Report On

Supply Chain Management Process of Andritz Hydro

By

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An internship report submitted to the BRAC Business School, BRAC University in partial fulfillment of the requirements for the degree of
Master of Business Administration, MBA

Master of Business Administration Department
Brac University
January 2023

Declaration

It is hereby declared that

1. The internship report submitted is my/our original work while completing degree at Brac University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material that has been accepted or submitted for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Letter of Transmittal

Sayed M Rahman
Associate Professor,
BRAC Business School
BRAC University
66 Mohakhali, Dhaka-1212

Subject: Submission of Internship report

Dear Sir / Madam,

With due respect, this is my pleasure and privilege to present the internee report titled **Supply Chain Management Process of Andritz Hydro** as a partial requirement to complete my MBA program. My internship report reflects my employment and work experience as a supply chain Officer at Andritz Hydro a. Through the study, I have tried my best in my capacity to accommodate as much information and relevant issues followed the instructions you provided.

I have attempted my best to finish the report with the essential data and recommended proposition in a significant compact and comprehensive manner as possible.

I trust that the report will meet the desires.

Sincerely yours,

_____

Tariqul Hasan Rakib
18364013
BRAC Business School
BRAC University
Date: 26 January 2023

Non-Disclosure Agreement

This agreement is made and entered into by and between Andritz and Tariqul Hasan Rakib, student ID 18364013 at BRAC University. The non-disclosure agreement ensures that the data used in this report is only for the use and completion of the internship report. Using this data publicly and for any other use is strictly prohibited. Both parties have agreed to the condition and will act in the utmost good faith of the agreement term.

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Executive Summary

Hydropower is a vital component of the global Energy Sector as renewable energy. Because the large-scale use of conventional energy sources leads to increased environmental pollution and economic deficits. So, Supply chain management has become a concern of utmost importance for constructing or refurbishing Hydropower plants. It is creating momentum in procurement, storage of materials, effective usage, and distribution channel at the working site. For example, an important aspect of successfully managing the supply chain requires that the organization understand its logistical strategies, Vendor management, and practices thought the overall chain of production and operations. Moreover, Creating and managing an effective supply chain has become a way to improve competitiveness by reducing uncertainty and improving overall organizational effectiveness and efficiency. New hydropower projects often face long lead times, lengthy permitting processes, high costs and risks from environmental assessments, and opposition from local communities. For this reason, managing and ensuring an effective and smooth supply chain management is required to bring momentum to the organization. Also, it ensures effective supply chain policies, Logistics management, and procurement management policies.

Keywords: Hydropower, Renewable energy, Supply chain management, lead times.

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List of Acronyms

SCM	Supply Chain Managements.
PTFE	Polytetrafluoroethylene
RPM	Rotation Per Minute
PM	Permanent Magnet
HPU	Hydraulic pressure units
DC	Direct Current
SF6	Sulfur hexafluoride
CNC	Computer Numerical Control
CAD	Computer-Aided Design
AM	Additive Manufacturing

Chapter 1 Introduction

1.1 Introduction

Supply chain management is the supervision and management of the whole production process of a product or service. It describes how products or services arrive to the final user from raw materials. Most Companies build their supplier networks to manufacture products or services from raw material suppliers at a minimum cost. After all, all kinds of Goods and services are well managed by using supply chain management rules and regulations. For gaining maximize customer value and a competitive advantage the necessity of SCM indescribable. So, the SCM is essential to maintain and update the existing hydropower as well as support the grid to achieve the objective of carbon pollution-free electricity. Hydropower supply chain management includes turbine manufacturers, machine parts, generator manufacturers with auxiliary, and engineering innovation. Around 28% and 27% of those jobs are related to manufacturing and utilities, respectively, and remain sectors were circulated between business services, trade, transportation department. Therefore, SCM has become critical part for any organization to enrich the sourcing in world market and avoid high risk.

In this report, details of the Supply chain management of Andritz Hydro will be found. For every manufacturer organization like Andritz Hydro, supply chain management integrates all activities associated with getting and fulfilling an order received from the consumer. These activities are included sourcing, marketing, finance, and operations, including production.

1.2 Origin of the study

This report on the Supply chain Management Process of Andritz Hydro SRL, Bangladesh Branch was initiated as part of an internship program required to graduate Master of Business Administration (MBA). I have done an internship program at Andritz Hydro SRL, Bangladesh Branch. This report is created under the supervision of Mr. Sayed M Rahman, Ph.D., Associate Professor, BRAC Business School, BRAC University.

