



# Bacheloroppgave

**SCM600 Logistikk**

**Case study in Molde municipality - implementing 5S in the storage of personal aids.**

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**Totalt antall sider inkludert forsiden: 47**

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## **Abstract**

This report examined the personal aid storage facility of Molde municipality.

The problem setting is to examine if 5S Lean tool is applicable to the personal aid storage and if has an effect in waste reduction. The method of conducting our experiment is to perform a single case study of one chosen zone. The findings are that over 50 % of the items in the chosen zone is classified as waste, and another 37 % of the items are classified as usable items that have been moved to a different part of the storage facility.

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## 1.0 Introduction

A storage of items is a part of a supply chain of products and services, all aimed to cover a demand for the end user. The principle of storage of personal aids is to have the item in demand close to the patient when it is needed, and to keep the usable items after the end user is finished with the aid. If the storage is not functioning there will be a disruption in the supply chain, and the personal aid needed cannot be delivered as planned. To have a functioning storage facility, the prerequisite is to be able to know what is stored, to have an appropriate number of items stored, and to be able to quickly find the needed item.

This bachelor thesis will look at the benefits of waste reduction from implementing 5S in the storage of personal aids. Waste is a broad term that can be examined from different perspectives. For example, to have too many items stored is a waste because we are using too much space to store aids not being used. Another example of waste in the storage facility is items that are broken and not being repaired. Yet another example is older aid-models that are no longer compatible with the aids being used today.

Our bachelor thesis will be based on the following research question:

How can 5S' Lean tool contribute to waste elimination at Råkhaugen Storage Facility?

The storage of personal aids was initially not a subject the authors of this thesis considered when choosing the topic of bachelor thesis. By chance, one of us knew one of the employees working in the project "Smart distribution of personal aids" in Molde Municipality. When speaking about the subject of warehouse management it was mentioned that the storage situation in Råkhaugen Care Facility (hereafter referred to as the storage facility), where most personal aids in Molde municipality are stored had challenges in space, systems and the volume being stored. The goods stored are personal aids. Personal aids consist of a variety of items such as e.g.: wheelchairs, special cushions, support handles, ramps, visual aids, beds, digital aids, and hygiene aids such as shower chairs and toilet chairs.

The more information we received about the project and the challenges they were facing, the more we felt that our knowledge could contribute to a better storage. Knowing that we might be contributing to giving better solutions to patients and improving the societal benefit was one of the reasons we made the decision to write this thesis.

We were invited to visit the storage and could see the challenges with our own eyes. We were also informed about the ongoing project of “Smart distribution of personal aids” being developed by Molde and Kristiansund Municipalities, with the aim to implement an ERP system in the personal aids administration. Implementing this system will also set some new assumptions, as every item in the storage would have to be categorized and registered.

It was even more clear that the storage needed better systems to be optimized. As we saw the storage with our own eyes, we clearly could see that implementing the 5S Lean tool in the storage could give better working conditions for the employees and a more streamlined storage. The focus of LEAN/5s is to eliminate waste and to create a system that gives a good overview and proper work environment for the employees. Our first impression was that the storage was overfilled, and with a lot of different items covering the same demand at the user. There were also many different models of the same item. This impression was also confirmed with the fact that Molde Municipality had shipped several trucks with excess aids to Ukraine in 2022.

The findings of this thesis shows that over 50% of the items stored in the warehouse in Zone B can be classified as waste.

This bachelor thesis will describe the problem setting and the description of the case, before focusing on the relevant theory and literature on the subject. We then will describe the methods used for finding our data, before analysing and discussing our findings. The last chapter is where you will find the conclusions.

## 2.0 Case description and problem setting

### 2.1 Case description

The case is based on the personal aid warehouse of Molde municipality at Råkhaugen care facility. The warehouse has an issue of overflowing amount of items, and poor control of what items was stored in the storage facility. Due to the high amount of items the municipality feels a need for expanding the capacity of the storage and has decided to move the warehouse to a new location at Bergmo.

The storage facility is storing all personal aids for Molde Municipality, but the municipality also has satellites in Midsund care facility and Nettet Health house, as well as a remote storage for large items, like beds that are not collapsible.

In our case we are only looking at Zone B as shown in figure 1, which is the area for soft aids and some bigger items, we have highlighted the items stored in zone B in **bold** in the following table.

Table 1- Items stored in the facility.

Category	Item	Additional items
<b>Chairs</b>	Shower chairs Toilet chairs Wheelchairs Office chairs	Handrails Handrails and lids Arm rests, neck rests, winter tires, spare parts
<b>Cushions</b>	Air cushions Memory foam cushions Padded cushions	Hygienic covers
<b>Beds</b>	1-2 pieces (the rest is remote stored) Bedside tables	Self-aid for getting up, iPad/Phone holder, bedrails, headboards, spare parts
<b>Mattresses</b>	Memory foam Styrofoam Air mattress (w/compressor) Soft/blanket mattress	Hygienic mattress covers
<b>Digital aids</b>	Safety alarms Routers Medicine dispenser	Information pamphlets
Constructional aids	Ramps Railings	Spare parts
Walking aids	Walkers	Spare parts

Reaching aids	Pinching/grabbing tools	Spare parts
<b>Visual aids</b>	Magnifying glass Lights	Spare parts
<b>Personnel lifters</b>	Harnesses for different positions and sizes.	Spare parts
Safety aids	Key boxes	

## Storage facility – By Zone

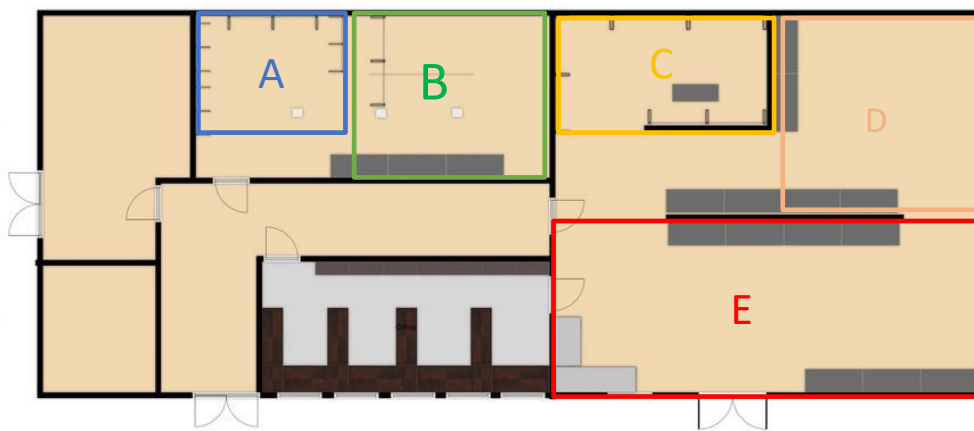


Figure 1 – Showing the organization by zone.

Table 2 - Contents in zones

Zone	Items
A	Receiving aids from NAV and assembling them for the end user
B	Soft aids, cushions, and mattresses. Beds, bed aids, personnel lifters, tables, visual aids, digital aids
C	Hygiene aids, ramps, railings, and items not yet tagged/registered in the digital twin.
D	Walkers and office chairs
E	Wheelchairs, spare parts for wheelchairs.

