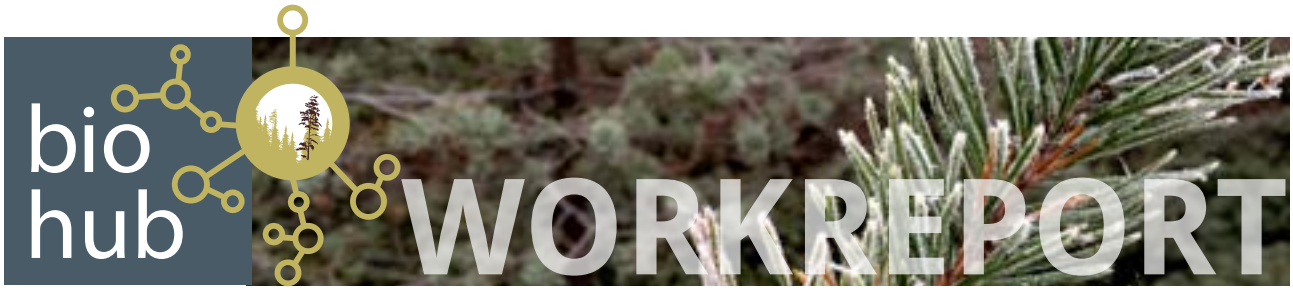

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Forest Biomass Terminals in the Botnia-Atlantica Region

BIOHUB TERMINAL REPORT

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FOREWORD

This work report deals with the results from an interview survey that was carried out among terminal entrepreneurs and managers in the Botnia-Atlantica region, that is, in Sweden the counties of Västerbotten and Västernorrland and the Nordanstig municipality. In Finland it is the three regions Southern Ostrobothnia, Ostrobothnia and Central Ostrobothnia.

The study was limited to forest biomass terminals that were at least 1 ha in size and undertook also other activities than only storage of the raw material, i.e. so called "production terminals"[1]. Special emphasis was put on terminals that were established in the form of an independent legal entity.

In total 18 terminals were surveyed of which 6 were from Sweden and 12 from Finland. The 12 terminals on the Finnish side represent 75 % of the total amount of terminals (16) that were identified in the region. On the Swedish side, 110 terminals (BioHub infosheet No 4) were identified. Even though the number of terminals is higher on the Swedish side, there are an estimated 70 owners operating these terminals. The 6 surveyed terminals represent 5 % of the total when compared to ownership structure.

The survey was done through semi-structured interviews with certain questions and themes asked in both countries. The interviews were recorded and resulted in c. 18 hours of recordings and 120 pages of transcriptions and interview notes.

The survey focused on the terminals as business operations. The main aim was to identify key success factors, bottlenecks and most pressing development needs of current terminal operations. These and other prominent themes from the interview material have been compiled into this report. In addition to the survey, several terminals were contacted through cross-border study tours and networking activities and the report has also benefitted from the information gained through these events.

The Survey has been carried out by the Swedish University of Agricultural Sciences (SLU), BioFuel Region (BFR), the Seinäjoki University of Applied Sciences (SeAMK), and the Natural Resources Institute Finland (Luke). The work has been part of the project BioHub (2016-2019) which has received financing from the EU Interreg IVA: Botnia-Atlantica programme, Region Västerbotten, Region Västernorrland and the Regional Council of Ostrobothnia.

More project results have been published in infosheets at the project's webpage (www.biofuelregion.se/projekt/biohub). The project has also developed a web-based support tool for decision-making for terminal entrepreneurs and developers, which can be found at: www.biofuelregion.se/biohubmodel.

[1] Term translated from the Finnish term "tuotantoterminaalit" (used by the Finnish Forest Centre and Natural Resources Institute Finland (Luke) in the guide "Puuterminaaliopas" published online at www.luke.fi/puuterminaaliopas as a result of a joint project "Keski-Pohjanmaan metsälogistiikka").

CURRENT STATE OF FOREST TERMINALS IN THE BA REGION - AN INTRODUCTION

In Sweden and Finland, forest biomass resources have provided the basis for significant industrial activities for more than a century. Sawn timber products and pulp and paper products have dominated the use over a long time but the use of forest biomass for energy purposes has grown rapidly over the past decades.

To fulfil political climate and renewable energy goals, the use of forest biomass in all industry segments including emerging biorefineries is expected to increase in the future. In the shift to a bioeconomy, cost competitive forest biomass supply is of utmost importance. A large part of the cost for forest biomass comes from transportation and handling, and these costs are therefore important to reduce.

Forest harvesting operations normally intensify when harvesting conditions in the forest are favourable. To avoid soil damage, accessibility to certain forest areas is limited to winter when ground is frozen. The industry demand of round wood is normally rather steady all the year around, while the demand from heat and power plants rises during winter time. This creates an imbalance between supply and demand, and hence requirements for storage of the biomass. To avoid large volumes of forest biomass being stored at roadside landings, terminals serve an increasingly important role in the supply chain.

