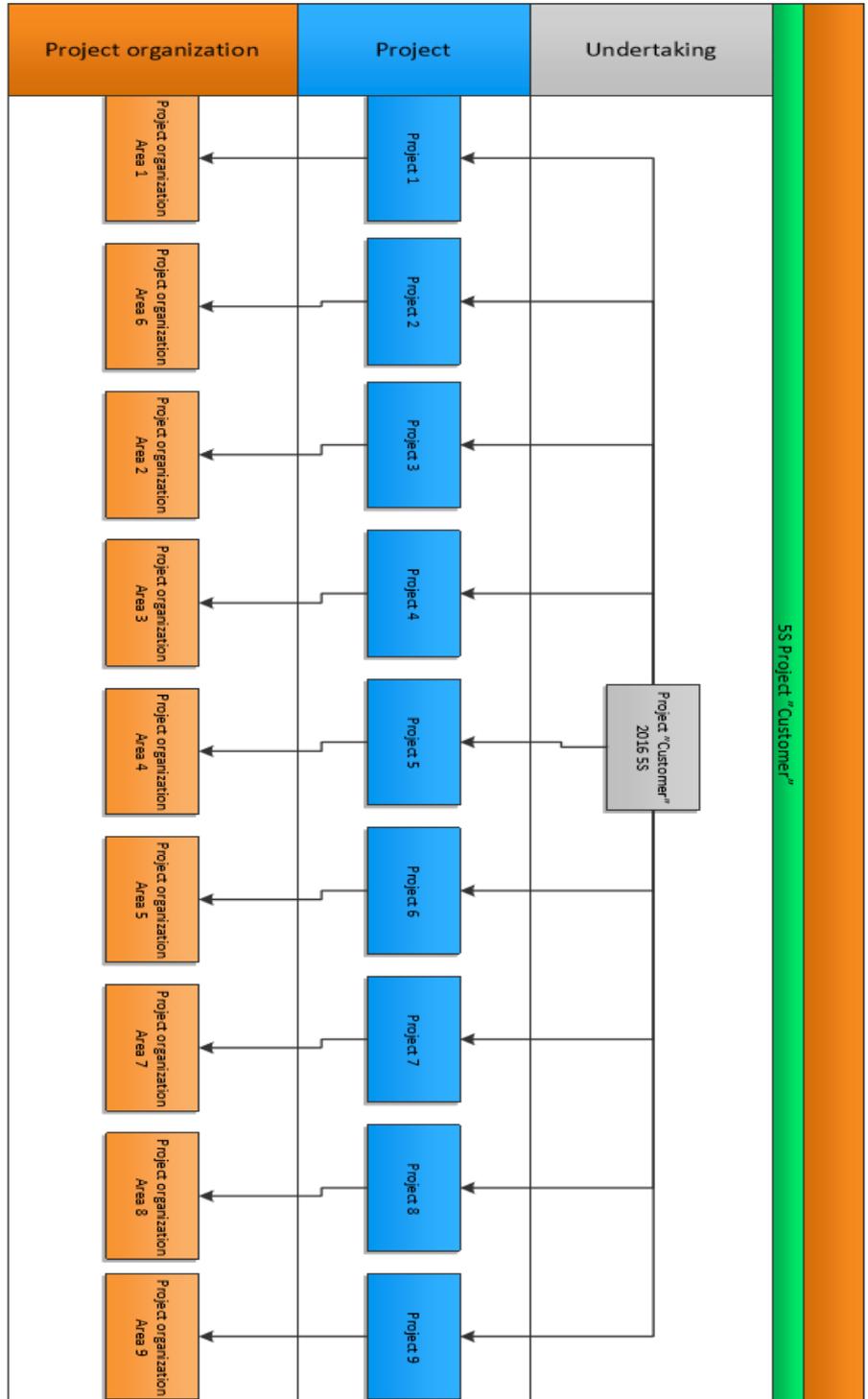
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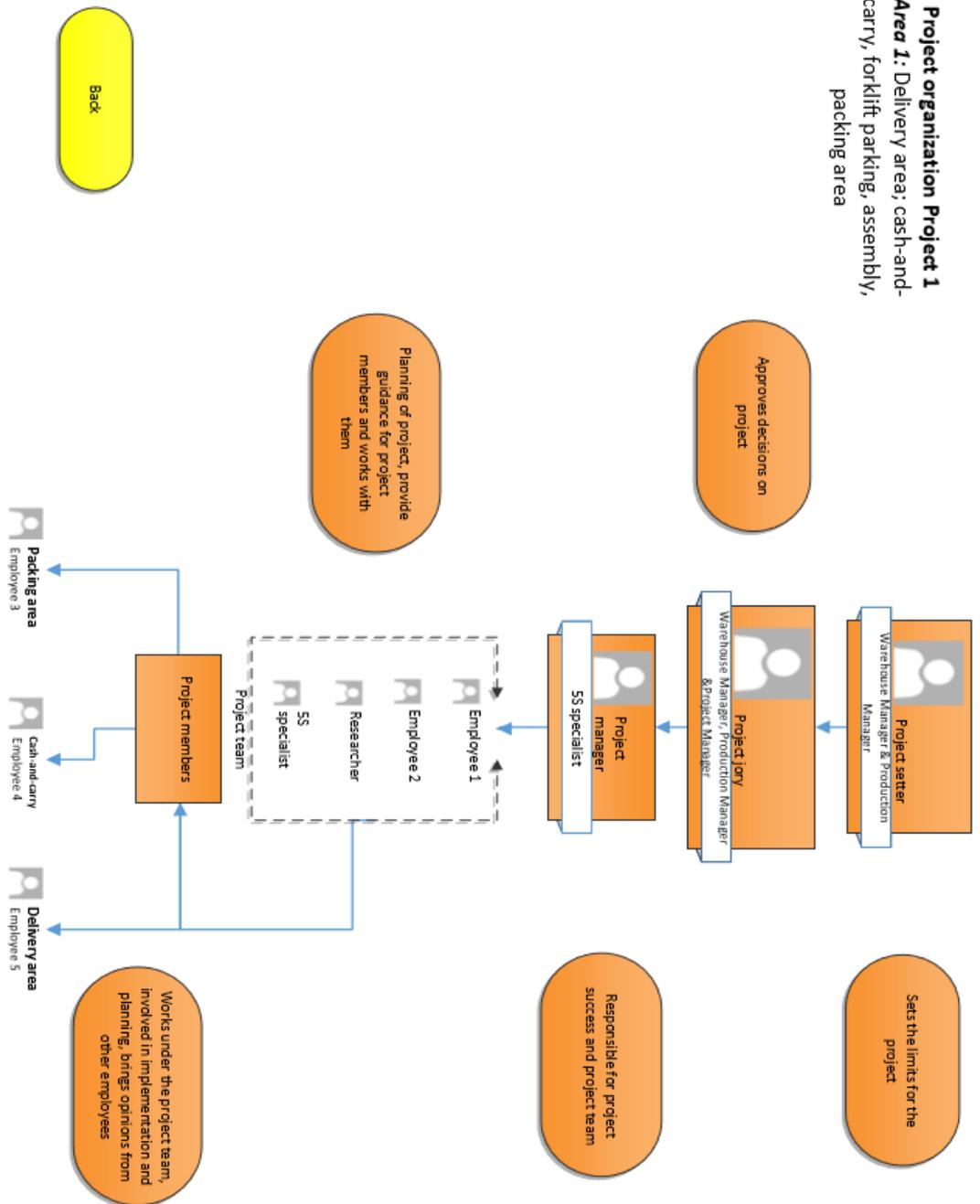
