Onboarding of the Pressurized Equipment Supervisor Role Work-process for Vestas Finland Oy

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EXAMENSARBETE

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Titel: Implementering av arbetsprocessen för rollen som övervakare av tryckbärande utrustning för Vestas Finland Oy

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Abstrakt

Detta examensarbete handlar om att ta hem en funktion och process utveckling och har gjorts på uppdrag av Vestas Finland Oy. Syftet med arbetet var att ta hem rollen för tryckkärls övervakare för Vestas och därmed behövdes en arbetsprocess för tryckkärls övervakarens roll.

Målet var att Vestas skulle kunna erbjuda kunderna en servicehelhet, och då även kunna lägga till den lagstadgade tryckkärls övervakarens roll som tillägg till nuvarande servicekontrakt och därmed ge mervärde till kunderna.

Arbetet inleddes med att bekanta mig med lagstiftningen kring detta, samt att skaffa tillräckligt med kunskap om vad är en tryck ackumulator. För att bilda en helhetsbild på nuvarande situation både hos tryckkärls övervakaren som kunden själv sköter och roll axlad av tredjepart bokade ja intervjuer med representanter från båda samt med en intern övervakare.

I arbetets teoretiska del presenteras teorin om insourcingens för och nackdelar samt vad man bör ta i beaktande vid planeringen. Därefter behandlas lagstiftning om tryckkärl och vad som krävs för att kunna axla tryckkärls övervakarens roll. I teoriavsnittet tas även upp vad är en tryck accumulator och var används dessa, härefter en redogörelse av vad som är påverkande faktorer vid kravet att registrera tryck accumulatorn. Senare i teoridelen presenteras ett par olika studier på andra fall av att ta hem en funktion för att få lite referenser vad andra har kommit fram till.

Resultatet är en arbetsprocess och en beskrivning av rollen som den lagstadgade tryckkärls övervakaren ska utföra samt en RACI matris där ansvarsfördelningen framgår.

Språk: Engelska
Nyckelord: insourcing, prosessutveckling, tryckackumulator

BACHELOR'S THESIS

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Abstract

This thesis focuses on insourcing a functional and process development initiative conducted for Vestas Finland Oy. This work aimed to bring the pressure vessel supervisor role in-house, necessitating establishing a work process for this position.

Vestas' goal was to offer customers a complete service package and then add the statutory Pressure Vessel Supervisor role to the current service contract, thus providing added value to customers.

The work started with familiarizing myself with this legislation and acquiring sufficient knowledge about a pressure accumulator. To form an overall picture of the current situation, with the Pressure Vessel Supervisor managed by the customer and managed by a third party, I booked interviews with representatives from both mentioned and with an internal supervisor within Vestas.

The theoretical part of the work presents the theory of the advantages and disadvantages of insourcing and what should be considered when planning for insourcing. This is followed by a presentation of pressure vessel legislation and what is required to fulfill the role of the pressure vessel supervisor. The theory section also discusses what a pressure accumulator is and where they are used, followed by the factors that influence the requirement to register the pressure accumulator. Later in the theory section, a couple of different studies on other cases of insourcing are presented to get some references of what others have come up with.

The result is a work process, a description of the role of the statutory pressure vessel supervisor, and a RACI matrix showing the division of responsibilities.

Language: English
Keywords: insourcing, process development, pressure accumulators

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1 Introduction

Vestas started operating in Finland in 2011 on small scale with 41 delivered wind turbines with a total power of 27 MW (Vestas Wind Systems A/S, 2011) but the wind turbine service is a rapidly expanding business. In 2024, the forecast for Vesta's deliveries in Finland onshore turbines is a total power of 723 MW. Today, Vestas' fleet consists of over 1100 onshore turbines in Finland, with a total power of over 5000 MW, according to Vestas' customer portfolio. (Vestas Windsystems A/S, 2024)

1.1 Background

The business has grown, and the processes used on small-scale operations now need to be revised to correspond to the current volume and maintain alignment with legislated requirements. Vestas operates globally in the wind turbine Service business, but exclusively in Finland, there is a legal requirement for an appointed Pressurized Equipment Supervisor and one deputy. The work process for the supervisor role of pressurized equipment needs to be mapped out and customized to continuously grow large-scale businesses to meet the requirements and the area of responsibility defined for the pressure vessel supervisor. Construction must, during the project phase, appoint their Pressure Vessel Supervisors if to be

The turbines and all its equipment are the customer's property; thus, they are their responsibility. The customer is responsible for all the legislated requirements related to the installed equipment. They can make decisions on to:

1) Appoint own Pressurized Equipment Supervisors, or
2) Outsource to a third party, or
3) Include the role as a part of the Service Scope with Vestas

Amendments can be made to existing contracts if the customer decides to include this additional service later during the contractual period.

If Vestas is contractually given the Pressurized Equipment Supervisor role, the role is assigned to Lead Technicians within their geographical area. The work process is currently unclear to the Lead Technicians. A new and defined way of working is needed, as well as reporting possibilities. Furthermore, the internal working process must be standardized.

1.2 Objectives

The main objective of this thesis is **to map out the process** for the Pressurized Equipment Supervisor role in Vestas Service Finland, provide instructions on the workflow, handle work orders related to pressure Vessels in an internal process flowchart, and Pinpoint the **process steps for the appointed supervisors**.

This also covers the workflow for legislated requirements regarding periodical inspections and replacement of pressurized pitch accumulators, which are generating the need to update the governmental register, and also identify steps that require inputs or action from any involved parties, i.e., identify work orders for windfarms where a third party is responsible for pressure vessels and ensuring the information flow is not compromised regarding Pressurized Equipment. The process continues after a work order is completed as the new serial numbers of the replaced equipment are to be updated by the Finnish Safety and Chemicals Agency, hereafter Tukes.

This thesis project also covers the **Master data** to be established in SAP. The database is to be built under the turbine structure and matches Vesta's item's serial numbers to the Tukes registration number for each piece of equipment. Other necessary information, such as inspection dates, is relevant information. This may initially require manual data entry, but if possible, in the near future, import, utilizing Excel macro. The target is to employ an already existing ERP system for reporting, as we are using this parallel to SAP. The aim is to generate notifications and reports based on the data on work orders related to Pressurized equipment.

The goal is also to map out the **responsibilities and tasks related to the role, how they will be handled internally, and define collaboration needs between divisions within Vestas Service Finland, i.e.,** between Construction and Vestas Service, prior to the handover to service, HOTS.

In the results of this thesis, I will provide a Process flowchart, Workflow instruction, and RACI matrix. Based on legal requirements, we need to align Vestas' internal processes. I will develop a way of working by gathering information from the field, external counterparts, and customers on how it is currently managed and implementing the best practices from the obtained material.

Whether the Pressure Vessel Supervisor is a Vestas resource or a third party, we need a database of contacts who will receive reports and notifications. Master data must be gathered and built up in SAP to extract necessary reports. This information is to be retrieved from Tukes and existing turbine material structures.

In chapter two of this thesis, an introduction to the company Vestas Service and the service functions in Finland is provided. Starting from the history of Vestas, the products and services it produces, and the target group. Chapter three presents the interviews I have conducted, the current situation in Vestas, and the challenges I have faced. In chapter four of the theory, I have given the pros and cons of insourcing, followed by case studies on insourcing. The legislation related to the process and the material used is also described. Here is an overview of the requirements of the Pressure Equipment supervisor and the Deputy, as well as the RACI matrix and conclusions regarding the theory. The fifth chapter contains the result of this thesis, where the process is described. The last chapter is the sixth, where the conclusions and ideas for development are presented. Before the Thesis project, I worked at Vestas Service Finland for almost two years as a customer agent, which is also my current role in the company.

1.3 Delimitations of the Thesis

The process development is delimited to Vestas´ Service's internal way of working within the Service division. The aim is to ensure the workflow of the process and that the necessary information reaches the supervisors.

Construction must appoint its own pressure vessel supervisors during the project phase; if a resource is to be borrowed from the service, the resource in question must consent to this task. However, this collaboration is not part of this scope, nor is there a need for construction to train its own pressure vessel supervisors.

This thesis will not discuss the roles or groups of the user levels in SAP or other ERP systems, existing ones, or ones to be created for externals. There will be a need to revise third-party user rights in Vestas Online, but this thesis will not go further into this.

The ongoing project by Suomen Tuuulivoima Yhdistys RY regarding changes to legislation will not be a part of this thesis. The current version of Pressure equipment law (Finlex, 2016) is a perspective adapted to the process industry and the circumstances prevailing in this field. There is an ongoing initiative to customize the Pressure equipment law to suit the conditions in wind farms better.

The profitability of this process is not part of the thesis; this has been processed on a higher level in cooperation with the sales department and management. Also, we need to establish a fully functional process and evaluate the resources required before we can create a business case and dispatch the sales offers for our process.

The improvements in report extracting from the TUKES register need to be addressed as a separate case from higher-ranked resources, separate from this scope. Communication regarding this will be handled entirely on a management level.

2 Vestas Overview

This chapter will open up the main activities and operations and describe the targets, starting with the history of Vestas. Vestas is one of the leading wind energy companies in the world. The area of operation is worldwide, with manufacturing and commissioning operated by the Power Solution department and as a service provider for wind parks in operation Vestas Service.

2.1 History of Vestas

The company Vestjysk STaalteknik A/S was founded in the late 19th century in the city of Lem in Denmark and started as a family business run by the Hansen family. The operations at Vestas started in the blacksmith industry; later, the business switched its focus to kitchen appliances. Manufacturing of scales and mixers started after World War II when the company struggled to stay afloat, and the name was shortened to Vestas, which originates from the manufacturing company VEstjysk STaalteknik A/S. Around 1950, the desire for the company to go international resulted in buying a patent for a milk urn cooler. The durable products were exported to European countries and Finland. (Vestas Windsystems A/S, 2024)

The leap from Household appliances to wind turbines started with the idea of developing coolers for turbochargers. However, the company suffered a setback when a fire destroyed its premises in 1960. In less than 10 years, it had built a new factory and expanded its business, now also producing hydraulic cranes for light trucks. (Vestas Windsystems A/S, 2024)

In the early 1970s, the company started experimenting, developing, and testing different energy production options in secret; this is where wind turbine technology comes into the picture. They hired an engineer, Birger Madsen, and with his ingenuity, they developed the technology that converts wind into electricity. During this same period, there was another Danish project in the same field, but due to the lack of financial resources, they asked Vestas for help, and this three-blade model is still in use. Around 1987, the company began to focus mainly on wind energy and was also then taking on "Vestas Wind Systems A/S." (Vestas.com, 2024)

2.2 Vestas today

Globally, Vestas Wind Systems A/S has over 29,000 employees today, and the headquarters are located in Aarhus, Denmark, while here in Finland, the only office is located in Vaasa. Vestas achieved revenue of EUR 15,382 million in the year 2023, and this is expected to rise up to 16 – 18 million in the current year. (Vestas.com, 2024)

The company has solid experience and passion for wind power. Vestas takes care of the entire process of wind turbines, from design to installation and service (Vestas, 2023). In the Picture below, Figure 1, is one turbine of the latest product family, the EnVentusTM platform, currently available in four different variants. According to information from (Vestas A/S) the smallest model, V150-6.0 MW, model V162, is available in 6.2 MW and 7.2 MW, and the largest model, V172, is 7.2 MW. Of which the two, first-mentioned types are already sold and commissioned in Finland for example according to (Vestas A/S, 2024) these types can be found in the largest active wind farm in Finland.

Figure 1 EnVentus^{TM} platform, the next generation of a wind turbine, developed with 40 years of experience, pictures retrieved from **(Vestas Wind A/S, 2024)**

CEO Henrik Andersen and Deputy CEO Hans Smith are heading Vestas' management team from Denmark. Vestas has offices in 24 different countries, and significant areas for the company are China, the Pacific Asia, the Mediterranean, and North Central Europe. As Director of Service for Finland is Mikael Strömbäck, the company is active worldwide in wind and various hybrid projects. Vestas has currently installed 164 GW of wind energy in 88 countries. Vestas was also the first company to reach 100 GW of installed wind turbines (Vestas, 2024)

2.3 Main activities and operation

In the sustainability report for the year 2023, Vestas stated that its primary focus will remain to be the leader in the green energy transition. In the mission to develop low-emission strategies, the partnership with ModvionTM continues, and it is known as the pioneer for wooden towers. Vestas is also committed to increasing the use of emission-reduced steel in production. (Vestas Wind System A/S, 2023) Vestas consists of the following divisions: Power Solutions, including onshore and offshore wind turbines; Development; and Services. The scope of the Vestas´ Service is described in the two following chapters.