To increase the geographical accessibility of forest biomass, terminals play a big role in current supply systems, and their importance is likely to increase in a growing bioeconomy. There are several types of terminals where each is playing its own role in supply chain from forest to industry. Terminals can have more than one role. From the forest industries perspective there are three terminal types which have been used for a relatively long time.

1. Satellite terminals

These terminals are relatively large (ca. 10 ha) and allocated close to the abundant forest raw material pool and far away from the industries. The main goal for these terminals is to increase long distance biomass supply efficiency. Satellite terminals often have rail road connection and they are situated close to well-maintained road network, in order to utilize transport modes of higher payloads such as trains and high-capacity-trucks, e.g. 74 t gross weight.

2. Feed-in terminals

These are located close to the end user of biomass, the industry. Their size depends on industry spe- cific demand and they are commonly used when the industry does not have enough storage space at the industry site, or if there are some environmental restrictions. In some cases these terminals can be used as buffer storages to balance differences between supply and demand. If high biomass quantities are handled, feed-in terminals are located close to good road network and / or railroad systems.

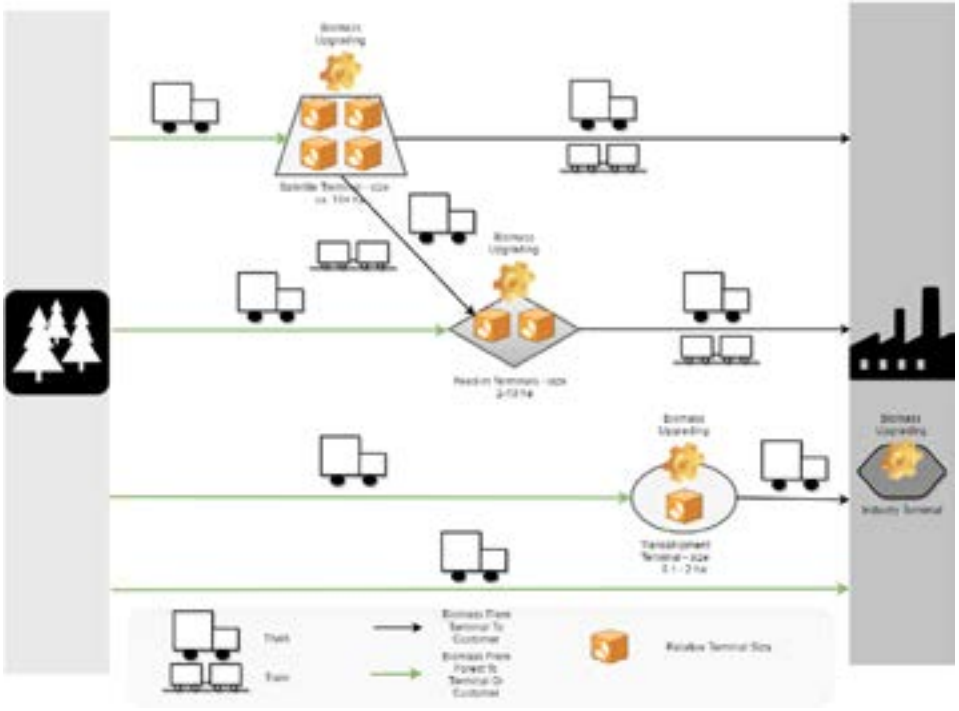

Figure 1. Terminal types.

3. Transshipment terminals

These terminals are the most common terminal types in the Nordic forest industry and are considered as present or benchmark terminals. Even though these terminals usually are small regarding their capacity, a vast number of them are handling a significant share of the total biomass that passes terminals. Transhipment terminals usually serve as buffer to even out variation in biomass supply due to seasonal, weather or other, usually foreseeable, factors. These small terminals are often filled during the season for low demand of biomass to be used during high demand. Therefore transhipment terminals are located close to good road networks which can be used all year around to secure supply.

Key differences between Finnish and Swedish part of the BA region

In the Swedish part of the BA region, the demand for forest biomass (both traditional round wood and fuel wood) is mainly concentrated in the coastal area (the main location of industrial facilities). However, the biomass is dispersed over vast forest areas, creating substantial logistical challenges to effectively harvest and transport raw materials from the forest to the industrial sites.

These challenges are especially pronounced when handling different forest fuel assortments like logging residues, which often have a bulky and troublesome nature. Normally such assortments are transported by trucks up to 100-150 km to industrial sites. Today most of the unexploited forest biomass resources are located in inland areas. To make more biomass available particular attention should be paid to developing terminal supply chains in these areas for supplying the growing industry demand.