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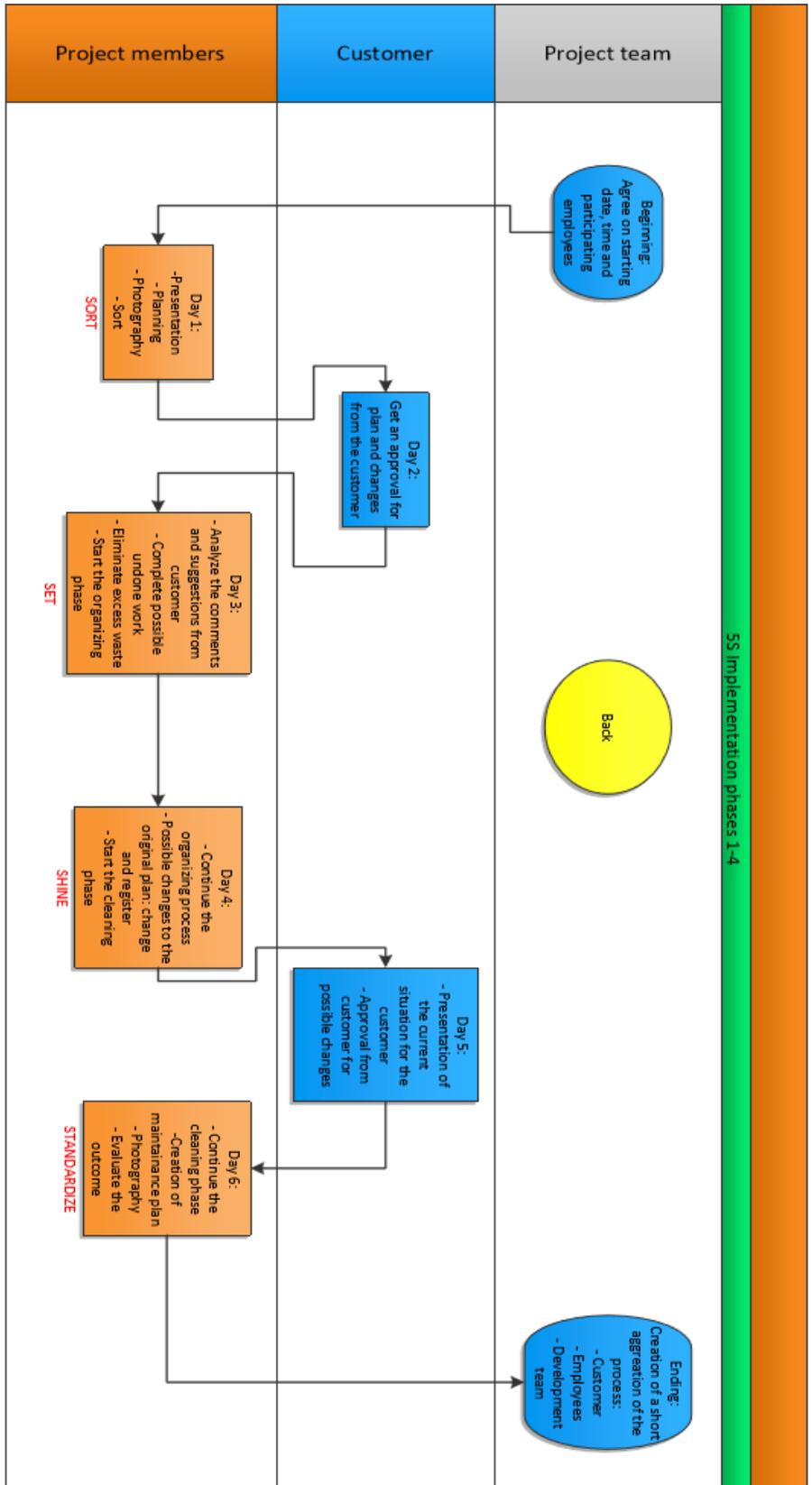
Project "Customer" 2016 5S