The zones do have different activities within them, some being only storage, and some also include assembly and repairs.

# Storage facility – By use

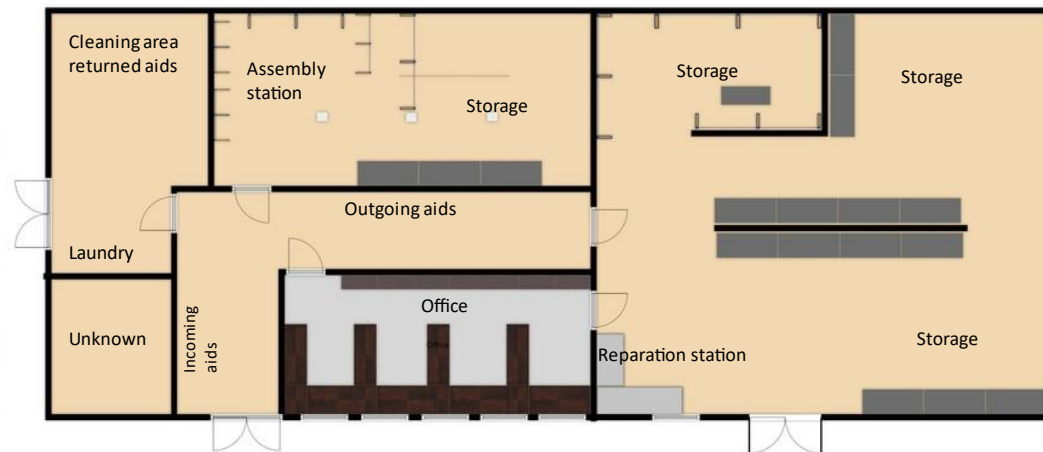


Figure 2 - Organization by activities

The supply chain for personal aids is pull based, where the patient orders the needed item, either from the personal aid warehouse of Molde municipality directly or via a therapist or from NAV. If the item is ordered from the personal aid warehouse or the therapist, the item will either be collected from storage or ordered and delivered to the customer. If the item is ordered from NAV, then NAV will order the aid and sent it to the personal aid warehouse. At the personal aid warehouse the item from NAV will be assembled and prepared for delivery and usage.

All items that are delivered to the patient will at some point be returned to the storage facility, either to be stored or to be returned to NAV. The tradition has been to keep all aids available at the storage facility because they might come in handy later. Because of this the warehouse is slowly being filled with items that is more or less needed. There is no statistics collected regarding any real demand. Therefore, the amount of each item is solely based on guesswork and availability of space.

We chose to analyse the storage of personal aids because it will have a value to our local community as well as giving us valued experience in implementing 5S and a look into warehouse management.

The case is to reduce types of waste in the warehouse. Our choice of approach to deal with the issue is to apply 5s to a specific zone in the warehouse that we consider to be representative of a substantial portion of the warehouse.

### **2.1.1 Problem description**

*The storage of personal aids in Molde Municipality is not ideal (Tangen, 2023).*

The statement above was the first we received from one of the project managers in the Smart Molde project.

The Smart Molde project has initiated the Smart Personal aids project, and in this context they had discovered that the storage facility could be an issue for going forward with the Smart Personal Aids project, because to implement an ERP system for all personal aids will require a precise overview of the inventory and a routine to continuously update and handle the implemented systems. The bottleneck effects that was visible to us was longer lead times, as they did not always find the aid required, and therefore they would order one more. Bigger workload for employees, causing more time used per task, totalling less tasks being done. The employees had to move aids around to find the required aid and use more time to look for aids. The storage is also filled in some areas/categories, and this prevents the personal aid management to order new models or other models, this is caused by storing old models, or models not compatible with the newer models being used today.

Smart Personal Aids Project is a

A digital solution (ERP System) where all involved parties in the process of distributing personal aids could easily find available personal aids and reserve them in the system. A therapist should be able to see what aids are available in stock, before deciding if there is need for ordering a new one, or they have something that is usable in stock. Employees in the storage facility should always know what is stored in their facility.

Today, the only way to know what is stored is to physically check in the storage, around the location it is supposed to be stored or the place the item was last seen. If a therapist or

an institution needs a personal aid, they call or email the employees at the storage facility, and they must go in the storage and look for the item.

As a part of the Smart Molde/Smart Personal aids there is created a digital twin of the storage facility, as a step in implementing a new system, but as of today this is not fully in use and implemented.

When arriving at the storage location it was not clear how the items was stored and organized. It seemed random, with items being stored on the floor or wherever there was free space.



*Figure 3 - Illustration of Zone B before starting the experiment.*

There has been attempts to organize the storage in the past, based on the observation of markings on the floor and the naming of the zones A-E. The zones are not named in accordance with the ABC sorting theory, where the sorting criteria is based on frequency of use, as opposed to sort items by categories, which is the system in the storage facility as of today.

In our preparatory meetings we were informed that there was an employee with a logistic background, but he was not employed there anymore. Both project manager and operation manager expressed that they did not possess the skill to maintain any known theory in storage management, where the zones are categorized by frequency of use.

### **2.1.2 Storage facility objective and organization.**

We will in this paragraph describe the challenges the storage facility faces, but to do this we will first describe the organization of the storage.

## Storage objective

The storage for personal aids in Molde municipality has these objectives:

- A. To receive personal aids from NAV Ålesund, (hereafter referred to as NAV) and to assemble and deliver them to the end user.
- B. To store an inventory of aids for use in the municipality and deliver these to the patients decided by therapists and institutions.
- C. Tasks that have been implemented or assigned over time.

## Process description – Ordering an aid.

In the span of a workday the employees have many tasks, and they will not always be planned. The process of an aid being assigned can be described as the following chart. In this example we are describing an aid being ordered through a therapist. For short term aids some users will contact the storage facility directly.