The Finnish part of the BA region is smaller and the logistical challenge described above is not that pronounced. The railway network is different and not frequently used to supply forest industries. The need for satellite terminals is therefore smaller. Small and medium sized heating plants using different biomass assortments are more common and several of the terminals are used as feed-in terminals to heating plants.

Terminals' operational costs are highly sensitive to their layout and design. In order to design more efficient terminals, it is therefore essential to understand the current state of forest terminals in the BA region.

OWNERSHIP

Today many terminals are owned by one single forest company and have been designed to supply their own industries with deliveries of round wood. Access to this kind of terminal is often closed for other end-users competing for the same biomass assortments and all biomass assortments are generally owned by the terminal owner. This can result in "halfutilization" of terminals, which is not optimal.

Terminals can also be owned by a municipality or a private company. These terminals can be open for everyone interested in using their services and it is either the biomass producer or end-user of the biomass who owns the biomass. The challenge for private owners as well as municipalities is to design and operate the terminals in the most cost-effective way. An open terminal with both round wood and wood fuel assortments may over time develop more activities to create added value for the end-customer. New types of ownership models need to be developed, especially new business models for shared ownership. Such models can show the way for more cost-effective terminals in the future.

With regards to the surveyed terminals, ownership could be divided into three main classes: independent legal unit (entrepreneur-owned), a unit belonging under an organizational umbrella (most commonly a part of heating and power plant), and a municipally-owned unit. In Finland, privately owned terminals (independent legal units) were most common (6) followed by terminals owned by power plants (4). Two terminals were also owned by municipalities. On the Swedish side, the ownership was dwivided quite evenly between 2 privately owned, 1 power plant owned and 2 municipally owned terminals.

Table 1. Ownership categories.

Ownership categories	Sweden	Finland
Independent legal unit (owned by an entrepreneur)	2	6
Municipally owned/ state owned (company)	2	2
Unit belonging under an organizational umbrella	1	4
Subsidiary	0	0
Part of a farm or forest estate/ holding	0	0

The terminal operators were also asked who should own the terminal. In Finland the responses divided between privately owned and power plant while in Sweden municipality owned terminals got also support.

YEARS ACTIVE

On average, the contacted terminals in Sweden and Finland had been operational 11.6 years by spring 2019, c. 16.2 years in Sweden and 7.8 years in Finland. The oldest of the terminals was located in Sweden and had been established decades ago in connection to forest industry. This terminal affected the average greatly as it would have been 9.3 years for Sweden and 8.5 years for Sweden and Finland combined, if the oldest terminal was left out. Apart from the old industry terminal, the

rest of the terminals had been established from the beginning of the 21st century onward (2000 in Sweden and 2001-2002 in Finland), with roughly 60% of them being established in the 2010s. The mean age of the terminals in Finland was about 6-7 years and 7-10 years in Sweden.

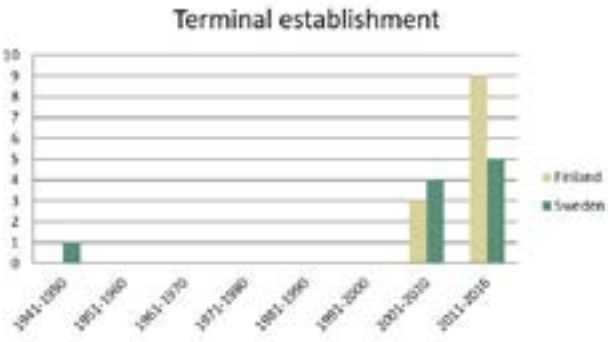

Chart 1. Operational years of terminals in the BA region.

SIZE AND VOLUME

On average, the Swedish terminals had nearly twice as much area than the Finnish ones (5.6 vs. 3.0 ha). Finland had multiple terminals with only 1 ha area when the smallest terminal in Sweden was 2 ha and the rest were bigger. The biggest terminal in Finland was 7 ha and in Sweden 10 ha.

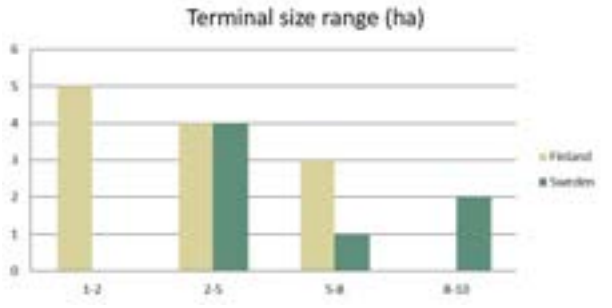

Chart 2. Terminal size range.

RAW MATERIAL ASSORTMENTS

Biomass assortments handled at the terminals are round wood (saw logs and pulpwood), and different assortments of wood fuels used for energy generation (logging residues, stumps, fuelwood - delimbed or undelimbed, sawdust, bark and recycled wood). Assortments can be comminuted or uncomminuted. Some terminals, particularly open terminals, also handle other material as road salt, industrial chemicals and recycled paper. For profitability, it is important that the terminal has flexibility in the assortments they can handle as changes of the assortments desired by the end-users can shift quickly, e.g. due to market fluctuations and quality demands.