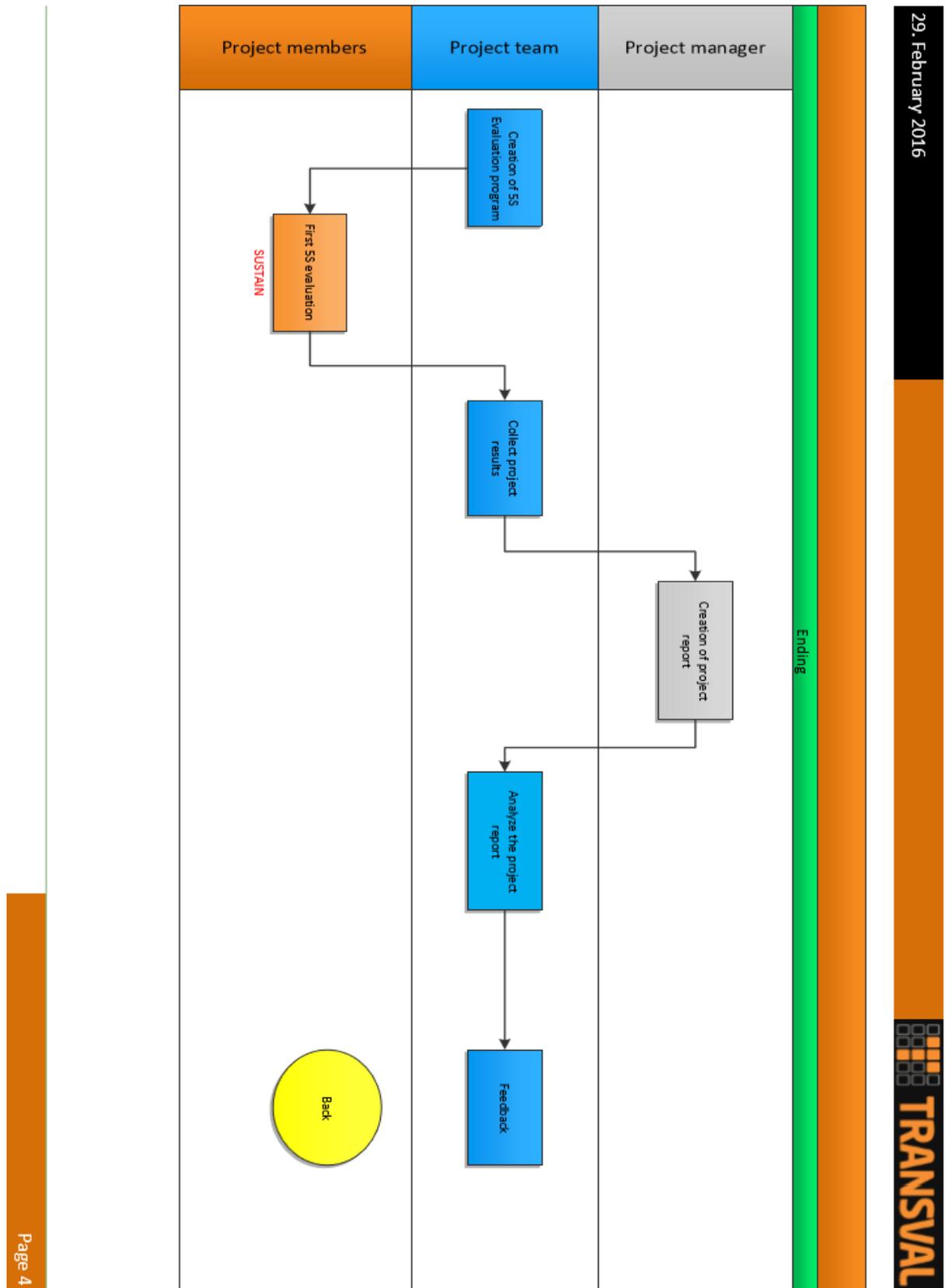
Project organization Project 1
Area 1: Delivery area; cash-and-carry, forklift parking, assembly, packing area