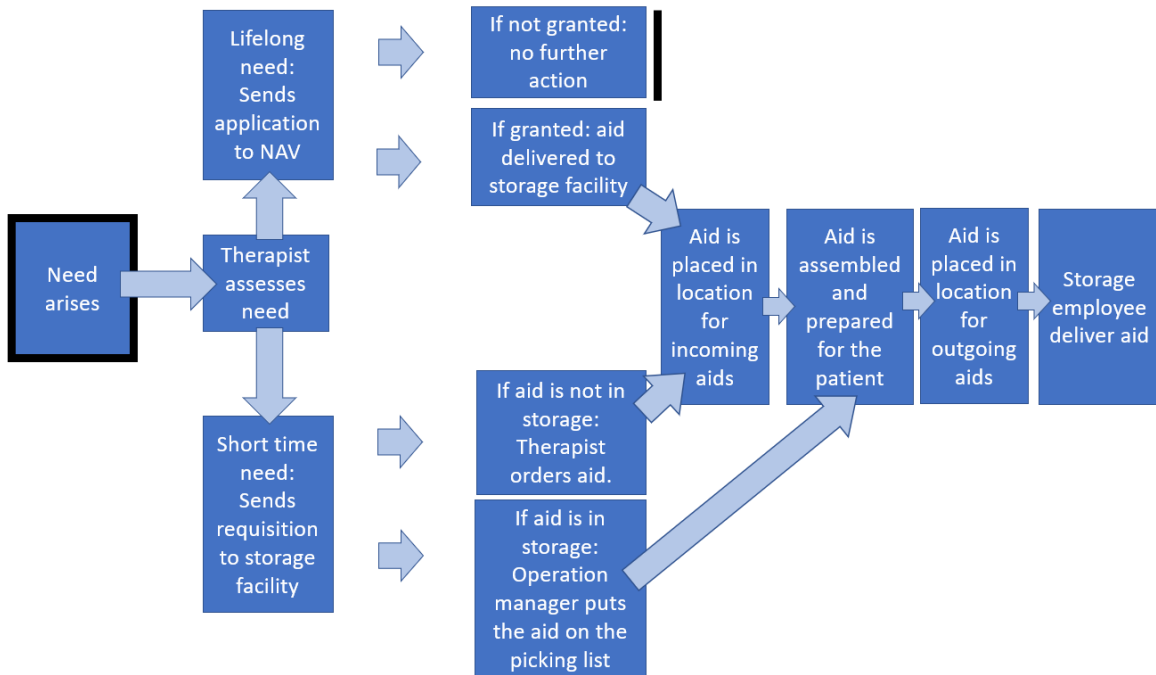


Figure 4 - Flowchart of acquiring a personal aid.

## Process description – returning aid.

In addition to delivering aids out, they also manage the return of aids when the patients no longer have the need for them, and either return them to NAV or to store them for a future patient.

The first step is the storage facility, where the aid is assessed, if it is in good condition the sorting conditions are as follows:



- If the aid is personalized, adapted to one person it is to be returned to NAV.
- If the aid is standardized it is to be stored.

All incoming aids will be cleaned before storage or return.

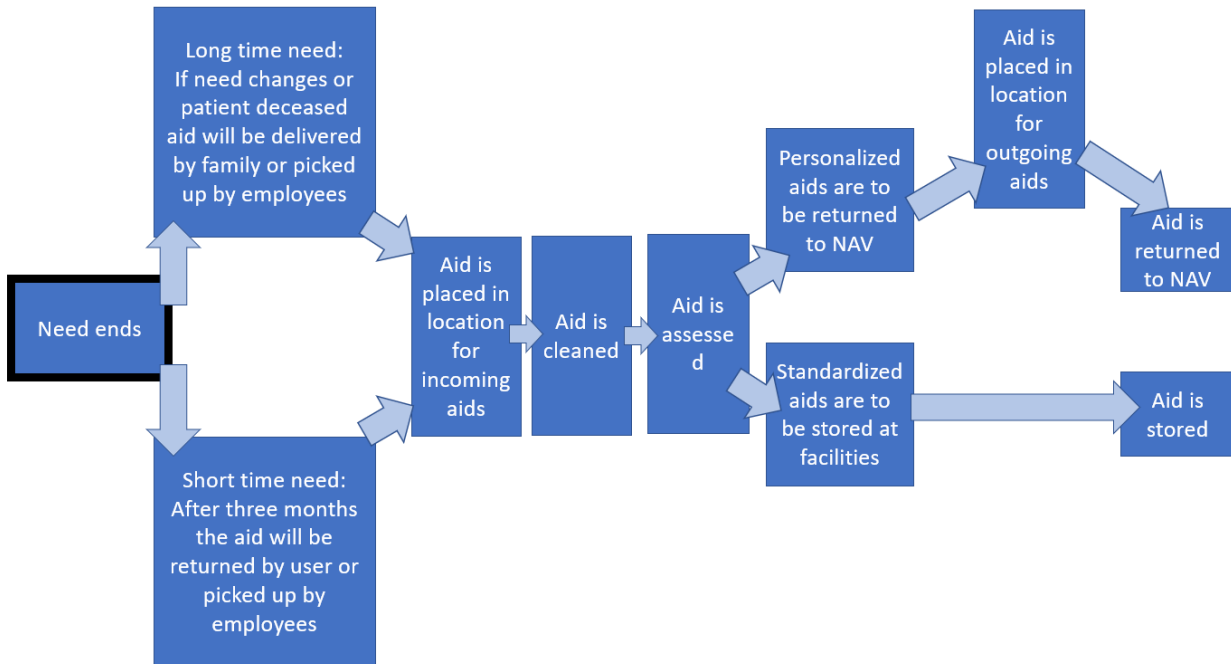


Figure 5 - Flowchart of returning a personal aid.

In both cases described above, there are challenges, both to execute the actions described in the figures, but also to assess the aids and not to store more than what is necessary.

There are several reasons for this, and we have tried to categorize them in the following paragraphs:

### **Implementing the Smart Molde /Smart Personal Aids projects**

The storage facility would function in today’s state, if there were no plans to implement the Smart Molde/Smart Aids project. Starting this process uncovered some challenges in the system that needed to be solved before collecting the benefits of the projects. Finding an ERP system that will keep track of all items stored and items being used by patients is one of the main goals for Smart Personal Aids, but they have had challenges finding a system that can manage the return of aids.

When the right system is chosen the inventory must be registered in the system, and to do this successfully it is necessary to have an efficient storage.

## **Information flow**

Information between the different operators in the handling of personal aids is a prerequisite for success. There are many levels involved making it more challenging.

### **NAV/Municipality**

One of the biggest challenges present today is the communication between NAV (state level) and Molde Municipality (Municipal level). Today, NAV cannot inform the storage facility of the aids being delivered. Therefore, the employees described it at “Christmas eve” every Wednesday when the truck from NAV arrived.

### **Therapists/Storage facilities**

When therapists order aids, it is often a similar, but different version of the ones stored in the storage facility. Some kind of standardization of models in use would make the process of storing and re-using aids easier.

### **Internal in personal aid distribution**

As we have mentioned earlier, there is a strong culture in the organisation that has developed over many years. As a new structure of the work processes is to be implemented by the “Smart Personal Aids Project” both the formal and informal communication and information flow could be a challenge to efficiently make the changes.

## **2.2 The problem setting**

A functioning storage facility is a prerequisite for effective functioning of downstream personal aids supply chain.

After the initial communication with the municipality the following criteria was identified as important for the warehouse manager:

- A storage that has the models being used available.
- A storage that has the right amount of items available, to what the demand is.
- A storage where it is easy to find the items you are looking for.
- A storage where it is easy to know what is stored.

The observations conducted during this thesis suggests that the storage facility does not fulfil these targets, meaning that implementing 5S will eliminate waste at the storage facility.

The problem setting that we want to look further into is:

How can 5S' Lean tool contribute to waste elimination at Råkhaugen Storage Facility?

## **3.0 Theory and relevant literature**

Based on the above presented case company problem and the formulated research question the following theoretical concept we will be presented in this chapter: warehouse management and Lean concept with the focus on 5S Lean tool.

### **3.1 Theory**

#### **3.1.1 Warehouse management**

Viale (1996) claims that warehouse management is a compromise of four different objectives. These objectives are:

1. Maximizing customer service

The role of the inventory in customer service is to reduce lead time and to be a buffer in a fluctuating forecast, changes in customer order and lack of account management.