1.3 Objective of the study:

The goal of the reports includes the following.

Main Objective: The report's main objectives are to observe, assess and analyze the supply chain management process of Andritz Hydro SRL.

1.4 Scope of the study

This study shows the meaning of Supply chain management based on some theories and practical basis. That means it is based on the sense and practice of Supply Chain Management. Moreover, this study discusses the supply chain management model in Industrial development in this competitive market. Lastly, the purpose of the study is to provide a deep understanding of the benefit of the supply chain and the essential steps that the organization takes to sustain itself in the global and competitive business.

1.5 Methodology

My experience in the internship is mainly utilized in the preparation of the report. Then it relies on primary and secondary data. It also includes information from annual reports, markets, and websites.

Data source method:

This report depends on both essential and optional information:

- Communication with high officials.
- Direct talking to the Stakeholder.

Secondary sources:

- Annual report
- Website
- Advertise the product
- Various articles

1.6 Limitations

There are some challenges to completing this report.

The biggest challenge is the company's policy of keeping confidential data critical to the report private.

Due to certain limitations, collecting information from many people takes much work.

Chapter 2: The Organization Overview

2.1 Company Profile

ANDRITZ Hydro is a leading global supplier of electrical and mechanical equipment with providing the maintenance services for hydro power plants. With around 190 years of experience and an installed 570 GW, Andritz offers all kinds of service for hydropower plants, as well as plant servicing, rehabilitation, and modernization of existing hydropower plants that provide services for upgrades.

This business area offers a complete product portfolio, including turbines, generators, and ancillaries of all types and sizes. The concept is electricity “from water to wire” for large and small hydro. Hydropower and pumped-storage power plants are also designed for site-specific hydropower and environmental conditions, so the associated electromechanical equipment is planned and developed accordingly. Before starting the project, every turbine, every generator, and, therefore, the plant layout are prototypes virtually. Therefore, ANDRITZ offers products and systems integral to hydroelectric power plants. Thus, the contractually agreed scope of services includes system planning, engineering, delivery, assembly, and commissioning.

This service area carries out system diagnostics, rehabilitation, modernization, and retrofitting of existing hydropower plants. Bandwidth can vary from complex upgrades to small spare parts deliveries. All ANDRITZ solutions meet customers’ requirements, are environmentally friendly, and support your operational management. The scope of delivery usually includes repair, overhaul, or complete replacement of components and system parts.

The Service Area product portfolio also includes standard services such as technical support, training, spare parts management, and repair contracts to meet all technical, economic, and

legal requirements. Lifecycle, risk analysis, operation, and maintenance services are often offered.