2.4 Vestas service division

After a new park is commissioned, it is handed over to Service, shortened HOTS. Vestas operates globally in 77 countries, where over 55,000 turbines are serviced. This consists of maintenance, repair, fleet optimization, and digital services. The main tasks are the daily 24/7 remote monitoring of turbines and scheduled maintenance, but there are also customer-specific service scope conditions. A significant part of the serviced turbines is Vestas´ fleet, but Vestas also provides multi-brand service, i.e., providing customers with parks manufactured by competitors. (Vestas Wind System A/S, 2024)

Vestas in Finland had 225 employees at the end of the year 2023, according to information from (Asiakastieto, u.d.). However, this number has been growing continuously in the current year. A significant part of the workforce consists of technicians working in the field. Warehouses are currently found in 19 locations in Finland, but the number is increasing, and these warehouses serve wind farms in the area regarding material handling and tools. Service warehouses work as a home base from where the technicians start and finish the workday.

Vestas Finland's head office is in Vaasa, Located in Airport Park in the Futura I building. The staff number is currently slightly over 60 people but steadily increasing. Functions in the Vaasa office are Construction, Project, and Logistics, as well as Customer Service and the Service Dispatching team. The most recent additions to the head office department are Technical Planning and HR.

The turnover in the year 2023 for Vestas Finland Oy was 784.3 million euros. This was 25 % less than in the previous year, 2022, but still 2 487 000 € in profit. (Asiakastieto, u.d.)

Wind parks in Finland are located along the west coast, with a few exceptions. In Figure 2, the green dots represent wind farms in production, and the orange is still under construction. The picture presents all operators' wind parks.

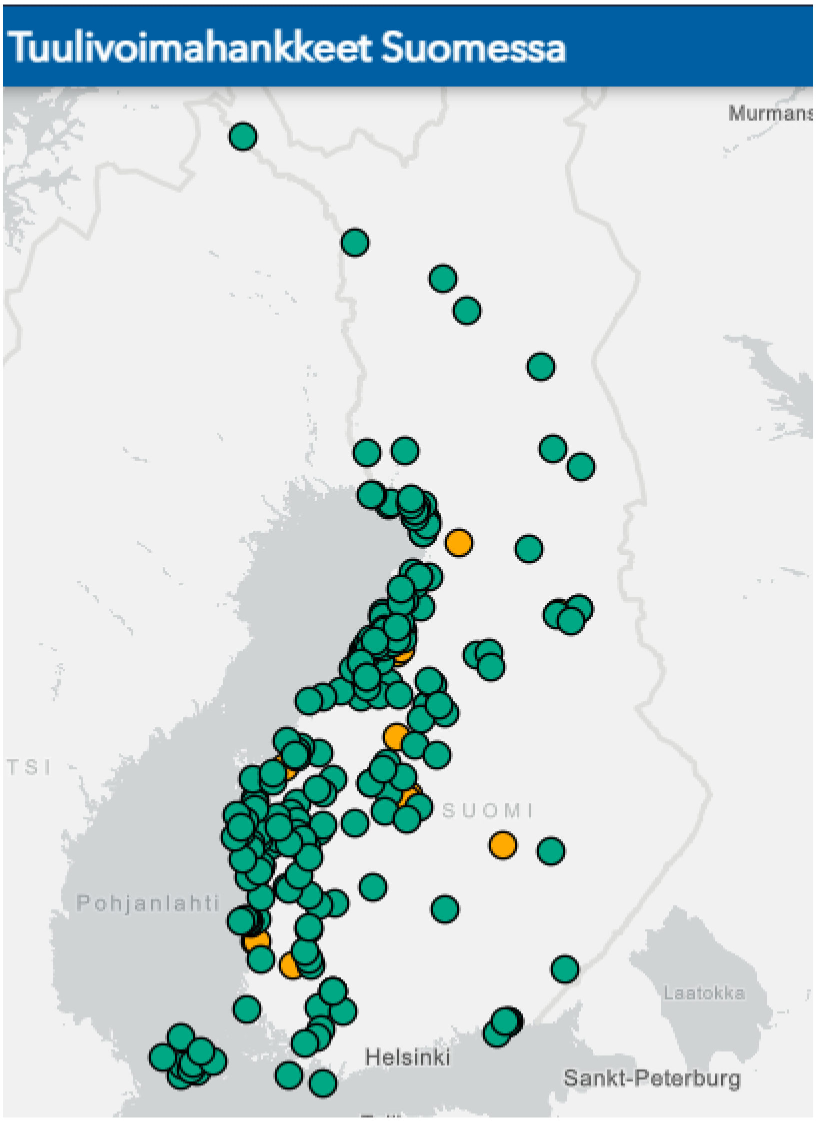

Figure 2 Wind power projects in Finland in production (green) and under construction (orange) 2024 **(tuulivoimayhdistys.fi/, 2024)**

Vestas´ warehouses are located between the wind parks and divided into areas where the distance to the park is around one hr. drive away. Most customers have several wind parks under service contract, but there are also smaller privately owned parks with a limited amount of turbines. Vestas has built Finland’s largest wind park, commissioned in 2023 Mutkalampi, with 69 wind turbines. (Vestas.com, 2024)

2.5 Targets of Vestas

The main target for the Service department is to ensure that the wind turbines are producing optimally, maximizing turbine uptime and efficiency by ensuring that wind turbines operate efficiently and have minimal downtime. These goals are reached through regular maintenance, timely repairs, and proactive monitoring. Vestas' policy is adhering to regulations and industry standards for safety and compliance to protect workers and ensure the turbines operate safely. Providing a cost-efficient solution for maintenance and repair to optimize the return on investment for wind farm operators. The optimization team is incorporating the latest technology, such as advanced diagnostics, predictive maintenance tools, and software for performance monitoring. Providing excellent customer service, timely communication, and tailored solutions to meet the specific needs of wind farm operators. Vestas aims to maintain its position as the market leader in manufacturing and service. (statista, 2022)

3 Pressure Vessel Supervisor

This section delves into interviews and discussions that shed light on critical operational roles, challenges, and processes around the Pressure Vessel Supervisor Role. I begin with interviews with professionals with diverse experiences. These interviews provide valuable insights into the practical challenges faced in the field, the responsibilities of supervisory roles, and the requirements for managing pressurized equipment. After the interviews, I looked into the critical challenges within the roles and reviewed the process flow in technical operations. It also addresses the associated pitfalls along with strategies to mitigate them—finally, a discussion on insourcing and its impact on operational efficiency.

As a starting point and as a foundation for this thesis work, and to be able to work with the development process work in Vestas, I have acquired knowledge of current legislation from (Finlex, 2024) and theory regarding pressurized equipment with information from Finnish Safety and Chemicals Agency (Tukes, 2016) All information is available online. The reason was to understand what is required and what standards we need to meet with the process. The framework was set up based on the requirements.

3.1 Interviews

I have chosen people for interviews based on their roles, mainly to acquire relevant input. In this chapter, the interviews are rendered as a whole with questions and answers to clearly demonstrate the target person's input on each question without further editing. The verbally given responses are written down as such, only leaving out names.

The interview with a former field technician, currently a customer engineer, supports my team in technical matters. He has good scope knowledge and is experienced in practical work in the field. The questions have been chosen to help me understand where the pressure accumulators are located, why they are needed in a wind turbine, and how they work. The interview was conducted via teams on 12.09.2024 and recorded, with permission, for further reference of the topic if needed.

The second interview was conducted with the lead technician in the Alajärvi area, a pressure vessel supervisor who is also Vestas' internal pressure vessel supervisor. He is located in the Alajärvi area, is new to the task, and does not have much experience in what this role requires. I aim to clarify what they must do in this role as Pressure Vessel Supervisor and what challenges he has faced. As a result of the feedback and challenges, I can use this information for a functional working process. The Lead Technicians have responded in writing via team communication.

It is also important to get input from the external collaboration parties; therefore, I have chosen to Interview with External, 3rd party Pressurized Equipment Supervisors on 16.9.2024 as the fourth interview. This is when the owner of a wind farm, on their own initiative, outsources the role to a subcontractor. Two people attended this interview, representing the owner's subcontractor. I was searching for their perspective on the current cooperation and communication situation and the challenges they have faced. Their suggestion for what needs to be improved was important to learn about, as an external may face different challenges compared to in-house resources. The interview was conducted on 16.09.2024 via teams and recorded, with permission, for further reference of the topic if needed.

In the last Interview with the External Pressure Equipment Supervisor, customer managed. I selected a customer who undertakes the role of Pressurized Equipment Supervisor. As a customer, they have several different channels and platforms to use for communication, and the insight into Vestas' processes is on a different level than externals. Still, I see the need to explore their experience of the role and the collaboration with Vestas on the topic. As the customer is experienced in the field, it is essential to consider suggestions for improvement from their experience.

3.2 Interview with former Field Technician, currently Customer Engineer

To understand and learn about the material, pressure accumulator, what it is, and how it works, I have familiarized myself with information from the website (ABS Accumulators, 2021); even if we currently use other manufacturers' products, the technology is the same. Also, I have acquired excellent, in-depth information on pressure accumulators in Vestas' wind turbines and their use in wind turbines from Vestas' former technician currently working in the engineering team.

This was done via Teams and recorded, with permission from him, so I could go back to the interview and check information and facts if needed later in the process. This colleague of mine was pleased to contribute to my aim to deepen my knowledge of this topic.

Interview 1 . Pressurized Accumulators in wind turbines.

1. What is your background & history in Vestas?

   I have worked as a service technician at Vestas since 2018. The work was initially scheduled maintenance, but later, I attended training courses and deepened my knowledge. After that, I also performed troubleshooting and repairs. The tasks mentioned are normal technician work in the field. I worked in the field for five years.

   At the beginning of 2024, I joined the engineering team as a Customer Engineer, supporting Customer Agents and Managers in technical matters.

2. Where are the pressure accumulators located in a wind turbine?

   The accumulators for brakes are located in the nacelle, and the accumulators for blades are located in the hub.

3. What is the purpose of them?

   Pressure accumulators are used in wind turbines for two purposes, both of which are safety aspects. When a turbine stops and is without a grid connection, i.e., there is a power outage, we no longer control the turbine. The purpose of a pressure accumulator is to act as a reserve energy source, allowing us to get wind turbines to a safe mode.

   If a team is working in the turbine and needs to hit the emergency break for some reason, the power of these accumulators is used to engage the emergency breaks. This immediately stops the turbine; brakes prevent the rotor from rotating. The brakes' accumulators are small and located in the nacelle. Due to their size, they are not subject to registration.

   The larger pressure accumulators are located in the hub and are used for the blades. The main purpose is to control the pitch system to pitch the blade to 90 degrees. At *this angle, the blade has the minimum wind resistance. This is also needed if the turbine is without a grid connection or emergency brakes are engaged. Both occasions are intended to keep the turbine in a safe position.*

4. Do you have any experience working or handling this material?

We follow a normal procedure for yearly service, where the nitrogen pressure is tested. Depending on the environment's temperature, the pressure needs to be about 100 bar; this is adjusted to the correct level. Both accumulators in the hub and on the blades follow the same procedure.

Also, in troubleshooting, we occasionally need to measure the pressures, as the sensors give alarms if the pressure changes. A Faulty accumulator needs to be replaced and cannot be repaired. Usually, the gasket or the bladder are the reasons for failures.

5. Other relevant info to be added?

Two different pressure accumulators are used: piston- and bladder models. Generally, the bladder model is used in older wind turbines and the piston model in the newer ones. Today, modern turbines have bigger and longer blades, causing the need for more powerful Accumulators to be used. This is where the size exceeds the given limit, and pressure accumulators must be registered and have an appointed supervisor.

The exchange work is quite a task as they are heavy and must be manually removed from the hub through small passages and lifted out by utilizing the internal crane.

3.3 Interview with Lead Technician - Pressure Vessel Supervisor

As we already handle tasks related to this scope in Vestas, I conducted interviews using the available resources. In-house, we have Lead technicians, and I have interviewed one of them. I reached out to all 12 current Lead technicians, but unfortunately, I only had one respondent who was willing to agree to this interview. We decided that I would send him my questions, and he would reply in writing. I got good knowledge and insight into the current situation from this interview. I have acquired material to draw out the frames on what we need to focus on and their expectations on guidance in this process. He was very satisfied to hear that process development is being addressed as instructions are urgently needed, and he lacks work instructions.

Interview 2. Vestas internal Pressure Vessel Supervisor mmm

1. What is your background & history in Vestas?

   I am an Electrician. Service technician for 5 years since 09/2019 and Lead technician since 12/2023

2. Can you describe the task work/process you must do as a Pressure Equipment Supervisor?

   This is hard to say since I only recently became a Pressure Equipment Supervisor. Vestas does not clearly instruct pressure supervisors about what they are obligated to do.