2. Maximizing efficiency of purchasing

To reduce cost in purchasing by purchasing in greater volumes and increasing inventory.

3. Minimizing inventory investment

Reducing inventory to free the capital tied to the inventory.

4. Maximizing profit

By managing the inventory, the profits can be maximized. Excess inventory should be eliminated.

Warehouse management is a balance between these four objectives. Too much of a focus on point one and two will increase the inventory investment and reduce profits. Too much focus on point three and four will increase lead time, reduce customer service, and reduce the efficiency of purchasing.

### 3.1.2 LEAN

LEAN can be defined in many ways. By some it is a leadership philosophy, by others a set of principles. By some it is a set of objectives. According to Santos, 2006, LEAN manufacturing is described as systematic elimination of waste. Even though our case study does not investigate a manufacturing business, we still see the definition as valid.

Lean can be achieved by implementing the following principles:



Figure 6 - Principles of LEAN, *Lean Thinking and Practice* - Lean Enterprise Institute

1. Specify value from the standpoint of the end customer by product family.
2. Identify all the steps in the value stream for each product family, eliminating whenever possible those steps that do not create value.
3. Make the value-creating steps occur in tight sequence so the product will flow smoothly toward the customer.
4. As flow is introduced, let customers pull value from the next upstream activity.
5. As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, repeat this process again and continue it until a state of perfection is reached in which perfect value is created with no waste (Lean enterprise institute, 2023)

### 3.1.3 Seven types of waste

The third principle of Lean “create flow” implies elimination to the effective flow. Waste is one of these barriers. Waste can be classified as more specific waste types. The Japanese have classified these as:

Overproduction or asynchrony – Producing too much, too early, or too late to meet the customer’s demand.

Inventory – raw material, work in process and finished products stored.

Motion – unnecessary movement of the body

Defectiveness – non-conforming products and services in general

Transportation – unnecessary movement of products between processes

Overprocessing – processing beyond customer requirements

Waiting – having to wait before commencing the next activity (Chiarini, 2013, p 18-19).

### 3.1.4 5S

Our experiment is based on the framework of 5s. The 5s methodology consists of five successive processes. These five processes are sort, set in order, shine, standardize, and sustain (Santos, 2006).

**Sort** – All of the items in the area should be sorted in three groups.

- Those that are used frequently.
- Those that probably will be used and is stored.
- Those that never will be used and will be classified as waste.

The items that belong to the two later groups should be removed from the assembly areas.

The items in group number two should be stored in an area, to avoid throwing it away. The items in group three should be thrown away (Santos 2006).

We chose to use the three-container method when organizing the area. One container for useless objects, one for useful objects and one for objects that is shared with other areas.

To identify the different types of objects we chose to use the red tag technique.

The red tag technique is divided into seven stages:

- Training and awareness regarding red tags.
- Identifying objects that need to be observed.
- Defining evaluation criteria.
- Producing the tags.
- Applying the tags to the selected objects, which are then stored in the designated area.
- Object evaluation according to the selected criteria.
- Result analysis.

**Set in order** – Organize the items that is left after step number one.

This process' main goal is to cut the time required for material searches as well as to facilitate the movement of objects through the factory (Santos, 2006). To do this one can use tools such as sorting theories, sorting based on category of personal aid or general size of the personal aid. This part of the process requires some extra space and time. The process can be performed in stages.

**Shine** – Implement cleanliness.

After the first two steps shining should be implemented. To maintain the warehouse clean and swept at all times. This should be applied to both the general warehouse area, but also machines and equipment (Santos, 2006). By doing this the work environment of the employees is safer and the workspace is more welcoming.

**Standardize** – The standardization of the condition of the warehouse.

To standardize the condition of the warehouse, implement the changes and work out a routine to the three first process. To implement this thoroughly the workers need to assigned responsibility for the change (Santos, 2006). By standardizing new aids will be placed correctly to begin with. There is more overview of the storage and requires less training for new employees.

**Sustain** – To sustain the standardization.

To sustain the changes that have been imposed. This requires a good work culture, which is open for these changes and to sustain these changes (Santos, 2006). To achieve this the

employees, need to put their pride into their work and must have a degree of ownership to the standard of their workplace.

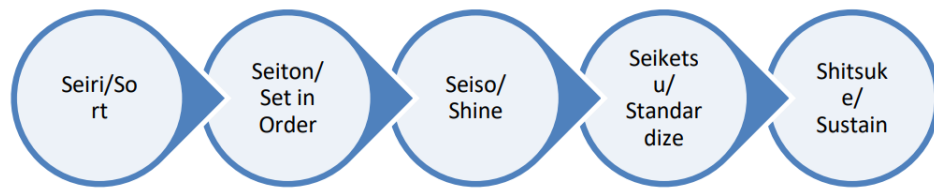


Figure 7 -Rizkya et al. 2021

## 3.2 Literature

In this subchapter we will present problems that are similar to our case study. The 5S' lean tool has been implemented in both cases has given results that are transferable to our case study.

### 3.2.1 Warehouse Improvement with LEAN 5S – A case study of Ulstein Verft.

Master Thesis by Iva Gergova. Molde University College, 2010.

Focuses on implementing 5S in the warehouse, the facility is already working from a LEAN shipbuilding perspective. Before implementing 5S they had done a pilot project in the maintenance and warehouse departments, and the employees were familiar with the Lean theory. They had issues with correctly registering incoming items and labelling them correctly, thereafter the items in storage are moved around several times resulting in difficulties finding the desired item. The next issue is production employees taking items out of storage without registering it correctly in the systems, making an unbalance in the registered stock vs the real stock. Visual data, before/after pictures are partly used as documentation of the results and is confirmed by interviews. The report is written before the 5S is fully implemented and mentions this in the limitations.

The benefits found in this thesis that can be transferred to our case study is a tidier work environment, a better overview of items in stock, heightened competence for the employees regarding processes and systems, resulting in better warehouse management.

### 3.2.2 Implementation of 5S methodology in a warehouse: A case study

Rizkya, 2021 Case study. Universitas Sumatera Utara.

Describes the assessment and application of the 5S work culture in the warehouse area. The warehouse stored cooking oil and had issues with production interruptions due to not finding items and to have items not in use stored. The process of implementing 5S was done by first doing a check for correlations between the current state and the principles of 5S and then execute the experiment. Very much based on visual data before/after pictures. The benefits that are transferrable to our case study is that the implementation of 5S lean tool resulted a tidier storage and better work environment. This resulted in more storage space available.

## **4.0 Method and data**

### **4.1 Method**

Our bachelor thesis is a single case study, where we used direct observation and participant observations in the experiment of implementing 5S in a limited area of the storage facility of Molde municipality's personal aid.

#### **4.1.1 Choosing of research method**

The process of choosing our method was started by talking to our supervisor at HiMolde. We described the theme and our ideas, and he launched the idea that this could maybe be a good foundation for a case study. We agreed, as this is a real-life situation, and we will have to describe and interpret the case, it is apparent that a qualitative method has been applied.