2.2 Corporate Organogram

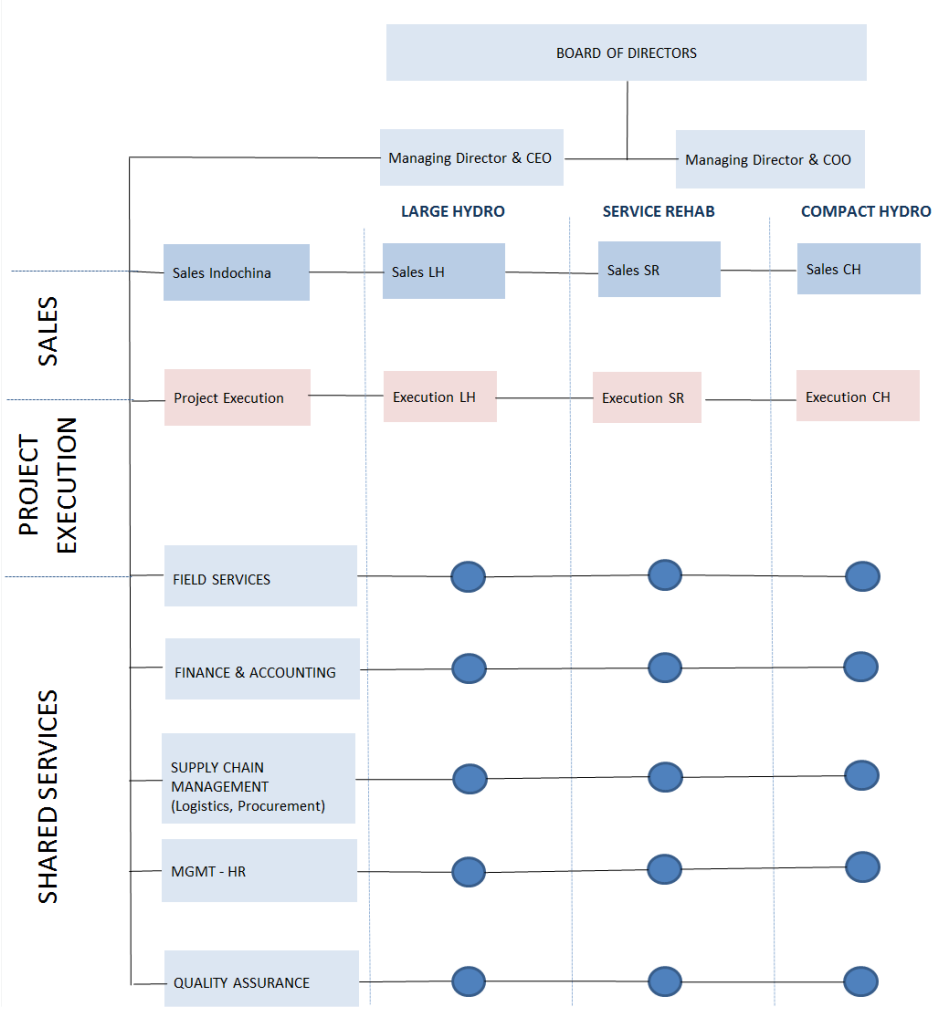

Figure -1 Andritz Hydro Organization Chart

2.3 Mission

Andritz drives the success of customers by following

- Innovative and quality engineering
- Services
- Strong and sustainable relationships

2.4 Core Values

Partnership: The essential viewpoints of Andritz as a partner are reliability, integrity, and respect. From the first day, Welcome to enjoy his pack, experience his onboarding buddy system and mentoring programs, and respectful relationships with colleagues, customers, and partners.

Perspectives: Andritz constantly creates new perspectives for their company, employees, and customers. He develops initiatives to find new ways and promising technologies and solutions based on his inherent power of innovation and entrepreneurial spirit.

Versatility: They are willing to face new and often spontaneous challenges and be able to deal with them flexibly and creatively. This assortment helps them to learn and develop diverse aptitudes to make a difference compared to others. Finally, explore on-the-job and professional development opportunities by organizing leadership programs.

Passion: They love what they do. Times and technologies change, but their power is always the same.

2.5 Vision:

As a leader in this industry, Andritz is passionate about innovative engineering solutions., They create sustainable value for their customers and shareholders because of technology and quality leadership, thus helping and ensuring long-term profitable growth.

2.6 Strategy and Long-Term Goals:

Long-Term Profitable Growth:

- Concentration on markets with maximum growth rates
- Development of product portfolio through research and developments
- Accomplish annual revenue growth that is 10-15% depending on market growth

Extend Market Position:

- Long-time servicing and sustained potential growth
- Increasing current position in Europe, North America, and Asia.

Safety, Technological:

- Become an ideal supplier in terms of safety, technology, quality
- Focus on digitization by using updated technology to help customers achieve their safety, productivity, operating costs, energy efficiency, and environmental protection goals.

Global And Local Presence:

- Further expansion of global presence
- Provide the best service close to customers

  Further transfer of production capacity to developing countries

Chapter 3: Supply Chain Mapping for Hydro Power Plant

3.1 Technology Overview

A hydroelectric power plant converts potential energy into kinetic energy and kinetic energy to mechanical that helps to rotate turbines. Rotating generators connect the turbine through the intermediate shaft and produce electrical power. During the rotation of the turbine, the generator's rotor also rotates as both are associated with the same shaft, and the rotor's outer surface is covered with electromagnets (field poles). An alternating current (AC) is produced when these electromagnets pass through the copper windings that are the stator of the generator. The alternating current converts into high-voltage electricity using a step-up transformer transported through the national grid. Wicket gates or valves are used to control water flow to the turbine. Also, the turbine generator unit can be isolated for maintenance or emergencies.