Many biomass assortments have a large seasonal variation. Wood fuel is commonly consumed in the winter and the need for buffer storage is great in summer and autumn. Round wood is piled up in terminals, when the regional harvesting conditions in the forest are favorable, especially during winter. The handling of both wood fuels and round wood can make more flexible and effective use of terminal space all year around.

There are some *differences in the use of assortments between Finland and Sweden*. The (surveyed) terminals in Finland mainly handle energy wood assortments while in Sweden a big share of terminals handle pulpwood. Undelimbed stem wood is not commonly used in Sweden while it is used quite a lot in Finland.

There has been a lower demand for forest energy assortments in both countries over the last few years. This has affected the assortments that pass through terminals. In Sweden logging residues are today only handled in the southern part of the Botnia-Atlantica area where it can be transported by train to areas of high demand (Stockholm). Stumps are currently not used in Sweden mainly due to FSC regulations. Stumps in Finland have been heavily affected by the decrease in demand and most terminals have, or are considering to, stop handling stumps.

The decrease in wood fuel demand in Finland is partly explained by changes in taxation and subsidies making it more favourable to burn fossil coal. In Sweden, market changes, prices for electricity and green electricity certificates together with warmer winters can explain the decreasing demand for wood fuels. The situation where political decisions can change the attractiveness of different assortments overnight is pointed out by many terminal owners (especially on the Finnish side) as the main obstacle for development and planning of future investments.

The volume handled per year is a critical factor for profitability and there is interest among the terminal entrepreneurs to increase volumes. The trend in both countries seems to be going towards better delivery timing and biomass quality. It is important for the logistic system to be able to adapt to new situations as decreased or increased demand of biomass, and the addition or removal of assortments have a large impact on the system. To quickly respond to a changing environment, it is essential to have good relations with regional suppliers of round wood and wood fuels. This is a guarantee to handle enough volumes for customer satisfaction and terminal profitability.

NUMBER OF EMPLOYEES, SUPPLIERS AND CUSTOMERS

As the surveyed terminals in Finland were generally smaller, there were no full-time employees in Finnish terminals except for one terminal. One terminal had also employed a part-time driver but the remaining terminals had outsourced all actions. In Sweden, 2 out of 6 terminals had employees.

In Finland, most of the terminals had multiple suppliers. The range of suppliers varied greatly and included e.g. private forest owners, companies that donated waste wood, own supply organization, and so on. In Sweden, 3 terminals stored their own wood (owners or renters) and 2 had multiple suppliers.

All the stored material was energy wood in Finland and it was destined to heating and power plants. Five terminals had just one customer while the remaining 7 had multiple customers. In Sweden the terminals stored both pulp and energy wood. Two terminals had just one customer, the rest had several.

DIVISION OF RESPONSIBILITIES

In Finland, there was usually only one person responsible for terminal operations, except for two terminals where the responsibility was divided between two persons. In Sweden, 3 terminals had just one responsible person, 1 terminal had two persons and 1 had the responsibility divided between 4 employees.

In Finland, 1 terminal did their own chipping and 1 terminal had their own transport equipment (under different company but same private owners), the remaining 10 terminals had outsourced all actions in terminals to contractors. All the terminals did chipping, 8 also crushing. Loading, sieving and mixing was also done in one terminal each.

In Sweden, outsourced actions included loading in 5 terminals, chipping and crushing in 2 and weighing and scale calibration both in one terminal.

The choice between outsourcing and own work was linked to the amount of work required (part-time) and ability of all parties to focus on their core business which was expected to lead to better productivity when outsourcing was preferred and to easiness of management and ability to gain profit from all work phases oneself when own work was preferred.

The gender division in terminals is heavily male dominated. Most of the surveyed terminals on the Finnish side did not have any women involved in the terminal operation. In Sweden, two of the surveyed terminals had women involved in the terminal operations; one terminal had three women working for their contractor and the other had a woman supervising the operations.

Terminal operators pointed out a few reasons that might affect both men and women's decision to work in terminals: mainly part-time work is involved for contractors, workload can vary a lot during low and high season and peaks in demand can come in short notice, and machine operators in forest have harsh work conditions that are difficult to combine with family life. On the positive side, work at terminals was considered independent and responsible. For terminal managers, terminal operations provide work that includes aspects of both, a desk job and more hands-on handling of wood and a work environment close to that of forest environment. (For more information, see BioHub infosheet No 43)

THE VALUE CREATED BY TERMINALS

From a business perspective, current terminals seem to serve (mainly) 5 purposes: 1) security of supply, 2) improved operational efficiency, 3) improved quality, 4) added value through productisation, and 5) added value through services (renting of terminal space). Also, a public service aspect (6) was noticeable with terminals that dealt with re-cycled wood (pallets, old building material, garden trees and bushes, etc.). To some extent, respondents could not describe a business model for the terminal (7).