5S Implementation: Phases 1-4



5S Implementation: Ending Phase



Before and After Survey

"CUSTOMER" 2016 PROJECT 1 SURVEY - BEFORE/AFTER SURVEY					
(1= Unsatisfactory 2= Poor, 3= Satisfactory, 4= Good, 5= Excellent)					
	1	2	3	4	5
1. In your opinion, how is the area utilized?					
2. Is there excessive items/products in the area?					
3. Are the tools/items visually presented?					
4. How would you evaluate the overall cleanliness of the area?					
5. Is is the area safe to move by foot?					
6. Are there instructions available in work units, where instructions are required?					
7. Are all work related tools easily reachable?					
8. How would you evaluate the work safety in the area ?					
9. Are the reserve shelf's of the area in immediate precense?					

T5 Evaluation Form



T5 Arviointi kaavake

Alue	Päävarasto		Selvitys
	Kyllä	Ei	
Laatikoiden teko alue	X		
D2	X		
D3	X		
D4	X		
C/D5		X	Pahveja
C/D6		X	Styroksia lattialla ja laatikoita ulkona hyllystä
C/D7		X	Pakkausnauhoja lattialla (pantoja)
C/D8		X	Tavaraa lattialla
C/D9	X		
C/D10	X		
C/D11		X	Tyhjiä pahvilaatikoita
C/D12		X	Roskia + pahveja lattialla
C/D14		X	Pahveja ja muoveja
D90		X	Muoveja & sekaisia keruupaikkoja
D91		X	Muoveja & sekaisia keruupaikkoja
D92		X	Pahveja ja muoveja
D93	X		
K23	X		
K24	X		
K25	X		
K16	X		
K17		X	Muoveja
K18		X	Roskia
K19	X		
K21	X		
Yhteensä	13	12	52 %