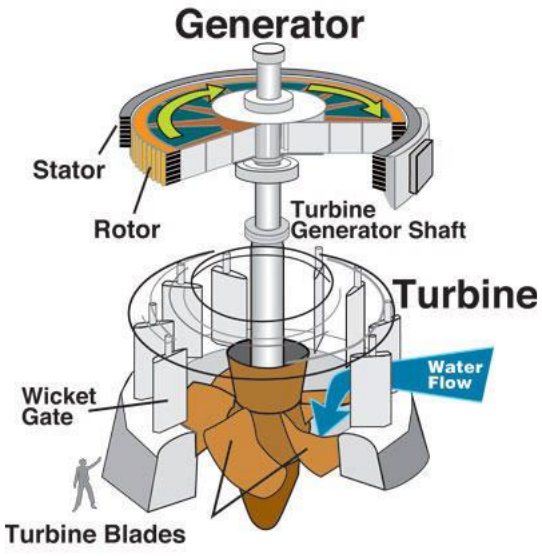

Figure- 2 Major Components of a Kaplan-type Turbine

A powerhouse, there might have multiple power generation units. For example, at the karnafuli hydropower plant, there are three generation units. Figure 1 demonstrates the significant

components of a Kaplan-type runner with its all equipments similar to the karnafuli hydropower plant.

3.2 Turbine

There are various types of water turbines, depending on the combination of water flow and, the height difference between the water inlet and water outlet. Impulse turbines and reaction turbines are two major types of turbines. Reaction turbines, known as Francis and Kaplan, are installed in under the water. Those are used for low-head and high rate of flow systems. Impulse turbines, known as Pelton, operate in open air. Those are used by high-velocity water flow for high-head. Proper curvature of runner blades and selection of high-quality casting materials that increase to maximize efficiency are used for manufacture as raw materials.

Steel, carbon, or stainless steel are main components of runner; the remaining factors depend on the requirements of custom.

Spiral case and penstock: It is a custom-made steel casing surrounding the turbine runner, and connected with penstock, water is coming into the spiral case from the lake or river though penstock. The penstock is the first component that the water flow reaches. Spiral cases and penstock are made of fabricated carbon steel plates.

Runner: For capturing the maximum energy, runners' blades are designed and manufacture from steel castings, forgings, and sometimes mixed plates.

Wicket gates: Wicket gates, also known as adjustable gates which is used to control water flow through the turbine. It is made of carbon steel or stainless castings.

Draft tube: The draft tube links the turbine outlet to the tailrace that is applicable for the Kaplan turbine, which we are using in the karnafuli hydropower station. The draft tube reduces

the pressure of the water, bring at atmospheric pressure. Carbon steel plates is the main raw materials for draft tube.

Headcover: Headcover separates the wet turbine elements from the dry powerhouse elements. Respectively those are, runner and wicket gates, and the generator, wicket gate operating servomotors. Also, steel plates, castings, and forgings are the main components of the headcover.

Bearings: Turbine guide bearings (TGB) and other bearing are made of copper, SS composite, or (Polytetrafluoroethylene)Teflon-type material.

3.3 Generator

Generators, significantly larger units rated above 110 MW, custom design and manufacturing are required, and the main parts of a generator are:

Shaft: The driven end (DE) shaft links the generator with the turbine shaft with intermediate shaft. It's usually fabricated of forged steel.

Rotor: It revolve s at a constant speed that is defined by rotation of the turbine and the governor command. The rotor is allied to the turbine shaft, and with field poles, its outer surface is roofed. Field poles contain thin layers of magnetic material such as copper. Spiders transmit required angular force and power from the shaft to the rotor's rims sheets and poles, and also rotor rims supply the necessary support for holding the poles. They are often made from forged steel.

Stator: Stator winding, by cutting the magnetic flux from the rotor, produces electricity/ voltage on the armature side. The stator frame, usually steel, is designed to provide necessary support the stator core and stator windings. That is made by a thick layer of fabricated steel plates. The stator core contains stacked thin laminations. For the stator windings copper is used which is covered by insulant materials.

Fiberglass and mica powder has been selected materials as insulation recently.

Bearings: Generator bearings are typically bushing types. Typical bearing materials are composites or PTFE materials. Thrust bearings also are used in some cases.