1. SECURITY OF SUPPLY

Security of supply was the most common identified value derived from the terminal. Security of supply was important for both terminals who deliver material to customers as well as for those who supply their own industrial need.

Terminals provide a solution to challenges linked to seasonal variation in the use of wood fuel, i.e. the balance between supply and demand, and difficulties with direct supply from forest due to frost heave. Terminals also provide the possibility to handle unexpected peaks in demand as it is possible to have ready-made material (whether it is pulpwood, saw logs, fuel or fuel mixes) available at all times. In this respect, terminals were seen as a source of competitive advantage.

With regards to security of supply, terminals were described as an “insurance” and “necessity”. The idea of necessity was to some extent linked to the poor profitability of the terminal as it was difficult to get back the terminal investment in terms of improved supply. As one respondent noted, “No-one would establish an extra terminal. They are established out of necessity only.” while another respondent put the same thought into these words: “If there is a storage site at forest road side in an open space with good conditions for drying and in connection to good [well-bearing] roads, there is no point in establishing a terminal.”

2. IMPROVED OPERATIONAL EFFICIENCY

In Sweden, improvements in operational efficiency could be gained e.g. by re-loading to more effective means of long-distance transportation (mainly train) at the terminal while in Finland improvements usually referred to more efficient use of machinery. The use of machinery was considered more efficient in the following terms:

- Less time spent on transition from one place to another.
- The expenses for chipping smaller batches at forest road side can climb higher than those of bigger batches, using more effective machinery usually, at a terminal area.
- Pace of work is different from e.g. contracting which affects machinery. Machinery can be kept in better condition and lasts longer as maintenance work can be done preventively.

Depending on how the business is set up (own machinery vs outsourced services), the benefits of the more efficient use of machinery can also fall on the contractors, not (only) on the terminal.

3. IMPROVED QUALITY

Terminals can provide better conditions for drying the biomass due to, for example, paving and better air flow or even roofed storages. Storage and handling at terminal environment can also decrease the number of contaminants (e.g. soil) in the raw material.

4. ADDED VALUE THROUGH PRODUCTISING

Today especially fuel producers have established terminals for this purpose in both countries. Productising here refers to processing of raw material by for example chipping, crushing, shredding and making fuel mixes according to customer demand. Here the terminal environment is utilized for productising the raw material and the terminal is treated as a business which aims to make profit.

In addition to fuel production, the productising at terminals can include innovative development of new products. In the future, terminals could produce feedstock for different biorefining purposes. Upgrading of biomass assortments into intermediate energy carriers such us pyrolysis oil is a possible future option. Lack of suitable infrastructure can restrict such development.

Even though the core idea is as stated above, other aspects of the business can differ significantly. For example, all phases of the operation can be carried out by the company itself with the idea of gaining the profit (value) from all work phases or external services can be used to high extent with the idea of improved productivity with all focusing on their core business.

The selling of fuel to external customers can also be combined with other terminal functions. For example, the terminal operator can use the terminal for supplying his/her own operations

(e.g. heating plant) as well as selling to external customers. In these cases, the selling of fuel to external customers can vary from rare occasional sales of excess material to a situation where fuel trade is (part of) the core business.

Most terminals only handle forest biomass. However, there are examples of terminals that handle also other materials, such as road salt, gravel, industrial chemicals and waste assortments. These terminals can focus on forest biomass or can mainly handle other assortments and have forest biomass as a side business. There are also examples of terminals that want to expand to other sectors, such as container transportation.

5. ADDED VALUE THROUGH SERVICES

Terminals can also be set up to serve biomass suppliers and end-users by renting them terminal space and offering related services (e.g. chipping, crushing, measurement, transportation, etc.). No terminals tied the rental of terminal space with the purchase of other services

In Finland this kind of terminals are usually owned and run by the private sector (individual entrepreneurs) while in Sweden mainly municipality owned companies are involved.

The design of the terminal area can vary based on what is considered the best design for the targeted customer segment. Development of the area (e.g. paving, instalment of stationary equipment, etc.) tends to follow demand, not received permits. However, it is common for terminal entrepreneurs to have all necessary permits (e.g. for paving, crushing, etc.) ready in case development needs arise. More investments are made in Sweden. These include, for example, investments linked to train connection and photogrammetry measurement.

Most terminals only handle forest biomass. However, there are examples of terminals that handle also other materials, such as road salt, gravel, industrial chemicals and waste assortments. These terminals can focus on forest biomass or can mainly handle other assortments and have forest biomass as a side business. There are also examples of terminals that want to expand to other sectors, such as container transportation.