3. Challenges in the current way of working?

   It would be nice to have clear processes/ instructions on what is part of our job as Pressure Equipment Supervisor. For example, what information should we send to Tukes if the accumulator is defective and needs to be replaced? When the accumulator is replaced, who is in charge of ordering the commissioning inspection, and do we need to inform Tukes after it has been performed?

4. Improvement suggestions?

   -Basically, I said everything about the questions above.

3.4 **Interview with External, 3rd party, Pressurized Equipment Supervisors** ***16.9.2024***

As there are also Pressure Vessel Supervisors performing this task on behalf of the Customer, as a third party, I needed to understand their situation and their challenges. I reached out to a subcontractor I have cooperated with on a regular basis in these matters in my own work; this can be found in Interview 3. The subcontractor was very positive about this initiative and also, on their own initiative, asked if he could take a colleague to the agreed team meeting. This meeting was also recorded with their permission for me to use as reference material in this thesis process. This was a very eye-opening discussion with the customer subcontractor. I got input on their work, what they do, and what their challenges are. Also, suggestions for improvement were provided, and there was an overall good discussion on the collaboration at the current level and the goals for the future.

Interview 3. 3rd Party Pressurized Equipment Supervisors

1. What is your background and history in the current field of occupation?

   Person 1*: I have been working for 3,5 years in this company.* (Own remark - provides services for the renewable energy market, project development to project supervision Owner's Engineer, and operation and maintenance support.) *Before that, 6,5 years at Vestas as a Service Technician*

   In the beginning, my work basically consisted of turbine inspections as the main task, commission inspections, and Safety and statutory inspections. For the last one and a half years, I have been responsible for Technical Operations for customers' wind farms. The pressure Equipment Supervisor role became a part of my scope at the beginning of the year 2024.

   Person 2: I have been working in this company for over two years. Before that, I worked for Vestas for three years, two of which were as a Service Technician and one as a Team Leader. Prior to my Vestas career, I worked mainly in the engineering industry*.*

2. Can you describe the task work/process you must do as a Pressure Equipment Supervisor?

   As Pressure Equipment Supervisor, my main task is keeping track of what is happening in the wind farms, including replacements and periodical inspections. Third-party, certified inspectors perform the periodical inspections, and I also attend as a supervisor. The third-party provides the inspection reports. We do Visual inspections before the Pressure Equipment Supervisor role is accepted for each turbine.

3. Can you describe the cooperation/communication related to Pressure Equipment with Vestas, if applicable?

   Vestas' technicians conduct periodical inspections of turbines and pressure testing of accumulators. This documentation should be shared with the third-party supervisor. The third-party, certified inspector requires this report in statutory inspections that occur only every four years.

4. Challenges in the current situation or way of working related to communication and information flow regarding pressure accumulators to counterpart Vestas

   The most important topic regarding communication challenges is how information will flow to third parties when a pressure accumulator is replaced. We can retrieve relevant information from service orders for parks where we have access to Vestas Online. But in many parks, this is not possible. In this case, the owner, park operator, or asset manager should provide the information regarding replacements. This makes it complicated and increases the risk of information not getting through.

   This can lead to the case that newly installed equipment is not inspected or registered at Tukes, and the authorities' register contains outdated information. As a result, the equipment is also not given a registration number.

   Service reports from periodical inspections when testing the pressure of the Accumulators in turbines are missing when a third party comes to do statutory inspections. Inspectors require this documentation. It is not a communication issue *in general, but the needed documentation on pressure vessels is challenging to get from the manufacturer.*

6. Improvement suggestions?

   Ensure the information flow to externals is not compromised; we need service reports on scheduled maintenance for pressure vessels and all information regarding equipment replacement.

3.5 Interview with External Pressure Equipment Supervisor, Customer-managed

In a discussion with my Line Manager on this topic, I brought up that I also needed input on the subject from a customer managing this role as a Pressure Vessel Supervisor on their own. And my Line Manager provided me with information on who to contact in this matter. He is a Site Manager in a company that is Vestas' customer, and in the interview, he describes his background and current job, including the Pressure Vessel Supervisor role. This interview was also held via teams due to long distances and recorded, with permission, for use in this thesis work.

Costumer-managed External Pressure Equipment Supervisor

1. What is your background & history in the current field of occupation?

   I have a diverse background in the electrical field. I am an electrician with an education in IT engineering and 16 years of experience. I began my career at Vestas in 2015 as a field service technician, which provided me with hands-on experience and a solid foundation in practical skills. Over the years, I have taken various courses related to pressure equipment systems, enhancing my expertise in this area.

   In addition to my technical skills, I am qualified to perform the role of Pressure Equipment Supervisor. My supervisory experience at Vestas has further honed my leadership abilities.

2. Can you describe your tasks and processes as a Pressure Equipment Supervisor?

   As a Pressure Equipment Supervisor, my responsibilities include ensuring that all interval inspections are completed on schedule. This involves:

   Regularly checking that all required inspections have been conducted within the specified intervals. Ensuring that all inspection reports and related documentation are accurately recorded and maintained. Making sure that all inspections and documentation meet regulatory and safety standards. Collaborating with inspection teams to address any issues or discrepancies promptly.

   On top of this is also the Visual inspections of the pressure accumulators.

3. Can you describe the cooperation/communication with vestas related to Pressure Equipment, if applicable?

   As a Pressure Equipment Supervisor, effective cooperation and communication with Vestas are crucial for Maintenance and Replacement Reporting. Communication is also needed regarding the status and schedule of maintenance activities and any equipment replacements. I must be informed about the current condition to meet pressure equipment requirements.

   I should be updated on technician skills and education so I can be sure they have a comprehensive understanding, adequate education, and sufficient skills to ensure they can perform the tasks assigned to them and that all work is performed to the legislated standards. As of now, this is not really being prioritized on my side.

4. Challenges in the current situation or way of working related to communication or information flow regarding pressure accumulators to counterpart Vestas

My challenge is that I do not have insight into the education or skills of the resources performing the tasks. However, more important is the information flow on the planned works or maintenance that I should be aware of, preferably in advance. Not to mention the replacements that I may have missed. Because of this, I neglected to book an inspection of the replaced component and also neglected the registration.

5. *Improvement suggestions?*

From my point of view, it would be best if Vestas could offer this service as they have the best insight into ongoing and upcoming work and the overview to perform this task according to the legal requirements. We are prepared to extend our contracts with this amendment if it is available at a competitive, reasonable price. Also, the in-house supervisor has on-point knowledge of the technicians' skills and education.

Conclusions from the interviews with all stakeholders show that the information flow is the most important aspect to focus on, as several stakeholders are externals. These interviews highlight the importance of providing access to relevant reports so that they can perform the task of Pressure Vessel Supervisor. The external supervisors face several obstacles to successfully carrying out the task that they have taken on.

Regarding the internal Pressure Vessel Supervisors, there is an explicit need for work instructions, task responsibilities, step-by-step instructions, and process flow charts. According to my own observations, several internal Pressure Vessel Supervisors are, in fact, new to the role, and thus, there is an even more urgent need for guides and instructions.

3.6 Challenges

We have three main challenges on this topic that will need to be addressed and to find solutions for

1) Creating the database of turbines where the Pressurized Equipment is installed, including the unique material number and the registration number, as well as the Supervisor and the deputy.

2) Systematically recognize orders regarding pressed equipment and process them according to requirements, ensuring the correct people are notified of any ongoing task related to the equipment.

3) How to ensure that during the construction operations phase, the Supervisor from Vestas service is fully aware of ongoing tasks and works regarding pressurized equipment when communication and collaboration in this phase are not yet established between the divisions.

The first challenge we recognized was concrete, and the process for this is described in the next chapter, the development process.

The second challenge is for the service desk and service planning agents handling orders to mark them with #PV regarding pressure accumulators. This allows the filtering of relevant work orders, which can easily be exported from an ERP system to an Excel sheet. From the information in the work order list, the Vestas internal Pressure Vessel Supervisor has a good overview and can take necessary actions on tasks within his area of responsibility. All Lead technicians can access one of our ERP systems for these reports. These reports can perhaps be generated as an automated process and sent to relevant recipients in the future.

The third challenge is for Construction to solve, and the Service Department has communicated initially regarding the possibility of Construction training its own resources to take on the Supervisor Role.

3.7 Master Data Acquirement

As the current master data in SAP is not living up to the needs of the new process, it is essential to collect the needed information and develop a database containing all required data. In the turbine structure, we have the material and serial number at this point. To meet requirements, we need to update and match the registration number provided by the external inspector. The register at TUKES is, at this moment, not supporting the extraction of the report we would need, as specified in Delimitations of the Thesis, not containing the ID number of the wind turbine matched to the material and a serial number of this equipment to correspond to the registration number. All in all, there are three numbers for each Accumulator. Additionally, the inspection reports do not contain the registration number either. In practical terms, we need to initiate a campaign for the technicians to visit every turbine. During this visit, every single pressure accumulator must be documented and reported to our Pressure Vessel Supervisors as well as the local technical planning department in Finland. In the picture below is an example of a registration plate, Figure 3 Pressure accumulator label with material, serial, and registration number; this is the registration plate received after the installation inspection is completed. Picture: Vestas internal.

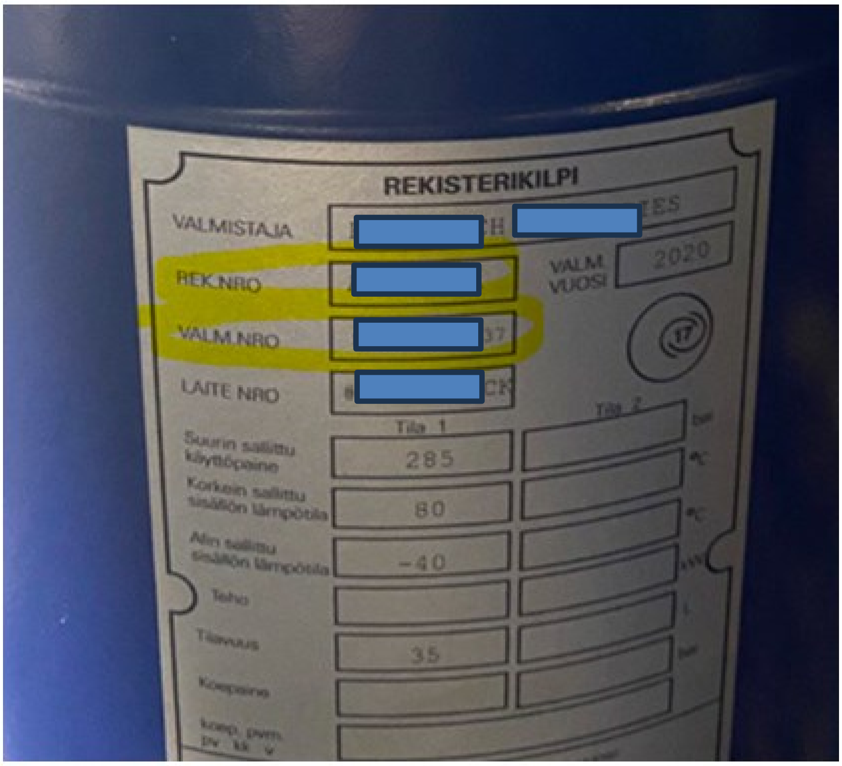

Figure 3 Pressure accumulator label with material, serial, and registration number; this is the registration plate received after installation inspection is completed. Picture: Vestas internal.

This is received when the new Accumulator is inspected and approved. From this thesis perspective, the most important information is the material, serial, and registration number marked in yellow in the picture. But the registration plate also holds other information about the Accumulator relevant for the use, including the maximum allowable operating pressure, the maximum and minimum permissible temperature of contents, and, of course, the volume in Liters, which in this case is relevant to the requirements.

Prior to this project, there were no existing fields in SAP for master data, i.e., registration number from TUKES and contact detail fields for the Pressure Equipment Supervisor and Deputy Supervisor; the Business Process Specialist from IT support requested these and are now available for testing.

3.8 Process flow

The Vestas´ internal workflow consists of the following discipline involvement according to the internal processes I have familiarized myself with during my two years as a Vestas´ employee.

- Work Order generated by SDC
- Technical Planning agent processes orders and updates with relevant information, work description, and material needed.
- The Service Dispatcher plans the resources and handles the material ordering.
- Service Technicians perform the tasks.

As the agent at SDC processes a Work Order generated from either a technician observation, from Remote Surveillance, Component Inspection Report so, so-called CIR, CIM case, short for Continuous Improvement, or from a scheduled service order, the identification of the Pressure Vessel relation i.e. #PV is needed already at this stage, most importantly to Pressure Vessel Supervisor. We are facing challenges as this is not necessarily an in-house resource. It may also be a third party involved, or a customer-handled the role. To secure the uninterrupted flow of information will be the goal towards the external Pressure Vessel Supervisors.