3.4 Governor

The governor controls the turbogenerator's speed, output, and required frequency. That is done by controlling water flow by opening and closing wicket gates or valves. These are the control and actuator components. A regulator is a hydraulic system with standard features in many industries. Velocity sensing devices have changed with different generations of controllers. Digital control algorithms and electronics provide the controlling speed signal in digital governors. A hydraulic unit (HPU) includes a pressurized oil tank, oil pan, air compressor, HPU pump, and motor. HPU provides the pressurized oil by which servo motors regulate the position of the Wicket gate. The system is fitted with an air-over-oil pressure vessel or called air accumulator thank used for emergency shutdown to stop water flow through the turbine.

3.5 Excitation system

Excitation system, consisting of electronic circuits (AVR) and Step-down transformer, which supplies and regulates the of direct current as per requirement in the rotor windings to create the generator's magnetic field. A hydroelectric generator is typically a rotating system mounted on a shaft and driven by contact carbon brushes. Modern equivalents supersede them.

Brushless rectifier exciter: No brushes are required as it uses a rotating rectifier directly connected to the field poles of the generator. They are used in small hydro generators that do not require large excitation currents.

3.6 Switchgear:

It is used in between the generator and the step-up transformer. It synchronizes the current frequency, voltage, and phase, leaving the generator with the current in the national grid.

• Circuit breaker:

There are four types of CB depending on the arc interrupting media used. Air (ACB), oil, SF6, and vacuum.

• Surge Arrester:

It used for overvoltage protection.

3.7 Emergency closure systems

At closing time, the inlet head gate is getting down. It prevents water for entering to the turbine. They are made of worked steel. A hydraulic system accumulator, a gravity load, or an automatic crane for emergency use can power it. Usually, it can be operated by a hydraulic system, cable system, or crane.

3.8 Penstock

A penstock is a pipe that carries water from the inlet (river) to the turbine. A hydroelectric power plant may have two or more penstocks to supply water to various units. Instead, a penstock is branched or branched to distribute the water to different turbogenerator units. Steel is the most common raw material for this. However, other materials, such as wood staves, fiberglass, and high-density polyethylene plastics, are available. It can also be made from fabrics. Multiple materials and wall thicknesses (if pressure increases) can be used in one installation.

3.9 Bypass systems

Alternate waterways are required in hydroelectric plants when inflows exceed the turbines' capacity or when one or more turbines become unavailable.

• Overflow: A closed concrete structure with an ideal shape for flow. These are usually closed by large steel structures operated by wire rope hoists or hydraulic hoists.

• spillways: These spillways are not regulated. That is, there is no control over when the water passes through. This type of overflow overflows when the water reaches a certain level. It is made of concrete.

• Turbine bypass: Bypass systems are required in plants where the power plant is remote from a dam or spillway. These are typically valved systems in penstock where the turbine head gate valve is closed, and a bypass valve is opened in a parallel waterway.

3.10 Balance of plant

This category includes compressed air systems, oil supply and plant temperature control, ancillary systems such as hoists, and essential to plant operations, such as batteries, transformers, and cranes, although not specific to hydroelectric power generation. Components

Chapter 4: Theoretical framework of SCM

1. Definitional Analysis of SCM

For planning, control, and execution of any kind of project, Supply chain management (SCM) is required for combining all activity in a single raw. This is also important for the product manufacture, including the sourcing the raw materials and distributing to the user. This process should be done cost-effectively. After all, SCM provides materials information, financial capital flow, inventory management, storage, distribution, logistics, and returning failed goods. Strategies and specialized software are used for maintaining everything in each time frame which is created a huge competitive advantage in the industries.

In every organization, the SCM main goal of the SCM is processing customer requests at heir best level. For this reason, they apply new effective rules in marketing, operations, distribution, and customer service. SCM ensures that all collaboration activities and departmental needs are met to meet customer needs. To ensure the dynamism of the entire line, little costs can be incurred. The total costs are-

- Raw materials procurement costs.
- Logistics and transportation costs.
- Plant facility cost.
- All kinds of manufacturing costs.
- Inventory holding cost.

- Additional expenses.

2. Key factors of SCM:

There are numerous vital factors to consider setting up a Supply chain in an organization.

- Total number of suppliers
- Total number of subcontracts
- Supplier information details.
- Delivery of products with proper quality and quantity.
- Storage location with given instruction,

3. SCM (Supply Chain Management) Processes

Supply chain processes are not the responsibility of the company. Multiple departments work together, numerous people are involved, and various processes create a smooth and effective supply chain.