A case study is defined by (Yin 2018) as:

1. A case study is an empirical method that:
  - Investigates contemporary phenomenon (“the case”) in depth and within its real-world context, especially when.
  - The boundaries between phenomenon and context may not be clearly evident.
2. A case study:
  - Copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result.



- Benefits from the prior development of theoretical proposition to guide design, data collection, and analysis and as another result.
- Relies on multiple sources of evidence, with data needing converge in a triangulation fashion.

A case study can be conducted as a single case study, looking at one case in particular or multiple case study, comparing several cases.

Method	(a) Form of Research Question	(b) Requires Control Over Behavioral Events?	(c) Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Figure 8 - The choosing of method, p 9 in Yin.

The form of our research question is inspired by Yin (2018) (see figure 8).

How the question is formulated decides in many ways what information or data it is possible to get out of the research, and it also tells us to a certain degree what the conclusion will be.

(Hedrick, Bickman, and Rog 1995) states:

*“Selection of a design affects the credibility of the research, its usefulness, and its feasibility. **Credibility** refers to the validity of a study and whether the design is sufficiently sound to provide support for firm conclusions and recommendations. **Usefulness** refers to whether the design is targeted appropriately to answer the specific questions of interest; a sound study is of little use if it answers the wrong questions. **Feasibility** refers to whether the research design and plan are reasonable given the requisite time and other resource constraints.”*

In many cases one can formulate the question in a way that you get the answers you are looking for, but it is of importance that one makes sure of formulating the research questions to the type of method used in the research.

(Yin 2018) states:

*“How and why questions are more explanatory and likely to lead to the use of a case study, history, or experiment as the preferred research method. This is because such questions deal with the tracing of operational processes over time, rather than mere frequencies or incidence.”*

In a case study, we are to understand a given situation and questions starting with how and why are more likely to give us those answers. A descriptive case study will describe a situation or a setting.

#### **4.1.1.1 Control over behavioural events and focus on contemporary events.**

(Yin 2018) states:

*“Case studies are preferred when the relevant behaviours still cannot be manipulated and then the desire is to study some contemporary even or set of events.*

*(“contemporary” meaning the fluid rendition of the recent past and the present)”*

We consider our case to be in accordance with the above citation. And therefore, we continued with designing a case study.

As with any form of methodology there are many views as to what the best for the given situation is. As we worked on the case and learned about the possible methods, we found references that lifted the question if case studies can be included as a research design for qualitative research. There are views from quite a few years back that a case study can be a way of gathering information but is not standardized enough to be used as a research design. (Yin 2018) states that:

*“A common misconception is that the various research methods should be arrayed hierarchically. Many social scientists still implicitly believe that case studies are only appropriate for the exploratory phase of an investigation, that surveys and histories are appropriate for the descriptive phase and that experiments are the only way of pursuing explanatory or casual inquiries”*

But this is not the view today, as case study research is used to a content that there is enough data to consider it a research method that stands on its own (Creswell 2018) .

## **4.1.2 Limitations, assumptions, and challenges**

### **4.1.2.1 Non-applicable work tasks**

This thesis will look at the storage of personal aids. The employees at the storage facility also manage more tasks than just handling storage of personal aids, like assembling, repairing, cleaning, and preparing the aids to be either reused or returned. These activities will be mentioned in the thesis where relevant but is not anything we have looked specifically at, since they are not directly related to the storing of aids.

### **4.1.2.2 Zones A, C, D and E**

The research scope is limited to one zone - Zone B. The zones in the facility are sorted by categorizing of items, and Zone B is chosen because it is a zone for storage of a variety of items, not assembling or other activities.

### **4.1.2.3 Workplace culture**

During the experiment and in the time, we have been working on this thesis we could see how workplace culture is affecting the storage facility.

J{Jacobsen, 2019 #4}acobsen, 2019 states:

*“The most important in any culture is the values and norms transferred from one generation to the next.”*

This can be directly connected to a workplace environment, and a culture is easy to recognise by looking for common views and experiences.

The way the storage of items has been done in the past is a natural way for the long-time employees to execute their job, and to change this routine will take time and effort. We have not focused on workplace culture in this thesis.

### **4.1.2.4 Establishing of a new storage facility**

Molde Municipality is in the process of establishing a new and improved storage facility in Bergmo care facility. This location will have more space and some of the challenges in the storage facility in Råkhaugen will be solved in Bergmo for that reason. We have not taken

the effect of moving the storage to Bergmo, as we believe the issues must be solved independent of the size and design of the storage facility.

We will however touch upon the new facility in our discussion and where relevant.

#### **4.1.2.5 Red tag limitation**

We chose a simpler and less time-consuming red tag system. We chose zone B in the warehouse, as we identified the zones to be easy to apply the theory to the rest of the zones.

We had a small introduction about the theory regarding 5s and the red tags.

We simplified the system to an analysis over only one day instead of a month. We also changed the order of the system. We disregarded the smaller items that already were in the shelf. The way we chose to do the red tag system is as follows:

- Small introduction of training and awareness regarding red tags
- Defining evaluation criteria. The evaluation criteria that we have chosen is to visually inspect if the item is cluttering the zone.
- Identifying objects that need to be evaluated.
- Producing the tags from post it notes
- Applying the tags to the selected objects
- Object evaluation according to the criteria.
- Result analysis.

### **4.1.3 Assumptions**

#### **4.1.3.1 Demand**

We are assuming that the need for personal aids is constant, that there will not be a substantial change in the near future and therefore we have not focused on demand in the thesis. This is because there is no data on demand and aids in circulation when not in storage.

#### **4.1.3.2 Same effect in other zones**

We only looked at zone B in the storage facility, but we assume that our results are directly transferable to the other zones in the storage.

#### **4.1.3.3 Results are transferable to new stock**

As Molde Municipality is in the process of moving into a new and bigger warehouse, we will assume that the benefits of implementing 5S also will be applicable to the new location.

### **4.1.4 Challenges**

#### **4.1.4.1 Culture**

Any employee in a workplace will develop a culture, based on common experiences as mentioned. As we were conducting our experiment, one employee came over and started meddling and putting tagged items back, as he knew where they were placed before the experiment started. It took some convincing and reassuring that we would re-set the area after the experiment before he agreed on us to continue.

#### **4.1.4.2 Estimated number of items**

As we were tagging items and documenting the sorting of them, we found some items to be of a substantial number, and a bit difficult to count, as they were placed in many different storage systems and in many locations. We collected the ones we could find and made an educated guess on the number of items. These are mentioned in the chapter of data.

## **4.2 Data collection**

When we knew a single case study is the way to go, we started to prepare to gather our data. Molde municipality is immensely helpful to accommodate our needs.

We first had one teams-meeting, 10.01.2023, where we were informed about the “Smart Molde” project and another teams-meeting, 16.02.2023, where we were introduced to the “Smart distribution of personal aids”, and “Online Aids” project in Kristiansund

Municipality. We also discussed the challenges the implementation will bring to the storage facility, and how to possibly avoid them.

The practical part of this case study was conducted over two days in February and March of 2023.

On the 8<sup>th</sup> of February we first visited the storage facility. The approach for this visit was to conduct a direct observation.