The agent in the Technical Planning Department should not need to have knowledge of who is the appointed Pressure Vessel Supervisor, nor if the pressurized accumulators are, in fact, subject to a registration obligation. Only to follow normal protocol and dispatch the order to the Service Dispatching team for further execution.

Once the order is dispatched to the Service team, including information on where work is planned, when, and what is to be done, the Pressure Vessel Supervisor can and must secure the safety aspects of upcoming work. At this point, the material number and serial numbers of the replacement material and pressurized accumulators must also be at hand, and this information is all to be found in the work order.

As the work order is technically completed, TECO, a service order report is generated. The pressure Vessel Supervisor needs to file these for the periodical inspections so he can act on reporting and updating the TUKES register if there have been replacements done.

3.9 Development process

Since the beginning of the development process, we have had internal discussions and brainstorming sessions with the Business Process Specialist, the Project Lead in the North& West region, and the Operational lead in Finland. Our Business Process Specialist is involved as he has organizational input on a global level and also the best insight into processes in-house. The regional Project Lead and the Operational lead are needed for the local operations. We regularly schedule sessions to review the current status and progress.

The starting point for all planned operations is based on the Law for Pressure Equipment (Tukes, 2016). An assessment of the current processes and a comparison to what we need to produce to meet requirements was done with the Business Process Specialist, the Project Lead in the North& West region, and the Operational lead in Finland. When the first meetings were held, we discussed what requirements we were facing, what we had at hand, and what we were lacking.

We have, step by step, identified and evaluated the service and maintenance tasks for pressure equipment, the replacements that occur, and the reporting and registration requirements regarding these tasks. As far as possible, we have focused on using the existing workflow but adjusting and refining the steps and responsibilities to cover the entire process from the order that is dispatched to inspection labels received and attached to the material.

First challenge

Building the database of turbines where the Pressurized Equipment Supervisor is required, including the unique material number and the registration number, as well as the Supervisor and the Deputy.

The Supervisors and the deputies were not listed or collected in our own register. When the first meetings with the Business Process Specialist, Project Lead in the North & West region, and the Operational lead in Finland were held, we discussed what requirements we were facing, what we had at hand, and what we were lacking. There were inadequate tables with partly outdated data regarding older park Supervisors available. This was a starting point in which I gathered and updated the Supervisors and the deputies, along with their contact information, for the complete scope of turbines equipped with material requiring a Supervisor for Pressure Vessels, both regarding Vestas internal and external Pressurized Equipment Supervisor. Also, the most recently commissioned parks that were missing from the list are updated.

I listed all wind farms under contract for this task and sorted them by model. All turbines start from V150 and bigger wind turbines. These have accumulators that exceed the size limit and thus require a Pressure Vessel Supervisor and also a dedicated deputy supervisor. For these wind farms, I have based on the contracts, decided whether the role is included already in the Service Contract and whether Vestas has this responsibility as a contractual obligation or if the responsibility is on the customer. In both cases, I looked up information on the names of the Supervisor and Deputy Supervisor. The internal work was done over teams mostly, by contacting Field supervisors, as they have the information of their own areas appointed supervisors handled by Vestas. As the next step, I was in contact with customers that was handling this role either on their own or by outsourcing to 3rd parties by mail. This part was slow as the response from the customer side took a long time to receive. Also, the Customer Managers were asked to help as they had knowledge of their own customer portfolios´ appointed Pressure Equipment Supervisors. All gathered information from supervisors is to be entered into SAP in each turbine's structure. This task will be assigned to local technical planning agents. This will initially require manual work to some extent, but once it is done, it does not require many resources except for updating in case of changes or when new parks are transferred to Service.

The registration number from TUKES was not, prior to this process, to be found in any other place within Vestas than in a turbine attached to the material with a sticker. The information is saved at TUKES, and the Pressure Vessel Supervisor can request a report on the equipment he is responsible for. The current report is not of any assistance at this moment and will need to be subject to revision, but this will not be a part of this thesis, as stated in the Delimitations of the Thesis. The current extracted report from the governmental register does not in any way link the registration number to a certain turbine or a material but rather to the customer owning this accumulator and the park in which it is installed.

I checked earlier inspection reports for a pressure accumulator, 4-year interval, hoping to discover the registration number, but it was not listed in the inspection reports. I also tried to find the registration number from the reports extracted from TUKES, but this information was not included there. This left us with only one option: to get the correct data gathered, create work orders for taking photos of the labels of the accumulators in every turbine of this scope of work by mass creation of work orders for each turbine, once we have been granted financial approval for the work. The task is to go into the hub and all three blades to take photographs of the registration labels from TUKES with the number so we can build the database to match the registration number to the existing material number in the turbine structure in SAP. The documented info will be a task for Finland's local technical planning agent to process and update the material structure in SAP. The master data updating task will be time-consuming as it is not straightforward to automate this process simply because an original component is part of an assembly that consists of two different accumulators. If we have done the replacement, the new component is shown as a spare in the structure. Therefore, the process requires manual assessment and awareness of the pitfalls and the risk of adding a registration number to a replaced component.

We have chosen two wind farms as pilot projects. These will be of higher priority when collecting the registration numbers from the turbines. The decisions on which parks will be tested were taken in a meeting with the Management, Business Process Specialist, Project Lead, Operational lead, my Line Manager, and myself. Both wind farms are owned by a customer who has shown great interest in taking this process as an add-on service to the contract. The new process is to be implemented for Vestas in Finland after the testing has been successful.

Second challenge

Systematically recognize orders regarding Pressurized Equipment and process them according to requirements, ensuring the correct persons are notified of any ongoing task related to the equipment.

In discussions with the Business Process Specialist, Project Lead, and Operational lead, we have seen the need for tagging the orders, as the Pressure Vessel Supervisor must be able to extract reports on planned operations under their own area of responsibility. Service territory filter allows to narrow down to own area, but there is no component-specific filter.

The process owner of creating and handling work orders is SDC, Global Service Desk. Our need for the country-specific recognition of work orders related to pressure accumulators is to be approved by management before the SDC can implement the required changes for identification by adding #PV as a prefix to work orders. This is needed to easily access the desired list when extracting reports from the ERP system. No filter is available for the pressure accumulator work order reports to be extracted from SAP or other ERP systems. Depending on the heading of the work order, we can extract some kind of report, but there will be uncertainties, and some orders will still not show up unless they are tagged. For other components, we use the same system of # marking, which has proven helpful.

In order to onboard the SDC Global Service Desk, we have set up a meeting to outline how they need to assess orders and what we expect and need. The Business Process Specialist, Project Lead and Operational lead, representatives from the dispatching team, and myself included. This session is to go through the next step for SDC, which is to add, according to our needs, work order Line Item, and WOLI on work orders related to pressure accumulators.

For inspection 4-year interval, we need to create:

WOLI #1 for the supervisor to be aware of upcoming work & ensure safety

WOLI #2 inspection of pressure accumulator by third party

WOLI #3 is for the assistance of the subcontractor/ third party working in the turbine.

For the Work Orders regarding the replacement of the pressure accumulator, we need to create:

WOLI #1 for the supervisor to be aware of upcoming work & ensure safety

WOLI #2 for the replacement

WOLI #3 inspection of pressure accumulator by third party

WOLI #4 for the assisting of Subcontractor/ third party in working in turbine

WOLI #5 for the attaching of labels when received

The operational Lead informed me that we have already experienced the challenge of work orders being closed and labels arriving with delay. This causes unnecessary add-on work for requesting new orders and risks losing labels in the pile. This risk is mitigated by keeping the work order open until all tasks are performed and adding WOLIs to the master order. This helps us stay on track with the tasks.

The 4-year inspection only requires three work order lines, the first one for the Pressure Vessel Supervisor, one for the inspection, and one for the assisting of the Subcontractor. But if there are remarks in the returned inspection report this will trigger the need for a new work order to be requested based on the nature of the remark. The Work Orders regarding replacing a pressure accumulator, on the other hand, contain five tasks. To ensure none of the steps is left undone, all must be created from the very beginning under the main order, not to rely on someone remembering this along the way.

Vestas´ Internal Pressure Vessel Supervisor can easily recognize orders marked with #PV and receive notification to the mailbox from the ERP system. This ERP system supports this function. The supervisor is aware of what work is planned and where, and also ensures the safety as well as the knowledge and skill level is sufficient on resources assigned to the task. This allows the Pressure Vessel Supervisor to live up to the requirements of following up and ensuring that all information is updated to the authorities, as the Work Order has already included all needed tasks and cannot be closed until performed or canceled. The system notifies the concerned Pressure Vessel Supervisor via mail notification as the master data is now updated with the turbine-specific contact information of the supervisor.

Third challenge

How can we ensure that during the construction operations phase, the Supervisor from Vestas is fully aware of ongoing tasks and works regarding Pressurized Equipment when communication and collaboration between the divisions in this phase are not yet established?

This problem has been forwarded to management and is not part of this thesis, as stated in the chapter Delimitations of the Thesis. This is a matter for management to execute. The problem was discovered internally as the Services´ Pressure Vessel Supervisor extracted their list of the parks where he was responsible from TUKES. To prevent it from happening again, the construction assigned a supervisor from Vestas´ service during the project phase, and we have taken preventative measures. Construction has been made aware of its responsibility to train and assign its Pressure Vessel Supervisors.

Profitability

At this stage, profitability is not evaluated and not a part of this thesis, as mentioned earlier in Delimitations of the Thesis. During the piloting of this process, the aim is to gather information on how many resources this requires and fine-tune the process. The initial work during the startup ties up human resources to a certain extent. Still, once we move forward, the workload on the Supervisors, local technical planning, and SDC will decrease to finally find a steady level of impact. The pricing for this additional service is handled at the management level based on data gathered from the pilot testing. The main goal at this point is for Vestas to own the process as we have the piloting phase's best insight and overview of the workflows and the internal reporting. Therefore, the Vestas´ Pressure Vessel Supervisor has the best prerequisite to fulfill the statutory requirements for the accumulators. The other aim is to be able to respond to customer demands for this role.

3.10 Pitfalls and how to avoid these

I have identified potential grey areas when the project is during the construction stage, appointing or assigning the service department´s Pressure Vessel Supervisors without consent from this person. We have seen this happen when the service department Pressure Vessel Supervisor extracts its reports from TUKES, and there are also listed sites that have not yet been handed over to the service department. This can lead to severe consequences when someone is unaware that they were assigned as a supervisor and, by this, fails to handle the responsibilities of the role, does not act according to requirements, or does not monitor security.

Communication between Construction and Service is not active in the early phases when the need for an appointed supervisor arises. Therefore, the Service's current Pressure Vessel Supervisors have raised this topic and identified that it is essential for construction to train its own resources for the role. When handover to Service, HOTS, is reached, the role will be transferred under the Service Division´s own supervisors' responsibility.

The challenge is related to component exchange. Changing a component in a turbine involves manually entering data related to the element, such as its serial number. This process must ensure that the system's inventory, maintenance, and production planning data remain accurate and up-to-date. The new part must be updated in SAP. This includes verifying and adding the material- and registration number and identifying the part in the turbine structure in SAP. As manual data entry is a potential risk, it can be entered incorrectly, allocated to the wrong turbine, or even forgotten. Errors in manual data entry risk were identified when the current structure in SAP was reviewed in a few selected parks.

The risk is related to the material, which can be either a part of an assembly or listed as a spare if replaced. This requires awareness of turbine structure in SAP and the knowledge of Bill Of Material, BOM. We noticed one wind farm where a CIM case with Accumulator replacement had been performed, where we needed to assess every turbine manually; we noticed that the material structure was compromised. If a part of an assembly is replaced, this must be added as a spare part, and the registration number must be appointed to the spare part. The registration number matched to the incorrect component is a consequence of the problem when only one part of the assembly is replaced. An assembly can consist of two accumulators, for example, 35 L and 20 L, with one serial number listed as *manufacturer name* 55 L accumulator. If 35 L is replaced, this must be added as spare and the serial number updated with the registration number, not for the assembly of 55 L.

We have not yet experienced this challenge, but we have, in our discussions with the Operational Lead and Project Lead, concluded this is a risk, as the registration number from TUKES is received at a later stage after the component is installed and inspected by a third party, i.e., certified inspector. Registration numbers must be matched to the exchanged component. This manual process can be time-consuming, but it's crucial for ensuring data is correctly entered in systems reliant on precise material tracking and maintenance records. Every step requiring manual input is risky, as humans can make mistakes and must remember to register the data.