The business opportunity can be combined with other terminal functions. E.g. some operators who have a terminal to improve their main operations (e.g. heating plant entrepreneurs) and have reserved a big enough area for the terminal from the start, have been able to improve the profitability or minimise the costs from having the terminal by renting out the excess terminal area to other operators. Some terminals are owned or connected to a group of machine entrepreneurs. In addition to the provided service, the terminals will in these cases provide benefits also in the form of more efficient use of existing machinery (trucks chippers and/or forest machines).

6. PUBLIC SERVICE ASPECT

Respondents involved in the treatment of re-cycled wood (from households and industries) brought up a “public service aspect” as they were treating material that was considered as waste by suppliers. The public service aspect was wider if waste wood was received from both industries and households.

With waste wood from households (garden trees, branches, bushes) monitoring of terminal area/ on call services might become relevant to minimise the use of the terminal area as a common dump site. Though, the problem of a terminal being used as a dump site can be tied to unmonitored terminal areas (no gates, no monitoring/ on call service) in general rather than strictly with the use of household waste wood.

Even though not a purpose in itself the idea of becoming a “big player” was occasionally linked to the point of having a terminal. The terminal provided the possibility to expand or maintain operations of a certain scale (meaningful amounts – meaningful player).

DISTINCTION BETWEEN THE TERMINAL BUSINESS TYPES

Based on the interviews, the terminals could be grouped into three categories based on the value derived from them:

1. Terminals that serve the owner’s own industrial need, i.e. terminals that are set up to secure supplies and improve overall operational efficiency and quality of the feedstock but not to function as a business themselves.
2. Terminals that provide an area where to productise the material (e.g. upgrade it to fuel) and sell it for profit to external customers. At the moment, fuel producers operate these kinds of terminals in Finland and Sweden.
3. Terminals, in which the terminal operators provide a needed service in the biomass supply chain, i.e. rent space to others and possibly provide related services.

The distinction between terminal types/ categories is vague, as a terminal can include all functions listed in table 1. This also has an effect on the distinction between open and closed terminals. Generally, the third type of terminals is considered open while types 1 and 2 are considered closed. In reality this distinction is not that neat.

A terminal can have one or several of the functions described above. Six out of 18 (33%) respondents described the terminal having only one purpose, five (28%) described two purposes and four (22%) described three while the remaining three (17%) respondents gave descriptions including more than three purposes. In those cases where only one function could be detected, it was either (1) “security of supply” (in 3 cases) or (5) “possibility to provide a needed service” (in 3 cases).

Table 2. Identified terminal functions.

Terminal function	Amount
1. Security of supply	11 (61 %)
2. Improved operational efficiency of main operation	7 (39 %)
3. Improved quality	5 (28 %)
4. Added value through productisation	6 (33 %)
5. Added value through services	7 (39 %)

ACTIVITIES AND SERVICES

Storage is the most common activity that takes place at terminals. However, not all terminal entrepreneurs are involved in storage of raw material. Some terminals in Sweden focus on reloading forest biomass from trucks to more efficient transportation means, for example to train or bigger trucks. Also, seven out of 18 interviewed terminals focused on or had included renting out space to other actors in their business portfolio. Even though forest biomass is stored at these terminals, it is in these cases the customer of the terminal who is responsible for it, while the terminal entrepreneur carries out activities linked to management, maintenance and development of the terminal area.

It is a normal practice to chip biomass at roadside landings with rather low productivity. Roadside chipping is carried out with smaller machinery which is more prone to break down. This system is characterized as "logistically hot", meaning that one machine often has the wait for another and therefore workflow is difficult to plan. If comminution is done at terminals more cost-effective and robust machinery can be used.

Most terminals on the Finnish study area were involved in comminution (chipping or crushing). Comminution took place or was offered in all but 1 the interviewed terminals in Finland. Almost by rule, fractioning was outsourced to contractors. In 10 out of 12 interviewed terminals, all work apart from management was outsourced.

In Sweden, loading was the most common activity, carried out in five out of six terminals. Weighting took place in four terminals and fractioning in three terminals.

MEASUREMENT OF VOLUMES AND MOISTURE CONTENT

Measurement of volumes both coming in and out from terminal as well as volumes stored at terminals is important for better management planning. Measurement was carried out in most terminals and by several means. It is relatively common for trucks to drive through scales (weighbridge) when entering the terminal area or the material to be scaled by other means, e.g. truck scales, crane scales, spring scales, portable scales, etc. Use of a weighbridge was more common (4 out of 6) in Sweden than in Finland (3 out of 12).

Calibration of scales for more reliable results, and in general, scales with good accuracy that do not malfunction easily (e.g. accuracy of some scales might be affected if sensors are exposed to water, etc.) are important as big discrepancies between procured amounts and deliveries to customers can be caused by problems with scales. Routine follow-up of storage by any convenient methods (e.g. one's own spreadsheet for storage bookkeeping) is a necessity for stock management.