Direct observation is a research method that lets us be a passive bystander, and just observe the actions and events of the employees. Pros for this method is that we see everything as it evolves, but it is especially important that we do not interfere, as we then can impose on actions and results. It is also a strength that we could observe all sides of the case at once. One downside to direct observation is that it takes a lot of time, and you do not know if you will observe anything on the given day. It could also be very resource demanding, as there could be multiple activities going on at once, and then we would have to be more people to cover it all.

The next day for observation was conducted on March 15<sup>th</sup>, 2023. Before meeting up this day, we decided that we would focus on Zone B, which had a selection of items stored that included soft items, furniture, and some digital aids.

We spent a whole day at the storage facility with the following agenda:

*Table 3 - Agenda for experiment*

Time	Activity
08.00-10.00	Direct observation of the employees and the storage,
10.00-12.00	Walk-through of chosen area (Zone B) and start participant-observation
12.00-12.30	Lunch break
12.30-14.00	Continue participant-observation
14.00-16.00	Conclude participant-observation, summarize, and re-set the area.

### **08.00-10.00**

As we arrived at the storage facility, we settled down in Zone B and started our direct observation.

## 10.00-14.00

We summarized our observations from the first two hours and wrote them down. After that we had a sit-down with the operation manager and informed him about our first findings and our plans going forward. We chose to have a walkthrough of our preliminary findings, to make sure that all parties had the same perception of the process, and willing to move forward with the experiment.

We started the participant-observation stage by walking through the storage with the operation manager. We mentioned some examples of the previous observations and explained some simple improvements, like storing all identical items in one location it would be easier to identify and retrieve.

After having the walkthrough with the operation manager, we started tagging the items not placed in the right location. We used a simple method of pink post-it's on everything misplaced. We did most of the tagging but had an ongoing dialog about the items we were unsure of.



*Figure 9 - Example of our tags.*

The criteria for tagging items were as follows:

- Broken items
- Unusable/unhygienic items
- Misplaced items
- Overflowing amounts of items

The items we tagged are sorted into three categories:

- USE
  - Items that belong in Zone B but is not ideally stored. They were either misplaced or stored in bags, boxes or just stacked on top of something.
- STORE
  - Items that should be kept, but not stored in Zone B.
- WASTE
  - Items that are broken, unhygienic, too many, not relevant, to be returned to NAV.

#### **14.00-16.00**

After sorting all items, we documented them by photos, and assisted the employees in placing them in the right location. The items that were classified as waste were disposed of. The items put back into Zone B was evaluated by the employees, so that nothing went back unless it was fully usable.

## **5.0 Analysis and Results**

### **5.1 Data analysis**

#### **5.1.1 Observations**

We visited the storage facility for the first time February 8<sup>th</sup>, 2023. At arrival at the storage facility, our first impression was the storage of 50+ walkers on the outside of the facility, next to a filled dumpster. When we got inside, the hallways were stacked with personal aids, and printed sheets with destinations and patients. We walked through the whole facility and was informed about the organization they used today.

Our observations at this first walk-through were:

- Overfilled storage
- Too many items of the same kind
- Too many different items
- Complementary items were stored apart from each other.
- All organization was dependent on the employee's historical knowledge.



- Overflow in the storage made it hard for the employees to find the item they were looking for, or to store a new item at the right place.

We also had the chance to talk to the employees to hear their views.

After this day of observations, it was clear to us that we needed to focus on a particular part of the storage, to be able to execute the experiment of implementing 5S in one day.

Observations from the 16<sup>th</sup> of March:

- The first thing we did was to clear out a table to have somewhere to sit. The items on the table were give-outs, some opened boxes of routers and digital aids.
- We could see similar items (i.e., mattresses) stored in four different locations, standing by the wall (assigned location), rolled up in garbage-bags stored on the floor, half lying on top of a spare bed, and stored on top of a different type of mattress, needing a compressor.
- There were also some items with obvious hygiene-challenges, big spots on mattresses, stored next to apparently new objects.
- A lot of items was stored in different ways and in different locations. Plastic boxes, cardboard boxes, garbage bags or just lying on top of another item.
- Some items were so many that the hooks on the wall had fallen down. The walls are plaster, and not the best for hanging hooks.
- One employee was looking for something and came in, looked in three different locations before he found what he was looking for. Then took what he needed and put the other items he found back in another location than he found it.
- New items in boxes are stored at the designated location, assembled items are stored somewhere else, most on the floor.

When conducting the direct observation, we are passive observers, as opposed to the participant-observation, where we are acting as an employee at the storage facility.

(Yin 2018) states:

*“Case studies need not be limited to a single source of evidence, in fact, most of the better case studies rely on a variety of sources”.*

We are documenting our findings by taking pictures of the tagged items and counting the number of tagged items in the different categories.

## 5.1.2 Data collected

When going through our findings we found that:

Table 4 - Number of tags in categories

Category	Number of tags	Percentage
<b>Total tags</b>	<b>199</b>	<b>100%</b>
Tags in category USE	73	9,55%
Tags in category STORE	19	36,68%
Tags in category WASTE	107	53,77%

As mentioned in limitations, within these numbers there are two categories that has an estimated number.

- Harnesses: Estimated to 40 pieces.
- Mattress covers: Estimated to a total of 30 pieces.

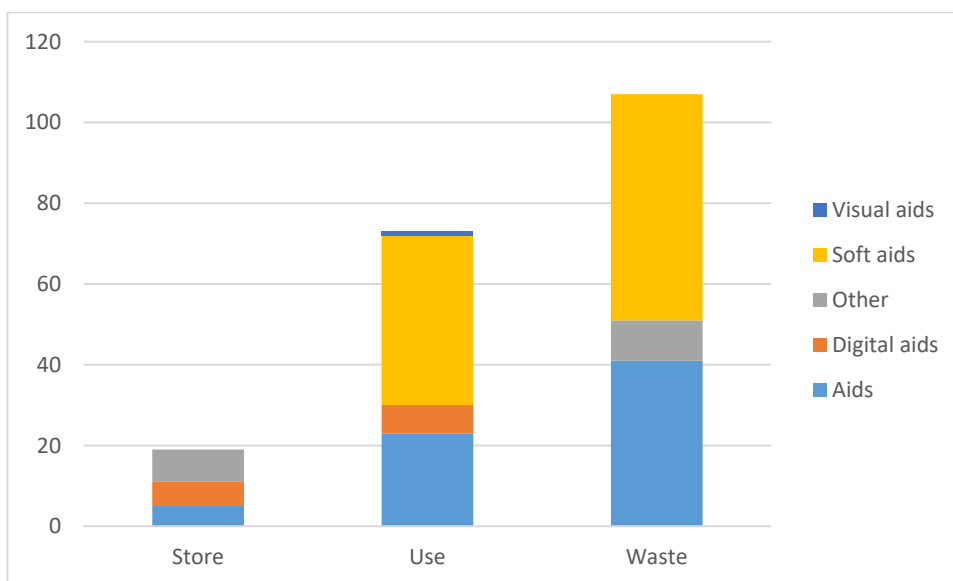


Figure 10 - Diagram showing distribution in categories.