The fourth challenge is regarding communication. Quality documentation and reporting linked to the part number must be updated in SAP to ensure all stakeholders know about the modification. However, third-party supervisors still need to be kept in the loop. And the challenges of keeping the information flowing outside of the organization. Based on the interviews, I have learned this is essential information for the Pressure Vessel Supervisor, but the externals have little or limited access to the mentioned documentation. Therefore, they are depending on someone to provide this for them.

3.11 Conclusions

The interviews I conducted have given excellent and valuable information on the situation, how the current Pressure Vessel Supervisors are experiencing the problem and the need for improvement as they see it. From the customer I interviewed, the feedback: If Vestas could offer this service, it would be the optimal solution, was brought to Management's attention. As not all customers may be making amendments to existing Service Contracts and adding the Pressure Vessel Supervisor role into the Service scope, we must adhere to the third-party improvement suggestions on communication and the availability of relevant documentation. The practical actions taken to deal with our challenges, the requested fields in SAP, and gathering the current Supervisors' names and contact information took their time to complete but are now completed tasks. The recognition of orders regarding pressurized equipment with *#PV* is waiting for execution at SDC. Also, the campaign to take photos of the registration plates in every turbine will take longer until it is completed. However, it is not the intention to roll out this process on the entire Vestas´ Fleet with conditions matching the requirements for registration of the pressurized equipment, but to implement this process and data gathered on the selected windfarms as a pilot project.

4 Insourcing

This chapter covers the pros and cons of insourcing a task or a process. Depending on the company´s aims, various factors influence the path choice. What is the best practice that serves the ideals or objectives of the company? It may vary and must be evaluated individually according to the process. As pressure accumulators are subject to strict legislation due to their safety risks, I am presenting the requirements in this chapter regarding Supervisors and their deputies. Further down in this chapter, I present the purpose of the pressure accumulators in wind turbines and, in the end, explain the RACI matrix.

4.1 Outsourcing vs. Insourcing: Understanding Core Competence in Business Strategy

Today, it is common for companies to outsource functions that are outside their core business or value chain if the function requires specialized knowledge or where excellence is required. Activities and processes that create competitive advantages are called core competencies. It may take work to pinpoint what the core competence is. According to Prahalad and Hamel, 1990 in the book (Edengren J. & Skärvad P-H, 2014), core competence is characterized by a "*significant contribution to customer perceived value, and that it can be utilized for multiple offerings, and it provides access to many markets and is difficult to imitate*" The opposite of outsourcing is insourcing, which in practice means bringing work or processes in-house, that were previously outsourced to an external provider. (Edengren J. & Skärvad P-H, 2014, ss. 35-37, 43) In this thesis, it is a process handled by the customer or vendors brought to Vestas operated function.

4.2 Advantages of Insourcing

Insourcing a service allows the company to maintain direct control over its processes. (Gold, 2017) According to (Harrigan, Kathryn Rudie, 1984, s. 2) a company can also reduce unnecessary steps and have cost-effective processes. Cost savings in reduced time consumption for the communication steps regarding RFQ and contract negotiations. (Harrigan, Kathryn Rudie, 1984, s. 2). According to Harrigan, this leads to quality assurance for customers, as the company can oversee every aspect of the work and ensure it aligns with corporate and internal standards and customer expectations. The in-house operations can be made more flexible to change and adapt quickly to meet demands and external requirements such as market, laws, or customer needs. This also allows for internal flexibility and creates product or service differentiation opportunities. (Harrigan, Kathryn Rudie, 1984, s. 2) Changes in processes or ways of working can be implemented when such is needed. (Edengren J. & Skärvad P-H, 2014, ss. 46-49)

Björn Axelsson sees the advantages of insourcing in corporate secrets, and knowledge stays in the hands of the owner when confidential information does not need to be shared with partners. (Axelsson, Företag köper tjänster, 1998, s. 193) With insourcing, the risk of losing competence to subcontractors is eliminated. (Gold, 2017) According to Oskar Gold in the article, the reason for insourcing is mainly about maintaining control. Also, the risk of losing customers if the contractor sells outsourced products under its own brand is avoided. Firms with superior control over critical parts of the supply chain or production processes can create higher barriers for competitors and can capture more value by managing those processes in-house. This can make it difficult for new entrants to compete effectively or gain market shares. (Harrigan, Kathryn Rudie, 1984, s. 2)

Communication and information flow is easier to control in-house. For functions outsourced communication failures can stall the process. There is hidden cost in the administrative chain caused by communication and coordination or related to vendor management, less risk for quality control issues all issues that can lead to an overall deterioration in profitability or result in smaller margins on services or products in the long term. (Edengren J. & Skärvad P-H, 2014, ss. 46-49)

If the competence level is high within the company, functions and production are kept in-house. This will affect the overall motivation positively amongst the employees and allow for the company to move resources and maintain the utilization of staff in their own company. (Edengren J. & Skärvad P-H, 2014, ss. 46-49) With today´s continuous cyber security threats, the risk of information leaks to the public domain or ending up in the wrong hands is reduced when sensitive operations are kept in-house. (Axelsson, Företag köper tjänster, 1998, s. 193)

It is also known that a reason for insourcing is to avoid disruption in supply in situations of foreclosure (Gold, 2017) as the control over the company´s own environment is subject to fewer uncertainties, making long-term planning easier and reducing exposure to economic shocks or sudden market changes.

Despite the role of Pressure Equipment Supervisors not being a core business for Vestas' Service, this is a step to maintain direct control over the Service' processes. Also, to ensure communication is seamless and collaboration is effective at every step of the workflow. With this, Vestas aims to enhance the customer experience and satisfaction, as this provides the opportunity for customers to have the full scope included under the service contract. Insourcing of this process is aligned with internal long-term goals and to meet the authority's official requirements.

4.3 Disadvantages of Insourcing

Insourcing may cause disadvantages related to the core business, costs, and flexibility. Dilution of focus can be a result of insourcing as the efforts are more widely spread, and insourcing can distract the company's core business or steal attention and resources from the core business. When a company brings non-core tasks in-house, it risks spreading its focus, potentially leading to **reduced efficiency** in the primary areas of expertise. Insourcing typically involves initial **investments**, such as **hiring**, **training**, or purchasing equipment. In addition, maintaining these functions in-house can lead to higher **fixed costs for salaries and training**, which ties up financial resources, especially in fluctuating market conditions. There is also an aspect of **scalability**, as it can be more difficult and slower compared to outsourced functions, as vendors have the possibility to quickly adjust to changes in demand. (Edengren J. & Skärvad P-H, 2014, ss. 44-45)

The technology and development can fall behind when a company brings in-house the function or service as cutting-edge expertise in the specific field is not part of their own core business (Axelsson, Företag köper tjänster, 1998, s. 193), the in-house team may lack the cutting-edge expertise and deep knowledge required to innovate, or not being able to provide specialized talent that external providers can offer. To avoid these pitfalls, businesses need to ensure that they have the right talent, resources, and commitment to invest in continuous improvement and innovation in the insourced area. To be able to isolate this, it is necessary to acknowledge the core business, as specified in Chapter 4. Insourcing and according to (Axelsson, Företag köper tjänster, 1998, s. 195) core business can be recognized when a company has the correct capability to perform a specific task.

When analyzing the advantages of outsourcing (Edengren J. & Skärvad P-H, 2014, ss. 44-45) and looking for the opposite effects, it is possible to conclude the following:

Unlike outsourcing to specialized suppliers who benefit from serving multiple clients, an insourced function usually serves just the company. This **limits the company's ability to achieve the same economies of scale,** leading to higher per-unit costs and inefficiencies.

In-house teams may lack the same level of expertise and specialization that an outsourcing provider offers. This can result in **lower efficiency,** less advanced methodologies, lower-quality output, and lack of access to specialized equipment.

Insourcing typically comes with **higher fixed costs**. The company must bear the total expenses related to staffing, training, and equipment, which are often shared among several clients in an outsourcing model. These overheads can make in-house operations more expensive in comparison.

Internal teams may **not be as quick to adopt the latest technologies** or methodologies due to budget constraints, lack of expertise, or risk aversion. In contrast, outsourcing partners, who must remain competitive in their specialization, are likelier to stay on the cutting edge.

If the company is based in a high-wage country, insourcing means **higher labor costs**, especially when compared to outsourcing to low-wage regions. This can be a significant disadvantage for labor-intensive processes.

Insourcing may **focus on** the company's core competencies. Financial, human, or technological resources must be allocated toward non-core activities, potentially leading to inefficiencies in the company's primary operations.

4.4 Case Studies on Insourcing

What types of benefits can a company gain from insourcing, and what challenges does it involve? Which criteria are prioritized in decision-making?

Here are presented two case studies on Insourcing a process or a task to a company; the first one is a *Case study of the benefits and challenges of insourcing in a technology company* produced as a Master´s Thesis in the School of Business and Management in Lappeenranta by Henri Luhtala (lutpub.lut.fi/, 2021) The second is *En kvalitativ fallstudie om Kinnarps och dess utmaningar* a Bachelor level study made by Elin Johansson & Emma Persson at Linnéuniversitetet in Kalmar, Sweden (lnu.diva-portal.org, 2022) Later in this In chapter I have asked Chat GPT for input on other known cases of insourcing and in the end of this chapter I have summarized the key takeaways.

4.5 Case study of benefits and challenges of insourcing in a technology company

The strive for efficiency and cost reduction has led organizations to specialize in key areas. In the case of a company, core competencies play a critical role in the make or buy decision; the company aims to retain its core competencies internally, following its company strategy, and certain technologies are kept insourced as part of this strategy. The case company broadly identifies core competencies as those phases that significantly impact the performance of the technology, such as product technology. (lutpub.lut.fi/, 2021, ss. 52-53) Even when core competencies exist outside the company, the decision can still be made to insource. (TCE). (lutpub.lut.fi/, 2021, ss. 52-53)

The decision to make or buy can be close to the company's core competence or related expertise. The decision then leans towards insourcing from that perspective, but other factors also influence the decision. Conclusions based on thorough analysis are crucial for a successful decision. If key factors are not accurately assessed, insourcing could become costly and difficult to execute. Insourcing can provide new opportunities. (lutpub.lut.fi/, 2021, ss. 54-55) While much academic literature has traditionally focused on outsourcing, recent trends indicate a shift toward insourcing. The supply chain disruptions during the COVID-19 pandemic and war or political aspects support this new way. Although the case study offers valuable insights, findings are specific to one company and industry, limiting generalization possibilities. (lutpub.lut.fi/, 2021, ss. 54-55)

4.6 A qualitative case study on Kinnarps and its challenges

Since long-outsourced functions at Kinnarps have been brought home. No structural changes were made at Kinnarps; they chose to integrate the insourcing into existing operations. (lnu.diva-portal.org, 2022, s. 27) When making decisions, management evaluates costs and time to determine if the price for a component is reasonable. They consult production for an in-house cost estimate if it is too expensive. If feasible, the project moves on to planning. Kinnarps also confirms with suppliers before resuming production, as the withdrawn component might be the supplier's most profitable, potentially leading to price increases for other components to offset the loss. (lnu.diva-portal.org, 2022, ss. 29-31) Conclusions based on this study are that it promotes proper feasibility studies and analysis relevant to the situation and is not to be based solely on trends. The content of the supply agreement is to be investigated to avoid disputes and unexpected costs. (lnu.diva-portal.org, 2022, s. 46)

4.7 Other cases of insourcing

To find other insourcing cases, I used the prompt Cases on insourcing on Chat GPT. Six different results were presented, but I chose to look at Boeing.

The information on this case I found on (Defence and Security Monitor, 2018) For Boeing to address supply chain pressure, they had begun insourcing critical operations such as actuators, nacelles, and aircraft seats. Boeing had experienced problems with its global supply chain, leading to disruptions in its assembly lines. Insourcing was seen as a way to regain control, improve coordination, and ensure the timely delivery of critical components. The operation was aimed at reducing dependency on external suppliers. Increased global defense spending was believed to provide growth opportunities for Boeing’s defense business. According to the article, they gained better oversight and control over the production process, reduced the bottlenecks in the supply chain, and got better cost management alongside more flexibility.   Key takeaways from other cases

The first case indicates that various factors, such as core competence, asset specificity, and the risk of supplier opportunism, influenced the insourcing decision in the case company. Still, it must confirm whether a final insourcing decision was made explicitly. Instead, the case study provided insights into the decision-making process and criteria for insourcing versus outsourcing. The thesis focused on the analysis and strategy behind the make-or-buy decision rather than giving a clear conclusion about whether insourcing was definitively chosen for the specific technology or product in question.