In Sweden, remote camera measurement is rapidly becoming more popular. Automated camera measurement has made it possible to deliver wood to terminals around the clock. This is much appreciated among truck drivers and makes it possible to increase volumes handled at terminals. The truck drives to a marked area surrounded by cameras. The cameras take photographs for measurement of log length and pile height. Cameras can also see end faces of the piles, for id-marking, quality species etc. The photos are automatically sent to authorized measurement personnel, SDC, who estimate the solid volumes (m^3 solid).

Measurements of loose volume (m^3 loose) can also be done based on the number of buckets loaded or unloaded of a front loader or by the truck driver based on the capacity of the truck. Measurement of solid volumes can also be carried out by harvester measurement system, pile measurement, and frame measurement.

For wood fuel assortments, *moisture content (MC)* dictates the value, normally traded in MWh, as it affects the effective heating value greatly – the lower the MC the higher the price! MC is the property that fluctuates most in the supply chain and thus is the main property to keep track of. To measure the MC, representative samples of each delivery or batch must be taken.

Sampling of comminuted wood fuel (e.g. wood chips) for moisture content is relatively common at the terminal. With regards to sampling, the suppliers (truck drivers) can be responsible for it and they can be educated on how to conduct sampling in a reliable way by either the terminal or by a company specialised in measurement. In bigger terminals, sampling and measurement can be outsourced to authorized personnel.

If the material is not comminuted (fire wood or logging residues) the sampling is difficult .However, sampling with a chainsaw provides a new possible option (Biohub infosheet No 31).

Determination of MC requires several samples and laboratory test that normally takes 24 hours. Several

terminal owners have declared a demand for fast, portable, and cost-effective MC determination technology. A new hand-held Wile Bio moisture meter can be one solution and has been evaluated here (Biohub infosheet No 32).

FUTURE ACTIVITY SET

On the Finnish side, the respondents were discussing how the markets for forest energy based products, and in the long run, for other higher added value products develop. On the Swedish side respondent hoped that activities related to upgrading of forest energy assortments like logging residues could grow in the future.

FUNCTIONALITY OF WORK FLOW

When asked about the positive aspects in their work flow and organization of work, none of the terminal entrepreneurs highlighted some specific aspect, though five mentioned to have a working system. However, during the interviews the respondents described changes that had been done in the past in order to improve the work flow, e.g.:

- For many terminals, it is too expensive to have on call service at the gate. This can be resolved in several ways. Deliveries can be controlled by an SMS system, where the suppliers send the terminal manager an SMS informing him when the material is ready to be transported to the terminal. In Sweden, remote camera measurement has decreased the need for on call service at the gate and made suppliers less tied to fixed hours of delivery. However, it is common that terminal areas (excl. industry terminals) are not restricted by gate and the relationship between terminal managers and suppliers is based on trust. Drivers off-load material independently but according to instructions that have been agreed upon at an earlier occasion.
- When multiple wood suppliers are concerned, slots can be assigned beforehand and marked so that drivers know where to unload. This can help to avoid disputes over responsibility in case problems arise (e.g. storage pile collapses) as only drivers from certain company unload and pile certain windrows. Having a map of the terminal area with each company's slot marked on it also helps internal logistics.
- Covering of storage piles (e.g. with a layer of birch during the warm season and with paper or plastic from early autumn onward) and stacks (e.g. plastic) in order to have a good drying process, avoid insect damages and improve fire safety is routine, but better options for coverage is of interest. Most covers cannot be re-used and some material easily sticks to the cover adding to material losses. Other options for paper and plastic are e.g. foams, re-usable covers such as top-tex.
- Simple means to follow the weight of the load when transporting material from the terminal to end-use or customer can improve the workflow. For example, the weight of the load is easy to follow if the trucks have wireless scales and the driver can follow the load weight development while loading.
- Routine maintenance of machinery is important for a smoothly running operation.

With regard to n*egative aspects in the work flow and organization of work*, the answers varied greatly. Among the Finnish respondents, 3 mentioned stock management (measuring, material losses) and 2 the extra work phase (transportation) caused by the distance to site of end-use. Among the Swedish respondents, 2 mentioned problems linked to railroad connections and 1 with stock management (material losses).

The terminal owner needs to better keep track of the stored biomass volumes at the terminal. It is difficult to measure the volume of the stacked biomass, particularly chips, logging residues and stumps. This can be achieved with use of techniques for stockpile inventory (e.g. photogrammetry). To better fulfil the end consumer's just in time delivery needs, advanced information management systems is needed. Measurement, classification and labelling of different biomass assortment can be developed step by step. By delivering the right assortment to the right customer at the right time added value can be created for better profitability for both the terminal and the end user.