### 5.1.2.1 Category Use

The items in the category use consisted of items that is supposed to be stored in Zone B. Items that should be stored in Zone B are soft aids such as cushions, beds, mattresses, digital aids, visual aids, and personnel lifters but was not in the correct location or was being stored in a less than ideal way.

- Soft aids being stored in cardboard boxes.
- Digital aids that do not have a designated location.
- Personal aids being stored in broken cardboard boxes.
- Mattresses stored in garbage bags on the floor.
- Items being stored on top of other items, instead of their designated location.
- Items stored in front of shelves when no room in the shelves.

### **5.1.2.2 Category Store**

The items in the category **STORE** consisted of items that are to be stored in the facility, but not in Zone B.

- Wheels for wheelchair – belongs in Zone E
- Aluminium ramps stored along the walls.
- Spare parts placed in plastic boxes, probably where last used.
- Empty plastic boxes
- Transportation wheels
- Parts for transportation trolley

### **5.1.2.3 Category Waste**

The items in the category **WASTE** consisted of broken items, or items not compatible with personal aids being used today.

- Soiled mattresses
- Out of date metal bedrails
- Out of date length of bedrails
- Incomplete bedrails
- Bedrails to old models of beds
- Empty boxes, plastic, and cardboard
- Lifting harnesses
- Broken racks from wall
- Seating cushions not compatible with wheelchair
- Broken trolley for stairs

- Wood shelves nobody knew where belonged to

#### 5.1.2.4 Visual results

The reason for tagged items is shown in this diagram:

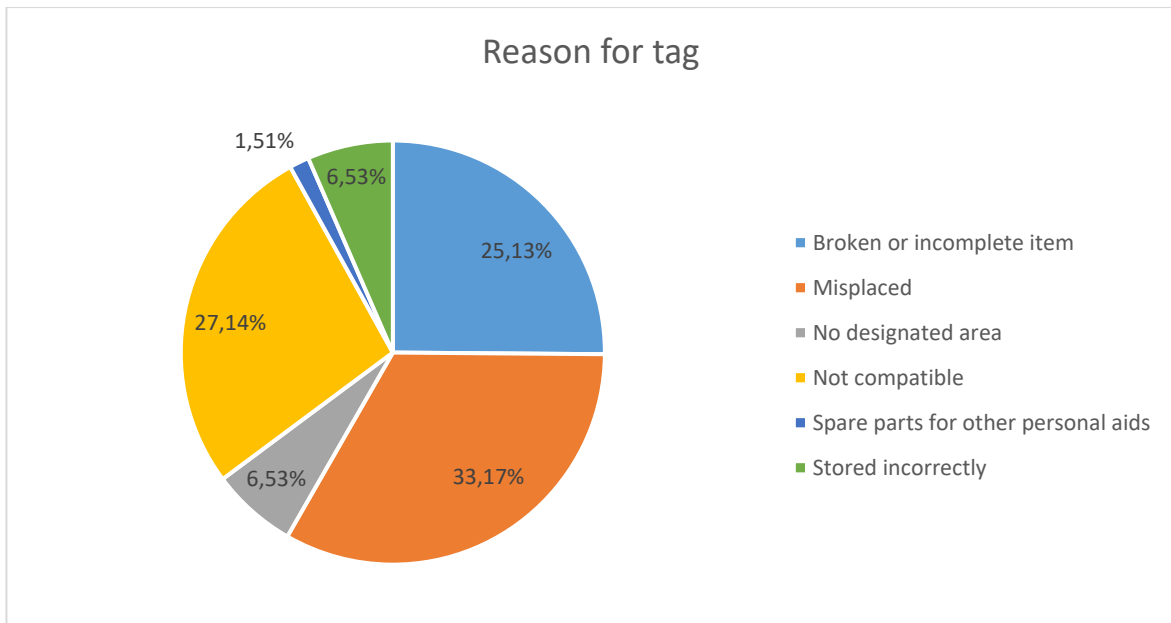


Figure 11 - Diagram showing reason for tagging.

The visual result of the experiment is shown here.

Before:



*Figure 12 - Zone B before the experiment 1*

The area between the mattresses and the shelving is shown here:



Figure 13 - Zone B before the experiment 2

After:



Figure 14 - Zone B after the experiment 1

Before:



*Figure 15 - Zone B before the experiment 3*

After:



*Figure 16 - Zone B after the experiment 3*

## 6.0 Discussion

This chapter includes our reflections on the implementation of 5S Lean tool in Råkhaugen storage facility and aims to connect our findings and the theory used in the thesis. We will also share our thoughts of what the company can do to further improve warehouse management.

### 6.1 Problem setting and case

The problem setting looked at the way the storage facility is organized today, and some of the activities the storage facility handles were excluded, because it was not a primary storage activity.

In our view the activities in the storage facility could be more specialized towards storage, and less repairs, delivery and serving institutions or end users. The impression we got was that the facility maybe had absorbed services and tasks over time, and even though this is great from an end user perspective, as the storage facility is available to do repairs quickly and is flexible as to what they can help with, it may make the storage facility less effective.

Today it is possible for a next of kind, or the patient itself to call and arrange a meeting with the personal aid department, we witnessed one person arriving the facility when we conducted our experiment. This will lead to a very little standardized process, and though we do see the value in this from a user perspective, where every patient could visit the storage and to a degree choose the aid they want, we would like to argue that to have a list of standard aids available for users would make the task easier and better planned for the operation manager and his employees, and also save time in helping the end user. We see that implementing this is a natural part of the “Smart Molde” project, and this again will help to minimize the needed space for storing personal aids, as there would be a smaller number of models stored.

When conducting the experiment several of the items we tagged was items that was supposed to be returned to NAV. The reason for them not being returned already was not clear, but we do suspect that it is put in storage to save potential procurement expenses. We would however argue that a storage filled with items not standardized or included in the selection of desired personal aids will increase inventory cost, as the processes of



finding things in the storage will take longer time, and there will not be available space for items needed.

The example above brings us also describes some of the culture in the storage facility. We witnessed somewhat of a hoarder culture when observing the storage facility, with items either soiled or broken being stored without any plans to improve them in a way that could make them useable again.

## 6.2 Theory and literature

Warehouse management:

1. Maximizing customer service

The storage facility has had a main focus on maximizing customer service over a long period of time. The storage had aimed to have as many personal aids as possible in storage to be able to meet a customer's needs quickly.

2. Maximizing efficiency of purchasing

To avoid purchasing expenses the municipality has acquired items from NAV. This has accumulated to high inventory levels.

3. Minimizing inventory investments

Due to the focus on point one and two the minimizing of inventory has not been prioritized. This has lead to an excessive amount of inventory.

4. Maximizing profit

This objective has not been considered in the evaluation by the municipality. The focus has rather been on maximizing societal benefit, which has been objective one. The municipality has also had a focus on reducing costs instead of directly maximizing profit.

We assume that the municipality see the reduction of purchasing cost as more valuable than reducing inventory levels

The following types of waste have been identified

The waste of overproduction and excessive amount of inventory:

There is an excessive amount of inventory since the storage facility accumulates items from NAV to keep for own storage.