The Second case from Kinnarps points out the importance of the feasibility study phase. Their COO said in an interview. It's a lesson *learned that we must spend much time on the feasibility study.* (lnu.diva-portal.org, 2022, s. 29) Altogether, the savings in time and money are carefully calculated and compared. Is there availability to acquire the right skills, or is there room for internal staff training to ensure the right skills are available in-house? Regarding the Boeing case, the conclusion is that the strategy model enhances quality, efficiency, and cost-effectiveness. To summarize, the most important things are to do the background work, invest resources in a proper feasibility study phase, and avoid the pitfalls of following the trends before making decisions.

4.8 Legislation concerning pressure accumulators

Mandatory requirements for the use of pressure equipment are laid down in the Ministry of Trade and Industry Decision on the safety of pressure equipment (953/1999). The legislation regarding pressure accumulators is not yet adapted to wind turbines, and thus, it needs to be customized. This is an ongoing process in cooperation with Suomen Tuulivoimayhtdistys Ry. To this date, no new amendments have been made to current legislation, but for the future, there is also a need to adjust for the coming offshore fleet.

The problem with this legislation is that it is tailored to conditions in factories and plants where work is carried out on-site, in the immediate vicinity, or where buildings or settlements are nearby. In a wind turbine, there are no humans present on a regular basis or settlements in the park's area. Neither is there an on-site presence by a supervisor in each park; this role is handled from a warehouse from a distance.

The design, manufacture, and use of pressurized equipment in Finland are supervised by the Finnish Safety and Chemicals Agency Tukes, which is the licensing and supervisory authority. The purpose is to ensure pressure equipment is safe throughout its life cycle. The use is nationally regulated, but the design, manufacture, and free movement follow EU directives. As new equipment is used, the authorities must inspect, approve, and register it. New devices must be added to register plates after inspection and registration are completed. The interval of the periodical inspection of pressurized accumulators used in wind turbines is four years, and the pressure tests are to be performed at eight-year intervals. (TUKES, u.d.)

If the equipment exceeds certain limits specified in the Government Decree on Pressure Equipment Safety 1549/2016, 6 § (Tukes, 2016), it must be registered at Tukes. This register holds information regarding the technical specifications of the pressurized equipment, such as the Wind farm name and location, turbine ID number, material/item number, appointed supervisor, and contact details of the owner.

4.9 Requirements for supervisor and deputy role

A pressure Device Supervisor holds critical responsibilities for ensuring compliance with safety standards. They must be well-trained, knowledgeable about legal requirements, and equipped to enforce safety protocols. For the supervisor, one or several deputy operation supervisors are to be appointed for the pressure equipment to act as operation supervisor when the primary operation supervisor is prevented from carrying out his duties during vacations or sick leave, less than 3 months. The qualifications provided for the role in Article 72 § stipulate that the supervisor must have adequate knowledge of the pressure equipment's construction, operation, and maintenance. However, the further requirement of the role specified in Chapter 10, paragraph 72 §, is strictly related to industrial equipment and not to pressurized accumulators used in wind turbines. (Finlex, 2016)

4.10 Registration requirements

Each turbine equipped with a device that fulfills registration requirements needs to be linked to an appointed Pressure Vessel Supervisor. This needs to be set up in SAP as asset information linked together with the material number and registration number.

The wind turbine type, starting from type V150-4,2MW and larger wind turbines, has a specific size and type of pressurized accumulators, which are subject to a registration obligation. If the size exceeds 10,000 Bar L, as shown in Figure 2, Equation 1 determines the size. (Tukes, 2018)

1

$$P_{gas} * V_{gas} > 3000\ bar * L$$ (Tukes, 2018)

Esimerkkejä painelaitteista, joiden sijoitussuunnitelma on tarkastettava

Painesäiliö, joka sijaitsee sisätiloissa, yleisötiloissa tai yleisen kulkuväylän välittömässä läheisyydessä	PS x V > 10 000 bar x L (paineen ja tilavuuden lukuarvojen tulo)
Autoklaavi	PS x V > 1 000 bar x L
PS = suurin sallittu käyttöpaine (bar) V = kokonaistilavuus (L = litraa) Sijoitussuunnitelman tarkastuksen rajat, katso **KTMp 953/1999, 7 §**	

Esimerkkejä rekisteröitävistä painelaitteista

Painesäiliö, sisältönä vaaraton kaasu ja sisällön lämpötila enintään 120°C	PS x V > 3 000 bar x L
Painesäiliö, sisältönä vaarallinen kaasu tai sisällön lämpötila yli 120°C	PS x V > 1 000 bar x L
Autoklaavi	PS x V > 200 bar x L
Paineakku	PS x V > 10 000 bar x L tai P_{kaasu} x V_{kaasu} > 3 000 bar x L
P_{kaasu} = paineakun kaasutilan käyttöpaine V_{kaasu} = paineakun kaasutilan tilavuus Rekisteröintirajat, katso **KTMp 953/1999, 3§**	

Figure 4. Examples of equations for determining the need for registration on pressure vessels. (Tukes, 2018)

Equation 1 calculates if the equipment in a specific turbine needs to be registered, thereby requiring an appointed supervisor. However, it can also be determined by the wind turbine model since only models starting from V150-4.2MW and larger turbines need larger accumulators exceeding 10,000 bar L. The older models and smaller wind turbines are equipped with pressure accumulators. As an example from Vestas´ turbine, in Figure 3, the pressure accumulator, P gas * V gas = 35 L x 285 bar = 9975 bar x L, Registration requirement >10 000 bar x L, will not be registered.

4.11 Use of pressure accumulators in wind turbines and the current situation

In wind turbines, pressurized accumulators are found in the nacelle and hub; Figure 6 is A general overview of the layout of a wind turbine's main components (LILY, 2024). The hub is the front of the turbine, where the blades are attached, and the nacelle is the body on top of the tower. Accumulators are used as energy storage devices. The primary use is for the pitch control system and the hydraulic power units. There is a separate control unit for each blade´s pitch system, resulting in three separate accumulators. In the situation of a stopped turbine, the accumulators also provide power to engage the brake system and the high-speed axle. (ABS Accumulators, 2021) The accumulators must be according to the obligation of the manufacturer, ensure conformity of pressure equipment (Finlex, 2023) and the safety can be guaranteed if the pressure equipment is used by the manufacturer's instructions (Finlex, 2023)

Figure 5 Piston accumulator has the shape of a cylindrical body, sealed with a gas valve, with a filling valve at the gas end and a hydraulic cork at the hydraulic end. A lightweight piston separates the gas side of the accumulator from the hydraulic side. **(ABS Accumulators, 2021)**

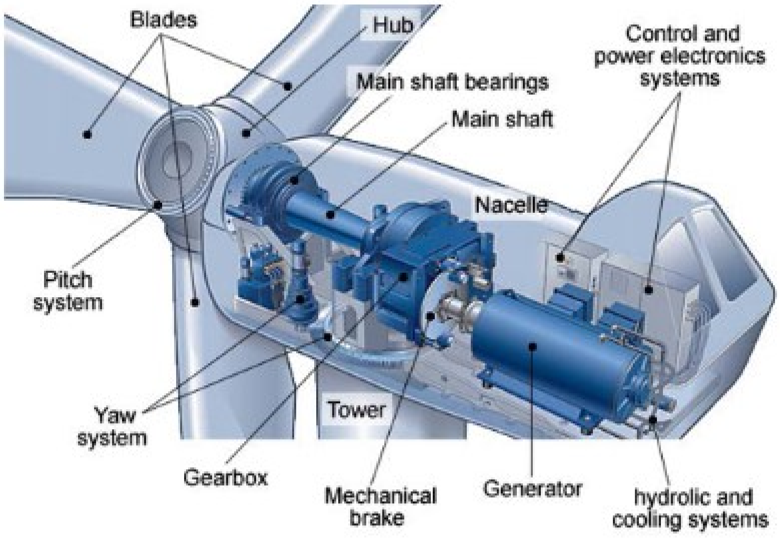

Figure 6 A general overview of the layout of a wind turbine's main components **(LILY, 2024)**

The most commonly used type is the piston accumulator, as in Figure 5, due to the many advantages compared to the bladder model. A Piston accumulator can be installed in any position and has a good tolerance for temperature variations as we do have here in our country, both high and low. Other advantages are the good compression ratios and better capacity, and also it is possible to install as a series or groups of cylinders. (zpcylinder.com, 2022)

The function of a piston pressure accumulator is based on the basic laws of physics. It uses the compressibility of gases, typically nitrogen, while fluids are incompressible. In a piston accumulator, a piston separates the gas and fluid sections. As system pressure rises, fluid enters and compresses the gas. When pressure drops, the gas expands, pushing the stored fluid back into the hydraulic circuit.

4.12 RACI matrix

RACI chart is a tool used to clarify employee roles and responsibilities throughout a project, or for a certain process, ensuring clear communication and smooth workflows. It helps prevent issues like last-minute complications from key decision-makers by ensuring they are consulted during the project's progress. RACI is an abbreviation for Responsible, Accountable, Consulted and Informed. In practice, a RACI chart is a simple table listing all project stakeholders and their roles for each task, marked as R, A, C, or I. Once roles are set, tasks can be assigned, and work can start. (Forbes, 2024) As can be seen in Figure 7, an Example of a RACI chart (Forbes, 2024), on the horizontal axis, lists the different stakeholders involved in the process, and on the vertical axis, the different tasks or steps in the process.

When creating a RACI chart, the idea is to list tasks down the left-hand column and stakeholders across the top row. Assign R, A, C, or I for each stakeholder's involvement in each task. Color coding tasks provide a faster overview of task distribution to ensure balanced workloads for all teams. Breaking the chart by project phases can help evenly allocate responsibilities. (Forbes, 2024) Even with a solid plan and great colleagues, unclear task division can lead to confusion, conflict, and loss of motivation, especially in complex projects. To prevent this, use a clear method for delegating and assigning responsibilities. (Projektledning, 2024)

RACI CHART EXAMPLE

Project tasks	Senior Analyst	Project Manager	Head of Design	SVP Finance	SEO Lead	Sales Director	Senior Management
Phase 1: Research							
Econometric model	R	I	I	A	C	I	I
Strategic framework	A	I	I	R	I	I	C
Risk factors	R	I	I	A	I	I	I
Phase 2: Structure							
Product specs	I	A	R	I	C	C	C
Design wireframe	I	C	R	I	C	I	C
User journey	I	C	R	I	C	C	C
User experience testing	I	C	R	I	C	C	C
Evaluation framework	I	R	C	I	C	I	C
Development backlog	I	R	C	I	C	I	C
Delivery roadmap	C	R	A	C	C	C	I

Figure 7 Example of a RACI chart **(Forbes, 2024)**

The advantages of the tool are to ensure that open communication is maintained with all stakeholders and to prepare for a project's future impact on all stakeholders. Once the responsibilities are clearly distributed the risk of "too many cooks" on the same task is eliminated. (Forbes, 2024)

Of course, there are downsides with this type of tool as well if, for simple projects, time is spent unnecessarily creating the chart for unclear roles or the role is not fully illustrating a team member's stake in a project. (Forbes, 2024)

In conclusion, the need for the RACI matrix as a tool in the Vestas´ process can be summarized with the following: once we have identified the steps needed in the process, as well as determine who is to perform the task, responsible for monitoring and who should be informed about what is going on, this constitutes a straightforward tool to visualize the distribution of tasks and responsibilities. A well-functioning process is crucial for successful results and the RACI model helps structure and delegate responsibilities clearly. The model provides a visual overview of task distribution and roles, focuses on assigning these, and reduces the risk of multiple people handling the same task.

4.13 Conclusions of the theory presented

The mandatory requirements for pressure equipment used are outlined in Finnish law, the Decision of the Ministry of Trade and Industry on the safety of pressure equipment (953/1999), and on (Tukes, 2016) stipulated *"The owner or holder of pressure equipment must register pressure equipment posing a significant risk in the pressure equipment register* maintained by Tukes". In the current legislation, there is a situation that is not fully adapted to the unique conditions of wind turbines.

The equipment must be inspected, approved, and registered, with specific inspection intervals, four years for general inspections. The Pressure Device Supervisor is responsible for ensuring compliance with safety standards, requiring thorough training and legal knowledge to enforce protocols effectively. He must also have sufficient knowledge of pressure equipment construction, operation, and maintenance. There must be an appointed Deputy Supervisor who takes responsibility where the primary is unavailable. The deputy can stand in for a maximum of up to three months during vacations or sick leave.

Utilizing available resources for the activities when insourcing can create competitive advantages, provide add-on value to customers, and, at the same time, allow the company to maintain control over processes. The prerequisites for meeting the requirements of sufficient trained resources are already found in-house. Insourcing also provides the possibility for Vestas to ensure the alignment with company internal standards and customer expectations to be met. In this particular case, the available resources can be utilized to manage the process in-house, which simplifies communication and information flow, reducing risks of miscommunication and, most importantly, owning the entire process.