Planning: The SCM planning process generates effective output supply chain strategies for any industry.

Procurement: Procurement is a combined process that involves completing a comparison statement and generating PO before sourcing and purchasing raw materials, and other needed goods.

Inventory management: This includes proper inventory management and timely reordering of raw materials and other commodities to ensure sufficient production to meet customer demand in a timely manner.

Production: The production process is the manufacturing the parts and assembly those parts for providing the raw materials into the desired products.

Distribution: Distribution processes manage the logistical flow of goods through the supply chain. Transport companies, third-party logistics companies, etc. Ensure goods arrive at the required destination quickly and safely.

4. Supply Chain Management Software

Previously, Supply chain management was controlled and tracked by conserving the data and recording manually by using the ledger book. But, during the manual process, finding any tracking orders, communicating with clients, and ensuring on-time logistics support to customers was very difficult at that moment. However, different software is used to make the process very easy and user-friendly. Andritz Hydro, is using Insite LMS software to track orders, and keep critical data.

Chapter 5: Supply Chain Management Process of Andritz Hydro

The components of turbines and generators are built in Andritz's factory. For manufacture those components steel, stainless steel, and copper are the primary raw materials. ANDRITZ strives to promote the implementation of internationally recognized environmental and social standards among suppliers and verify that these standards are met. An important step is to develop a specific supplier policy based on a standard code of conduct. In China and India, two auditors monitor compliance with these standards by local suppliers and organize corrective actions in the event of deviations. After getting a new contract/order, every department, such

as planning, procurement, manufacture, commercial, store managements, and logistics, are connected and works as a team. This team is called SCM team.

5.1 Planning

After Confirming any order, the planning department creates a plan to procure of raw materials to produce the main components of the power plant to fulfill the customer's orders. All required materials are divided according to the bill of materials. Moreover, as per the planned Work Breakdown Structure (WBS), all materials are organized so that it can be clear which will be used first.

5.2 Develop the plan and source raw materials

After planning, the following task is creating a procurement plan and sourcing the raw materials. This phase mainly focuses on establishing solid relationships with suppliers. This step identifies reliable suppliers and different planning methods for shipping, shipping, and paying for the product. The SCM department then builds a set of pricing, shipping, and billing processes with suppliers and builds a good relationship.

5.3 Manufacture

Turbine: Normally more than one year is needed for manufacturing a new turbine depending on size and also depends on many steps for example, the water flow and water head. At first it is first designed and tested in software which is Finite Element Analysis and Computational Fluid Dynamics methods. After that, a prototype might be formed for further testing purposes. After that, for achieving the desired shape, a mold is created by heating the material up to melting point.

Figure - 3 Complete Runner with Cone at Site

The use of CNC machining instead of conventional machining has become commonplace. CNC machining removes steel chips from the original part for achieving the desired shape, the whole process is guided by computer-aided design software (CAD). The start line for production is a stable block from which the cloth is eliminated till the favored form is achieved. In contrast, additive manufacturing (AM) is used in a mold, die, machine (e.g., grinder) or another tool also used to produce desire geometric target. Then a manual polishing process is started to achieve a smooth surface. Andritz represents nearly 15% of installed turbine capacity in the world.

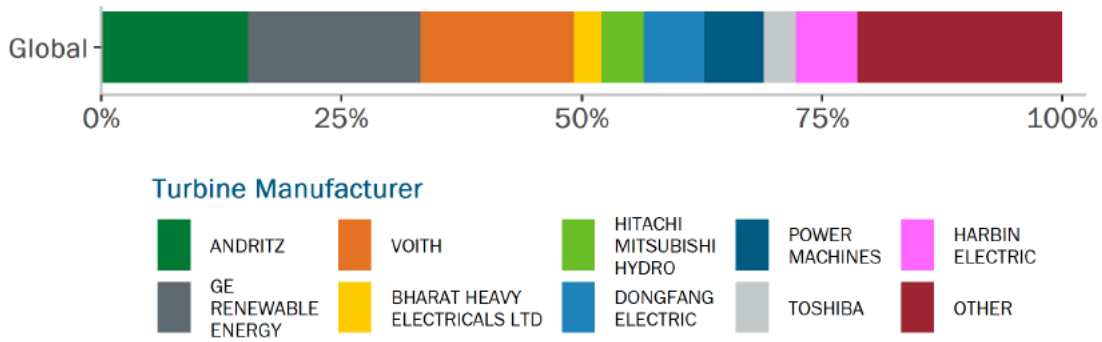

Figure - 4 Global market shares of turbine manufacturers

Generator:

Using similar processes and tools that were described previously, some components are made-up from steel using of generator. Though, stator winding requires an entirely different manufacturing process and raw materials. In a coil factory, the copper wires for making copper coils are taken from copper coils.