The waste of excessive amount of movement:

There is probably an excessive amount of movement for the workers. The excessive amount of inventory, and the lack of organization in the zoning demands that the workers must move between the different zones to collect the components for assembly.

The waste of defectiveness:

The storage has accumulated a number of defective components and finished goods. Soiled mattresses, items without spare parts, spare parts without items. A lot of the items that were removed in the experiment conducted were in fact defective.

5s:

In the experiment only three out of five stages were conducted. This was sort, shine and set in order. The stages standardize and sustain are two stages that the company need to make an evaluation of and implement. The reason for only conducting three stages is that the experiment had a timeframe of only one day and the two stages not conducted requires a longer timeframe.

The most meaningful and cost reducing stage would be to implement the stage sustain, this is the key to long lasting solutions. Otherwise, the process needs to be redone several times.

## **6.3 Method and data**

### **Data**

The method used for the red tagging is a lite version of the red tagging technique. The red tagging technique should be implemented over a longer period of time and by use of the operators at the storage, to determine the frequency of usage for the items. The version that was implemented was based on visual observation and our common interpretation together with the employees at the storage facility. The red tags were put on the items that looked out of place in the zone and were put into one of the categories of use, store, and waste. This may be a flaw in the data collection, as the determination of whether the item should have been tagged to begin with may have been predetermined. There may have been several more items that should have been tagged in this case, but that have been overlooked.

### **Research**

We chose a zone in the warehouse for the sole purpose of being able to have a clear result of our experiment. We did get a significant improvement of waste elimination and saw that 5s can reduce waste in their warehouse. We saw that 107 items were waste, an estimated 54 % of the items that were tagged. Another 37 % were items that were placed incorrectly and removed from the zone.

It is argued that the results of our findings may be applicable to the other zones and give the same effect. Perhaps this is true, but since the variety of the personal aids is so vast, it may not have the same effect in all the zones.

When analysing results this thesis is based on visual data, as well as the registered tags. To measure other KPI's in warehousing would give us more data to compare before/after the experiment and is maybe something we would do differently if conducting it again. We could have considered to measure the free  $M^2$  and compared it to the free space after conducting the experiment. We also considered to look at workflow and how to improve the efficiency, and while we think this is a relevant and interesting aspect, it is not a part of our thesis. We will mention it to the operation manager for him to consider if it is something they want to look further into later.

There is also a question of if the municipality see the same need for implementing 5S when they move to a larger warehouse. With larger capacity, they will perhaps not see the need to reduce waste, as it is less visible in the larger space. This is of course a temporary state, as the issue will build up in the new warehouse as well.

### **Implementing the Smart Molde Project/ Smart Personal Aid**

When looking at the projects about to be implemented, we can see the benefits of them. From a warehouse management point of view, it is important to make sure the input into the system is of high quality. To go through the inventory and get rid of unwanted items before registering them would be a big advantage. This can and will probably be done when moving into the new warehouse. We see that as an ideal time to do a thorough 5S and making sure that the new warehouse will be a clean slate, to start the improved warehouse of personal aids in Molde Municipality. Before this point of time, we do also question the motivation of continuing to work with the existing warehouse, how much resources, in the form of time and workforce, is to be put into improving a warehouse they are on their way out of.

When having the initial meetings with the operations manager we asked about how many items was in circulation today. He replied that they do not really have a number for this, as there has not been any registration of aids being sent out, other than in each patient journal. This makes it difficult for the storage facility to know how many items they have, and how many they should have in storage for future needs. We therefore assumed that the demand for personal aids is constant, but we have not specified what the demand is. Implementing the “Smart Molde” / “Smart personal aids” projects will give this data over time, and we hope this will give the operations manager the chance to make better decisions in these regards over time.

### **Variety of products in the warehouse**

As mentioned in the paragraph about the case setting. It does not seem that there is any kind of standardization when ordering new items, leading to many different aids being stored and the inventory being excessively big. We do not have the knowledge to say if any aids could cover more than one user need, or if every user needs one special aid. If this is the case, the idea of storing the item for later use for another user is maybe not relevant. We would maybe like to see that there is a standard model for most uses that should be stored in the warehouse, and all individualized items are only to be handled by NAV, and to be returned to them after use. We do suspect that this was the original intention, but that this has been downplayed at some point. In this aspect we could also discuss if the user perspective or the warehouse management perspective should be the leading perspective, as a combination of the perspectives could be colliding. To decrease the variety of products would also create many aids to be removed or disposed of, and to continue to donate them to Ukraine or other people in need would be an action creating common good. It would also be a good idea to check if other care facilities in Molde Municipality had any needs that could be covered by the aids being discontinued, this would also be in accordance with Molde Municipality’s aim to have a more circular economy.

### **Ability to sustain the improvements**

There is no doubt that the employees that contributed to the experiment saw benefits of the system changes and the improvements. As the storage was shined and the rights items was placed back all participants agreed that this looked much better. If they can keep it this way, both due to a high workload and a well-established culture of placing items where there is room, rather than in the right location, is unsure. It does demand a lot from the

workers, and we did not follow the process long enough to see any results. It is the employees that are supposed to maintain the system, and if they do not have enough knowledge about warehouse management and the principles for LEAN/ 5S it is hard for them to work in accordance with the theories.

## **6.4 Importance for the company**

The company can use this knowledge of 5s to reduce waste, improve routines and create a better internal standard for warehouse management. Since the majority of the items, we tagged were disposed of, the company can look into which items they should keep in the future. A form of intake control before storage is necessary to reduce the kind of waste of high amounts of items. The company should perhaps only have general items usable for a majority of patients, and let NAV deliver the items of specific needs. By doing this they would also reduce the workload of maintenance, since they could send a lot of items back to NAV. It would also create a better overview for the employees, where they know what is in stock, and for the patients that can more easily see what they can expect.

## **7.0 Conclusion**

To apply the 5S theory to the complete storage facility in Molde Municipality would create a more predictable work situation for the employees. To be able to find what you are looking for and to easily knowing what is in stock would create an opportunity to plan the days coming more efficiently.

Our research question was:

How can 5S contribute to waste elimination at Råkhaugen Storage Facility.

From our experiment it is indicated that 5s does contribute to waste elimination in a personal aid storage facility.

In the process of conducting our experiment we identified the following types of waste.

Waste of overproduction:

By creating a better overview of what is in storage it is easier to use the items in storage, rather than ordering new items.

Waste of inventory:

By disposing of items not ready for use, we created more free space in the storage.

Waste of movement:

By placing items in their correct location, the employees will need to move less and will more easily find the item in demand. By reducing the movement there is more value adding activity.

It is however stated that this experiment only implemented three out of five steps of 5s. The result of this is short lived if the municipality does not implement the last two stages, standardize, and sustain. Otherwise, the storage will gradually go back to the original state.

In this thesis we have not investigated the ethical aspects of accumulating aids owned by NAV for use in by the municipality should also be considered.

The fact that Molde Municipality, which is the host for Molde University College - a specialized University in Logistics, does not have logistics personnel employed or at least have a cooperation to use the competence located in the municipality, is to us, hard to grasp. We would strongly advice that channels for cooperation is established.

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