5 Results of the new work process for pressurized equipment supervisor at Vestas

This process development aimed to utilize as much as possible already existing workflows and processes from the beginning. We also had internal resources to assign to the task. The regular meetings with the Operational Lead and Business Process Specialist have been assigned to map out the Pressure Vessel process based on the existing ones, discussions on responsibilities for different teams, and who does what. This required good insight into many different roles and, therefore, the need to have this forum of discussion where knowledge of such could be shared. Assigning the responsibilities for the steps in this process was based on the type of work that each division has in its own area of responsibility. In a big organization, there are many teams involved in a process from start to end.

The interviews I conducted with stakeholders, partners, and internal resources provided me with valuable information on the current situation and what we are missing.

5.1 Process description and flow chart

In this chapter, I will explain the process as it is now planned to be carried out. The document I created for Process flow and tasks Vestas—Pressure Vessel Supervisor can be found in Appendix 1. The same process is also visualized as a flow chart and can be found in the Flow Chart, Pressure Vessel Process in Vestas.

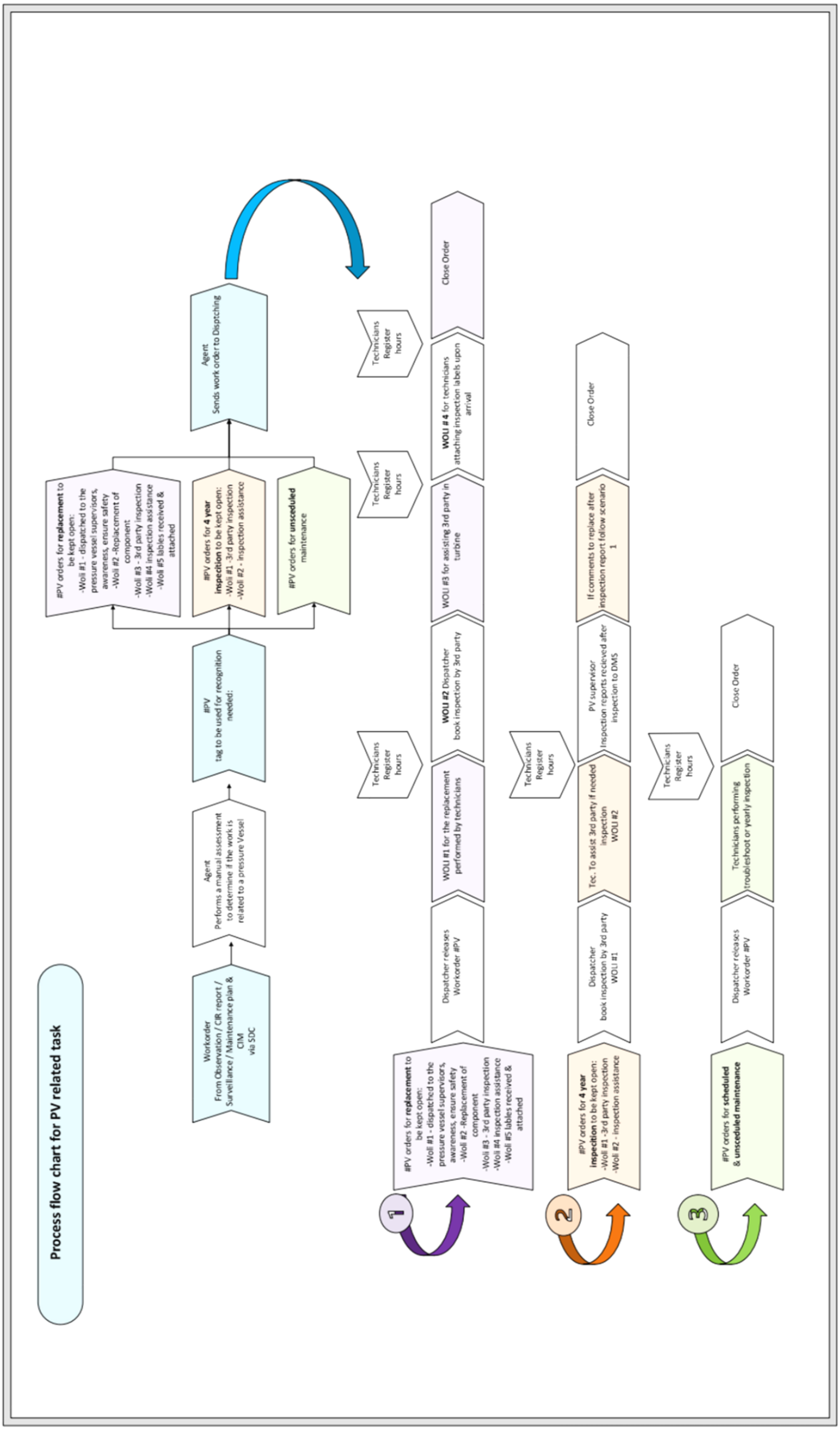

Figure 8 Flow Chart, Pressure Vessel Process in Vestas

The process starts in the chart's upper left box, with the SDC agent processing a Work Order generated from either a technician’s observation, from Remote Surveillance, Component Inspection Report so, called CIR, or Scheduled Maintenance Plan, or even from the CIR process. The next step is the manual assessment, performed by tagging the pressure accumulator work orders #PV as in step number three.

The agent in the Technical Planning Department should not need to have knowledge of who is the appointed Pressure Vessel Supervisor, nor if the pressurized accumulators are, in fact, subject to a registration obligation. After the manual assessment, follow normal protocol and forward the order to the Service Dispatching team for further execution.

There are three types of #PV orders.

The replacement work order is described in Scenario One. This first step sends the first work order line to Pressure Vessel supervisors for information purposes, to ensure the safety of the work, and to check that the assigned resources for the task have sufficient skills to perform the work correctly and in a safe manner. The pressure Vessel Supervisor needs to be able and aware of requirements to provide documentation & Information to 3rd party at inspection; yearly service reports may be requested, as well as dimensional drawings of the accumulator.

The second WOLI Replacement of a component is dispatched to the Service team. The work order contains information on where work is planned, when it is scheduled, and what is to be done. When a task is performed, the technicians register working hours on the WOLI.

Once it is replaced, the dispatcher plans a task in the third WOLI for third-party inspection, which needs to be done in the company of our own technicians as the third party is not allowed to operate a wind turbine on their own. This fourth Woli, inspection assistance, is dispatched to the technician at the same time as the inspection is to take place. When the assisting task is performed, the technicians register hours on WOLI number four.

After the completed inspection, we will receive inspection reports. If they are sent to the Service common mailbox, customer care forwards the reports to the Pressure Vessel Supervisor. However, the aim is to inform the third-party inspector of the correct recipient of reports to the Pressure Vessel Supervisor. So, this can be filed in DMS without delay.

When the inspection is done, the labels are sent out by the third-party inspector to the Pressure Vessel Supervisor.

The last WOLI, number five, is dispatched to service technicians. When labels are received, the dispatcher allocates this task to our own resources to attach the stickers to the inspected accumulators. When the label task is performed, the technicians register hours on WOLI number five. When all the tasks are completed, the work order can be closed.

Scenario two describes a four-year inspection work order. This has fewer work order lines. It consists of WOLI #1 for the third party to inspect the component and WOLI #2 for the Vestas´ Technician to assist, as the third party cannot operate alone in the turbine.

Scenario three describes an unscheduled service work order. This can be generated from visual observations of faults or errors or from the Condition Monitoring System detecting faults. Depending on the type of fault, these work orders may vary.

When the SDC agent has performed the assessment and marked the work order, it is ready to be sent to the Service Dispatching department work queue.

Vestas´ internal Pressure Vessel Supervisor updates the TUKES register as soon as the labels arrive from a third party. As the work order is technically completed, TECO, a service order report is generated. At this stage, it is automatically uploaded to Vestas Online, from where the customer-managed Pressure Vessel Supervisor gets information for updating the TUKES register regarding the replaced component.

From the process flow chart, we can see that there is the main focus on the back office process of the work order, and this needs to be considered, which is increasing the time an agent must spend on the work order before it can be sent to Service Dispatching. This also requires an understanding of the special requirements due to Finnish laws regarding the accumulators. From a service dispatching perspective, the process also increases the number of steps that they are processing on each order. However, the positive side is that we can follow the protocol and keep the work order open until all steps are completed.

5.2 RACI matrix Vestas Finland Oy

For a better overview of the responsibilities, I have created a RACI matrix, which can be found in **Fel! Hittar inte referenskälla.**

Task/Function	Service Planning Agent SDC	Technical planning	Service Dispatcher	Technician	Lead Technician PV	External Supervisors	Owner
1. Initial data updating SAP, registration number to existing equipment number & Pressure Vessel Supervisors	**R**	**C**			**C/I**	**I***	
2. Manual assessment & marking #PV orders	**R**	**I**	**I**			**I***	

Figure 9 Vestas Pressure Vessel Process RACI Matrix the complete version is found in **Fel! Hittar inte referenskälla.**

Above in Figure 8 is a snippet from the responsibility matrix that I have created for the Pressure Vessel Process in Vestas. This clarifies employee roles for every step in the process. The legends stand for:

R = Responsible, The person or the team who performs the task.

A = Accountable: The person or the team is ultimately accountable for the task's outcome.

C = Consulted, The person or the team whose input is required before the task is performed.

I = Informed, The person or the team who needs to be kept informed about the progress or outcomes.

A well-functioning process is crucial for successful results, and the RACI matrix helps structure the responsibility. It is a visual tool for the responsibilities. A great deal of the responsibility in the process lies upon the Pressure Vessel supervisor. To start with, this is responsible for the safety aspect of the pressure vessel-related work to ensure the technicians assigned to the work have sufficient skills and training for the tasks. Also, we need to update exchanged material and registration numbers in the TUKES database and our own ERP system, SAP. This task comes with the responsibility of ensuring the accuracy of the entered data. The pressure vessel supervisor must ensure that all master data for the wind parks under his own responsibility is updated, such as changes made by the supervisors or his deputy.

The RACI Matrix visualizes the Pressure Vessel process. In the first column in the RACI matrix, the Service Planning Agent at SDC is responsible for the manual assessment of work orders, and if related to pressure accumulators, this requires marking the work orders with *#PV*. The initial work of entering the master data to SAP at the beginning of the process is assigned to SDC when the required fields are established for this process. This scope consists of the registration number to the existing equipment number as well as the Pressure Vessel Supervisors and their deputies.

The dispatching team also has its own part of this process. They need to recognize this as a replacement work order. In addition to ordering parts, we will now require the dispatcher to book the third-party inspection once the replacement is done. In general, dispatching teams’ input in this process is minor, and no changes to the current process are being made. We just need to have their part marked, as it is a step in the process. They release work orders, book third-party inspectors, and order parts if needed.

Technicians are responsible for the operational execution of work orders. After the third-party inspection is done, technicians attach the registration labels from TUKES to the equipment.

If the Pressure Vessel Supervisor role is handled by the customer, then this is in the matrix marked with *. If not, it is not included in Vestas' scope of service. This means that the owner is responsible for all reporting, register updates, and inspection procedures.

6 Conclusions and evaluation

The goal was to map out the work process for the Pressure Vessel Supervisor in Vestas. The intention was also to follow and utilize as much as possible of current processes and ways of working. For the internal Supervisors, we needed to have a clear process flow chart and understand the responsibilities associated with each task. The lack of information and possibilities for extracting reports on upcoming works regarding Pressure Vessels was also something that was needed.

As this process requires us to have information regarding the accumulators‘ registration numbers stored and also who the appointed supervisor and deputy are, we needed to set up the possibility of storing this information in a logical place. As this was the most suitable way to build up in SAP, we started the process. I collected all the information needed mostly via emails or phone conversations with customers and partners and with input from our customer managers.

Monthly meetings have been held with the Business Process Specialist, the regional Project Lead, and the Operational Lead to go through the process and fine-tune details. This has been important for me to move forward as they have had good insight into the current internal processes.

This scope is very dependent on governmental requirements, and these must be met. Because laws govern and set the framework for Pressure Vessel Supervisors, it is of the utmost importance that you familiarize yourself with these and keep up to date with any changes. The internal requirement in Vestas is for the Pressure Vessel Supervisor to have adequate knowledge and experience of the equipment, how it works, and the safety aspects related to working with pressure devices. Therefore, this role was naturally assigned to the lead technicians. These have their own geographical areas of responsibility. For the wind farms in their own area, it is manageable to maintain control of the scope without compromising the number of wind farms to be in charge of, which becomes too large to manage.