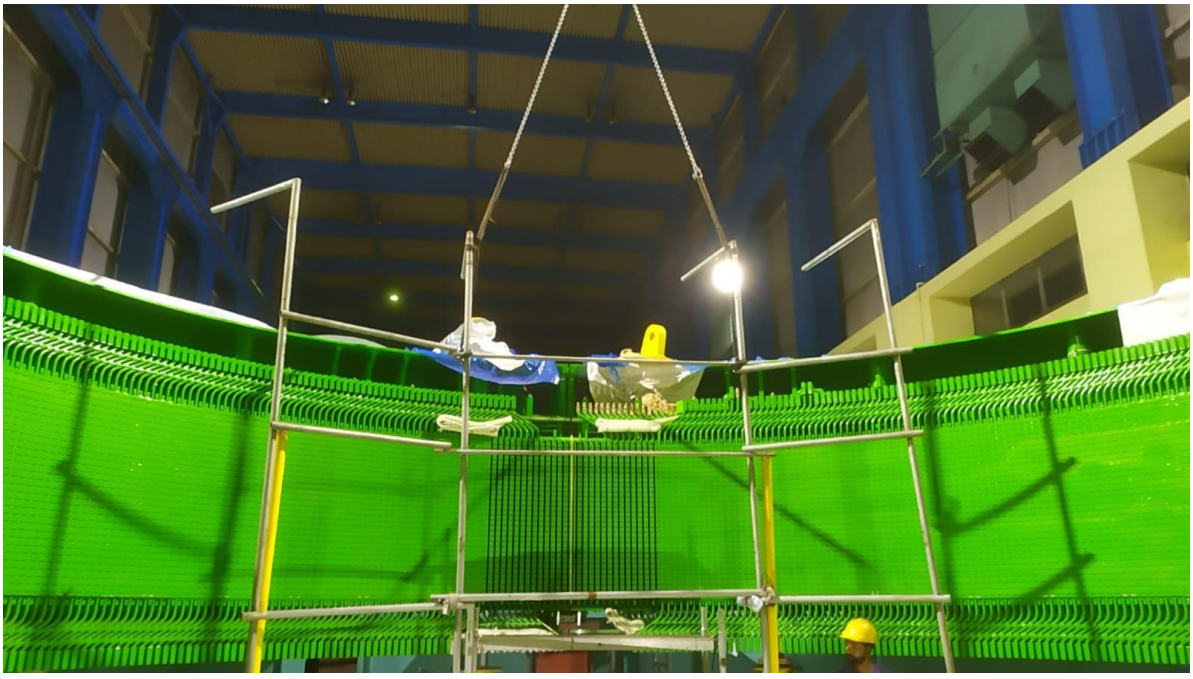

Figure 5 Stator with Frame and winding

In hydroelectric generators, single-turn rods or multi-turn coils are used for stator winding. In multi-turn winding, the fibers are insulated. Based on several strands form a coil extra insulation might be applied to the coil. The coils are then assembled into full turns. Next, the wall-to-floor insulating tapes are glued, and the coils are processed. For smaller units, the windings are in the stator slots at the factory, for large units, installation into the stator slots at the plant site. Andritz carries around a 10% share of the worldwide market for hydropower generators.