Alue	Pientavara		Selvitys
	Kyllä	Ei	
Laatikoiden teko alue	X		
A1-10	X		
A11-20		X	Tavaraa lattialla ja laatikot ulkona keruupaikoilta
A21-30	X		
A31-40	X		
A41-50		X	Roskia
B1-10	X		
B11-20	X		
B21-30		X	Tavaraa lattialla ja pahveja
B31-40	X		
B41-50	X		
M1-10		X	Roskia + tyhjiä laatikoita
M11-20		X	Pahveja
M21-30		X	Tavaraa lattialla
M31-40	X		
M41-50	X		
Yhteensä	10	6	63 %

Huomioi seuraavat asiat
Onko kulkuväyillä liikkumista haittaavia esineitä tms?
Esiintyykö tilassa turvallisuutta vaarantavia öljyvuojoja, irtojohtoja, roskia tms?
Ovatko pinnat, työpöydät, seinät jne siistejä, vapaita pölystä ja ilasta
Ovatko silvovälineet helposti saatavilla?
Ovatko kaikki varotusmerkinnät, palkoilleen laitettut ohjeet tms. siistejä ja helposti luettavissa?
Onko tilaan varastoitua säilytettäväksi sinne kuulumattomia tavaroita?
Onko kaikille työkaluille, tavalle ja pakkausmateriaaleille selvä sijoituspaikkansa käyttötarpeen mukaan?
Ovatko kaikki edellä mainitut kohteet suunnitelluilla palkoillaan?
Näyttääkö siltä, että silvovälineet on säännöllistä ja / tai tapahtuu aina tarpeen vaatiessa?
Onko kaikilla työvaatteet päällä ja ovatko ne asian mukaiset?
Ovatko alueen kaikki työkalut kunnossa?



T5 Arviointi kaavake

Alue	Koukku		Selvitys
	Kyllä	Ei	
Pakkaamo			
K05			
K06			
K07			
K08			
K09			
K10			
K11			
K12			
K13			
K14			
K15			
K20	X		
D34	X		
Palovarasto		X	Roskia
Yhteensä		2	1 67 %

Alue	Muut		Selvitys
	Kyllä	Ei	
Vastaanotto	X		
P-Parvi		X	Roskia + pahveja ja lavoja
Kokoonpano	X		
Tornado 9	X		
Tornado 6	X		
Radiohäkki	X		
Palautusparvi	X		
Noutopiste	X		
Pakkaamo	X		
Lempausalue	X		
Taukuhuone 1	X		
Taukuhuone 2	X		
Yhteensä		11	1 92 %

Huomioi seuraavat asiat
Onko kulkuväyliä liikunnasta haittaavia esineitä tms?
Esilntyykö tilassa turvallisuutta vaarantavia oijyvuojoja, ltojohtoja, roskaa tms?
Ovatko pinnat, työpöydät, seinät jne siistejä, vapaita pöytystä ja laasta
Ovatko silvovsäilneet helposti saatavilla?
Ovatko kaikki varoitusmerkinnt, palkollieen lalltetut ohjeet tms. silistejä ja helposti luettavissa?
Onko tilaan varastoitu säilytettäväksi sinne kuulumattomia tavaroita?
Onko kaikille työkaluille, tavolle ja pakkausmateriaaleille selvä sijoituspaikkansa käyttötarpeen mukaan?
Ovatko kaikki edellä mainitut kohteet suunnitellulla paikallaan?
Näyttääkö siltä, että silvouis on säännöllistä ja / tai tapahtuu aina tarpeen vaatiessa?
Onko kaikilla työvaatteet päällä ja ovatko ne asian mukaiset?
Ovatko alueen kaikki työkalut kunnossa?

Assessment for Researcher's Thesis Work on Site



ASSESSMENT FOR MR NIKO IMMONEN'S THESIS WORK ON SITE

Mr. Immonen has gained an outstanding knowledge on 5S as a tool in wider concept of lean. He also understands possibilities of lean in making various processes more efficient. This means of course, in warehouse environment, finding a balance between flow and resource efficiency.

Mr. Immonen also commands good skills in project work; planning, managing and reporting. He always presents himself in a professional and courteous manner and is able both leading a project team and working in a team as a member.

I would not hesitate to put him in charge of similar, or even larger scale projects in the future.

Yours Sincerely,

Juha Piirainen

Lean Specialist

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