When it comes to the practical arrangements, insights into ongoing or upcoming work related to Pressure Vessels, and the availability of needed documentation, Vestas has a good starting point for insourcing this. This has already been requested from customers as they have expressed this wish to Vestas´ Managers prior to this process development, as well as to me in the interviews I have done as research for this thesis. Being the owner of this process is aligned with Vestas' ideology of providing full-scope service to customers.

As of now, I have presented the Process flow chart to the Service Director and Service Area manager, and the additional work related to this role as Pressure Vessel Supervisor for the Lead technicians will be evaluated, but as we are still in the early phase of implementing this and there is no reliable data for evaluation available yet. During the pilot testing, we will be able to acquire valuable data for the coming pricing process, for building the business case, and for moving into offering to customers.

The collaborations with SDC are initialized, at least on the scheduled maintenance, but this is still to be developed. If this process proves difficult to maintain the quality standards required under Finnish law, it is possible that this task will be moved to be handled locally by technical planning agents in the Vaasa office in the future.

6.1 Challenges during the process

Problems I encountered during the work are related to the governmental register's content limitations. As there is all the information in the database at TUKES, we see the need to initiate an inquiry and negotiate the information shared when a Pressure Vessel Supervisor requests an extracted list of his responsibilities. This led to a lot of extra work hours for our own resources in collecting the registration numbers from every accumulator in this scope of work. To serve our purposes, the data extracted from TUKES would need to have all accumulators, their location, and material, as well as serial number and registration number.

Structure in SAP where the accumulators' material- serial number as well as the registration number is found requires knowledge of the material. As the Accumulator is a part of an assembly, one must be aware of the fact that it can have a registration number in the assembly, but if a part of the assembly is replaced, this goes into the structure as a spare part, and thus this spare must get the new registration number. Together with the Operational Lead, we have been looking at a specific wind farm where there have been component exchanges of the accumulators. However, as long as we ensure this information is pointed out to the local technical planning team responsible for initial data entry, this will not be an obstacle.

Also, I have experienced that in a big global organization, it may be a problem that things don’t happen fast. All decision-making has its given hierarchy, and requests to different internal stakeholders during the process take time.

6.2 Reliability and validity

It is important to also consider how consistent and reliable the approaches of the work and the sources are in order to draw conclusions about the reliability of the results in this thesis.

In the theory part, I was searching for cases as references on similar insourcing and process development projects, but no good sources were available matching my case. This would have been helpful, as the conclusions from similar projects could have provided something to compare and refer to.

The theory regarding requirements and legislation is based on the law and is undisputable as long as the regulations are not changed. The technical part of the theory regarding accumulators is based on the technology currently used. The source I have used as a reference is a manufacturer that is involved in the wind turbine business and thus has expertise in this particular field of industry.

The interviews I have done are only with one representative from each category. For a broader perspective of the opinions, several interviews could have been conducted. I have reached out to only one customer, one third-party Pressure Vessel Supervisor, and one internal Vestas´ Pressure Vessel Supervisor.

The result of this thesis is in the phase of an ongoing development process. This work will continue after this thesis is finalized. In order to evaluate the process, it should have been rolled out and offered to customers. For example, one year of experience gathered the outcome both in monetary matters and feedback from our customers and from the internal part of the process. This is impossible as this thesis's time frame will not stretch out to that extent.

6.3 Development suggestions

As a next step in this process, I feel there is a need for an info session for the concerned Vestas´ internal Pressure Vessel Supervisors and a similar one for the dispatching team to highlight the most important responsibilities and provide an opportunity for discussion from a practical aspect.

I hope to continue working on the Pressure Vessel Process even after this thesis work is concluded. I see it as necessary to gather feedback from our resources involved in the process.

- Was the work description adapted to fit the task and could this be utilized in all situations?
- Is there a need for adjustments or for the description to be revised?
- Which types of challenges have occurred in the work?
- How much of our working time does this new task require?

Feedback from our customers is as important as internal feedback, but this will focus more on communications and reporting. If my work on this process continues, I would like to be involved in developing the automatization of reporting possibilities for Pressure Vessel Supervisors with the aim of limiting the manual steps in the process. It would be beneficial internally as we could provide consistent quality of the task, as it is not dependent on any individual remembering to perform or extract certain reporting. Also, third-party supervisors could benefit from the automatization of reporting, as they now are dependent on owners remembering to notify their contractors of any ongoing tasks related to pressure accumulators.

The other next step I am interested in taking is continuing the initiative to adjust the Pressure Device Law to better suit the circumstances of a wind turbine. This was discussed in a meeting in the spring of 2024 with Suomen Tuulivoimayhdistys Ry and representatives from Vestas, a manufacturer and service provider, and one of our customers, asset managers, or wind parks in Finland.

6.4 Profitability

It is too early to say if this is possible to make profitable and to what extent, but we have put a new process into practice that we own and provides added value to the customers. This was the intention and the first priority, but naturally, there must be profit to gain from this. On the other hand, as the Pressure Vessel Supervisor role is mandatory to appoint for certain sizes of accumulators, it is also an argument to use in the pricing process. As mentioned in the Delimitations of the Thesis, this scope is handled at the management level and is, as of now, only in the initial phase.

6.5 Concluding remarks

The goal of this thesis was to map out the process for the Pressurized Equipment Supervisor role in Vestas Finland Oy and provide instructions on the workflow as well as define the internal process; this is visualized in the process flowchart and pinpointed the responsibilities at each division, which is presented in the RACI matrix. The master data I gathered was handed over to local technical planning as a task for them to enter into SAP. As this has not yet been fully implemented, we have not gathered sufficient information and feedback internally or externally.

During this process, I have learned a lot about the legal aspects of pressurized equipment and made acquaintances with departments within Vestas, which I did not know existed until this thesis work. I have learned how our internal processes work, and I have also had the opportunity to learn more about our customers, partners and stakeholders and also to collaborate with them. I am pleased that my work continues on this topic in Vestas, and I will be involved in the process with Suomen Tuulivoimayhtdistys Ry regarding the development of legislation for pressurized equipment to better suit the circumstances of the wind turbine industry. This has been a gratifying challenge to work on, and the task felt very important as the legislation requires this process to be functional.

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Appendices

1 Appendix Process flow & tasks Vestas - Pressure Vessel Supervisor

Process flow & tasks Vestas - Pressure Vessel Supervisor			Document ID: xxxx-xxxx_ INS ABC-DEF-GHI EUP ABC-DEF-GHI
Owner(s): MAAKO	Author (s): MAAKO	Valid from: 2024-10-09	Version: 00

Version history

Version No.	Date	Description of Changes (only the latest one)
00	2024.11.16	[Only the latest change is described here. Older changes are kept in the appendix section].

Table of Contents

1 Purpose

The purpose of this instruction (INS) is to define the local Pressure Vessel Supervisor tasks and workflow in Vestas. This is valid for Finland in region NCE.

2 General

1. Pressure Vessel Supervisor must secure the safety aspects for Vestas' service technicians.

2. Pressure Vessel Supervisor must ensure the allocated resources for the work tasks have the needed skills/ training as in the Chapter 10, Use and control of pressure equipment § 71, section 3

3. Pressure Vessel Supervisor must according to the Chapter 10, Use and control of pressure equipment § 71 in Pressure Equipment Act:

   1) monitor the use and condition of the pressure equipment and keep records of its use.

   2) keep the owner or holder of the pressure equipment informed of essential matters relating to the use and condition of the pressure equipment.

   (3) ensure that the personnel operating the pressure equipment are familiar with the operation of the pressure equipment, the instructions for use, the safety regulations and the operation, use and testing of the safety and alarm devices.

- When a work order is dispatched, **#PV** can be filtered for work order identification and extracting of reports

3 Yearly Maintenance Inspections for pressure accumulators

Follow standard Yearly Inspections process as a part of the yearly maintenance

- SDC creates **WOLI #1** subcontractor if applicable (work not performed by own resource)

- If NOT OK in yearly inspection → technician creates observation and process to **follow 0. 4 Replacement Work order**

4 Replacement Work order

- Pressure Vessel Supervisor Update replaced component in SAP material & serial number

- **Dispatcher to book 3rd party Inspection** of replaced component
  - Where (Park address & Turbine ID)
  - Component / Material to be inspected.

- Pressure Vessel Supervisor Provide needed documentation & Information to 3rd party at inspection
  - Yearly service reports may be requested

- Pressure Vessel Supervisor Update replaced component Serial number to TUKES, need Old Serial number and this is to be updated with the new Serial number.

- 3rd party has not own Credentials for closing Work Orders, assisting technicians or Pressure Vessel Supervisor must close Work Order.

- Pressure Vessel Supervisor When inspection reports arrive file them in DMS system.

- Pressure Vessel Supervisor Ensure the master data is correctly entered

- When Inspection labels arrive, according to WOLI #4, provide the labels to assigned technicians order for attaching them to inspected material in turbine -> technicians follow standard procedure with WO for reporting & closing. **Dispatcher assigns the wo to** technicians

- Pressure Vessel Supervisor Update master data in SAP with registration number received from 3rd party. Tukes registration number: old equipment to be updated with Tukes registration number from new equipment

The replacement work order must have following WOLI´s
(to avoid a Work order to be closed without all mandatory tasks are performed)

- - WOLI #1 - dispatched to P V supervisors, awareness, ensure safety
- - WOLI #2 -Replacement of component
- - WOLI #3 - 3rd party inspection
- - WOLI #4 inspection assistance
- - WOLI #5 labels received & attached

5 Accumulator, Inspection 4Y interval

- SDC creates orders, Maintenance plan.
    - SDC creates **WOLI #1** for 3rd party to inspect replaced component.
    - SDC creates **WOLI #2** for Vestas Technician to assist as 3rd party cannot operate alone.

- **Dispatcher** books 3rd party
    - Where (Park address & Turbine ID)
    - Component / Material to be inspected

- Pressure Vessel Supervisor Provide needed documentation & Information to 3rd party.
    - Yerly service reports will be requested for the elapsed time since last inspection.

- Pressure Vessel Supervisor conducts the reporting & closing orders (as long as not 3rd party not onboarded in ERP system

- When inspection reports are received, they are to be filed in DMS system. (Project builder in SAP?)

- Pressure Vessel Supervisor Request needed action if remarks in reports,

- → by making an observation → new order (follows 0. 4 Replacement Work **order**)

→The new replacement work order must have following WOLI´s (to avoid a Work order to be closed without all mandatory tasks are performed)

- - WOLI #1 - dispatched to P V supervisors, awareness, ensure safety
- - WOLI #2 -Replacement of component
- - WOLI #3 - 3rd party inspection
- - WOLI #4 inspection assistance
- - WOLI #5 labels received & attached

Sources

Pressure Equipment Act

Pressure equipment

2 Appendix RACI matrix

Stands for **Responsible, Accountable, Consulted, and Informed**

to clarify who is responsible for each task and who needs to be consulted or informed.

Task/Function	Service Planning Agent SDC	Technical planning	Service Dispatcher	Technician	Lead Technician PV	External Supervisors	Owner
1. Initial data updating SAP, registration number to existing equipment number & Pressure Vessel Supervisors	**R**	**C**			**C/I**	**I***	
2. Manual assessment & marking #PV orders	**R**	**I**	**I**			**I***	
3. Entitlement check		**R**					
4. Perform pressure vessel technical planning & set to Ready for planning		**R**	**I**				
5. Dispatching of Service Orders			**R**	**I**	**I**		
6. Information to external PV Supervisor of upcoming task							**R**

Task/Function	Service Planning Agent SDC	Technical planning	Service Dispatcher	Technician	Lead Technician PV	External Supervisors	Owner
7. Safety aspect of the pressure vessel works				**I**	**R**	**R***	**A**
8. Operational Execution of Work order				**R**	**I**	**I***	
9. After replacement Book 3rd party inspection			**R**		**A**		
10. Attaching labels of registration from TUKES				**R**	**I**	**I***	
11. Performing crew & pressure vessel supervisors reporting process & including time registrations				**R**	**A**	**I***	
12. Update Material number to TUKES					**R**	**R***	

Task/Function	Service Planning Agent SDC	Technical planning	Service Dispatcher	Technician	Lead Technician PV	External Supervisors	Owner
13. Update new registration number to SAP					**R**	**R***	**A***
14. Update master data changes: material-, registration numbers and organizational changes					**R**	**R***	**A***
15. Training, development of skills knowledge				**A**	**R**	**R***	

- ***If not in Vestas Scope of service**

Legend:

- **R (Responsible):** The person/team who performs the task.
- **A (Accountable):** The person/team ultimately accountable for the task's outcome.
- **C (Consulted):** The person/team whose input is required before the task is performed.
- **I (Informed):** The person/team who needs to be kept informed about the progress or outcomes.