Figure - 6 Rim Sheet installation with Rotor Spider

Figure-7 Rotor With field Pole

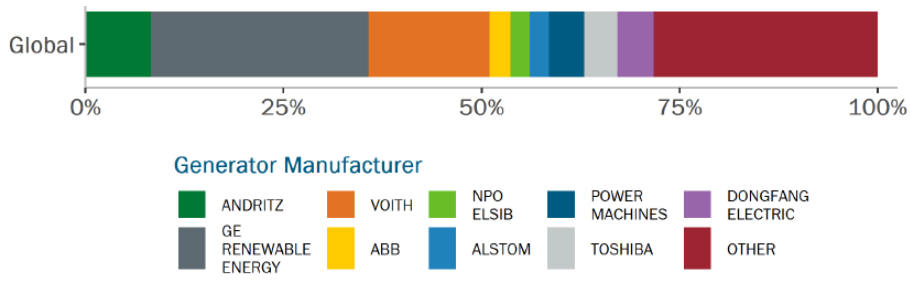

Figure -8 Worldwide top generator manufacturers

Other Materials:

Governor, Switchgear (circuit breakers and other electrical components), and Balance of the plant are sourced from local or international companies like GE, ABB, and Hi-Force.

5.4 Commercial:

The commercial department initiated their work by following the supply chain department requirements. It can be said easily that this is a part of the supply chain department. For Sending the materials to the site, the Commercial department creates the packing list of materials, opens LC, and collects the LC documents from the Client. After completing all paperwork, they Send the document to the logistics department. Andritz uses a third-party logistic company to send and receive materials at ports.

5.5 Transportation:

Once fabrication and other paperwork are complete, turbine and generator components can be shipped by sea. After arriving at port, barge or truck are used to send at site, depending on the size and weight of the parts. It also depends on the location of the power site. Products might be shipped fully assembled or in case of heavy and large materials, that are broken down into pieces that can be transported more easily by truck for final assembly and installation at the site. For heavy products, barge transport is used to transport to plants. If manufacturing occurs overseas, shipping is almost always the method of choice by sea.

Figure-9 Downloading the Heavy Materials from Berge

Figure -10 Transportation of Heavy Materials (Runner)

However, air shipping is used at the time of urgent requirements if the size is as per the requirements of the shipping company. During powerhouse design, the turbine-generator package is typically designed first. So, production of turbine and generator and civil construction work can be done parallelly. Therefore, the site mobilizes, they can be sent to the area first.

5.6 Storage:

After arriving the materials at the site, it is appropriately stored under a shaded area as the main parts of the hydropower plant are comparably large and sensitive until usage. During that unboxing time, all materials are correctly checked in terms of quality and quantity. If any deviation is found, it's reported to the concerned people.

Figure -11 Storage of heavy materials

5.7 Installation and Commissioning:

After receiving all materials at the site, the Store department issues the materials to the Concern supervisor (turbine, Generator, EPS, Automation) to start the installation as per the approved

design. When all kinds of installation work are done, commissioning work will begin. Finally, a new machine is handed over to the client for operation after the execution of all related tests.

Chapter 6 Conclusion and Recommendations:

6.1 Conclusion

After all, R&D of design, purchasing of all intangibles, marketing, distribution, and sales have greater impact compared to production. An uninterrupted supply chain and proper planning can improve the overall effectiveness of an organization. Andritz always strives to stay competitive in a competitive market. With all raw materials sourced by ANDRITZ from a variety of sources in national and international markets and finished products distributed nationally, an effective and efficient supply chain is of utmost importance to any sustainability organization. It is important. Additionally, SCM ensures that all departments are connected to achieve the organization's overall goals. Andritz believes that high prices are not the solution to achieving the company's goals but obtaining raw materials at the lowest cost and extending its supply chain are key to its overall success. It is also about ensuring an effective logistics system to get materials to customers. A path to achieving organizational excellence among competitors and within the industry.

6.2 Recommendation

- Production capacity needs to be increased to meet increased market demand.
- Logistics management should be improved to ensure on-time delivery of goods as requested by customers.
- Must conduct chain management training for all employees.
- Since the supply chain office is unstaffed, the organization must employ prepared personnel in the supply chain office to facilitate the supply and production process.

References

[1] Canyon Hydro (n.d.). Major Components of a Hydro System. Accessed on December 8, 2021: https://www.canyonhydro.com/guide/HydroGuide4.html

[2] EIA (2021). International Electricity Generation Capacity. Accessed on January 18, 2022: https://www.eia.gov/international/data/world/electricity/electricity-capacity

[3] Fasol, K. H. (2002). A short history of hydropower control. IEEE Control systems magazine (22:4); pp. 68–76.

[4] Sunil Chopra, Peter Meindl,. (2002, 01). Supply Chain Management. Strategy, Planning & Operation.

[5] Andritz Hydro website. https://www.andritz.com/hydro-en