SUMMARY OF DIFFERENCES BETWEEN SWEDEN AND FINLAND

The activities between the surveyed Swedish and Finnish terminals differ to some extent with Finnish terminals being more heavily involved in comminution of raw material for energy purposes while the Swedish terminals are frequently used for re-loading to more effective transportation means. In Sweden, train transport is used for pulpwood, timber as well as energy wood chips. Measurement rises as an important factor on both sides of the border. Investments in weighbridges are more common on the Swedish side and can be supported or replaced by remote camera measurement which does not exist on the Finnish side.

LOGISTICS

LOGISTICS INTO TERMINAL

The logistical solutions depend, to a large extent, on if the terminal is open or closed and if it is located far away or close to the end user.

Basically, all forest biomass is delivered with different kind of trucks to the terminals. The truck type chosen for the transportation depends on the material and transportation distance. Round wood and energy wood are generally delivered by normal log trucks. Logging residues, stumps and undelimbed energy wood are delivered with different kinds of cover trucks. Chips are delivered by chip trucks, chipper trucks or container systems. Other sawmill by products (bark, sawdust) are mostly delivered with chip trucks.

There is often a difference in truck types used for transportation depending on distance, particularly for logging residues. Loose logging residues are only transported short distances but this is not common in Sweden as many terminals do not have a good option for on-site chipping and the loose residues also require large storage areas. Transport of loose logging residues is somewhat more common in Finland.

Chipper trucks are common on short distances, and container systems or chip trucks in combination with chippers at the roadside storage are common for longer transportation distances of logging residues.

Stumps are only used in Finland and can be delivered with container trucks and shredded at terminals or shredded at the road side and delivered with chip trucks or container trucks. Shredding at the landing is more interesting on long transportation distances, but there is some concern that it might reduce the fuel quality.

INTERNAL TERMINAL LOGISTICS

By Kalvis Kons

Wheel loaders / front-end loaders are universal machine to have around terminals. In the Nordic context, the most common front-end loader size at the terminals is in the range of 18.5 – 28.5 tonnes operating weight. The front-end loader is a good alternative and one machine can serve several smaller terminals where both loose material and logs are handled at the same time giving space to use the machine outside terminal operations as well.

Wheel loader or front-end loader is perhaps the most widespread machine at the terminals and definitely one to find at the terminals handling loose materials. It is also a very universal machine since its construction allows to change material handling tools from buckets to forks etc.

Wheel loaders are almost exclusively used at all wood chip train and truck loadings at the Swedish biomass terminals. The range of wheel loader sizes is wide, from ca. 11 t up to 56 t operating weight. However, the most common size at the terminals is in the range of 18.5 – 28.5 tonnes operating weight.

The wheel loader's and bucket size is usually chosen to match the distances the material has to be carried from the storage area to the train. The longer the distance, the bigger is the bucket that is used. The machine and bucket size are less crucial when loading trucks.

At smaller terminals, wheel loaders are owned by contractors and are used on campaign basis when a chipping operation is underway or loose material from the terminal has been emptied and more intense truck traffic is planned. The rest of the time wheel loaders can be used in other work activities at construction sites, snow ploughing etc., therefore ensuring high utilization rates of the machine during the whole year.

Logs are the most common assortment at all terminals and the most commonly used machines are front end log loaders, high lift end log stackers.

Figure 2. Volvo L120H loading bark into the trailer.

Front end log loaders

Usually, the front-end log loaders can be equipped with different grapples depending on the work task. The machine can be used for loading / unloading of trucks and for placing logs onto feeding decks at mills. It is also fast at carrying small volumes of

logs over short distances. Usually, the front-end log loaders can be equipped with different grapples depending on the work task. The machine can be used for loading/unloading of trucks and for placing logs onto feeding decks at mills. It is also fast at carrying small volumes of logs over short distances.

Figure 3. Volvo 180G wheel loader equipped with log grapple at the mill log yard.

High lift

High lift is purpose build machine on wheel loader's base for log handling. Typically it will be a slightly heavier machine at ca. 35–38 t compared to the most commonly used front-end loaders.

Since high lift is purpose build machine it cannot be used for other activities despite log handling. However, it gives high productivity in applications like unloading / loading logs on trucks and trains as well as stacking, unloading sorting hoppers and loading feed tables. Since the grapple on the high lift can rotate 360° the cycle times are shorter and the stacks can be approached from every side.

The high lift can also operate at the stack heights at about 7 m, therefore, reducing the needed storage space for about 60% compared to when using front-end loaders.

Figure 4. Volvo 180E high lift at the satellite terminal in Sweden.

As with most machines the good ground bearing capacity is of high importance. When having full grapple the load on the front axles can reach ca. 70 t. As terminal activities are repetitive over time the ground conditions can be seriously affected.

High lifts are well suited for the terminals with high turnover and train loading / unloading activities. However, for terminal maintenance, a wheel loader will be necessary.

Figure 4. Swetruck TMF 12-9 log stackers unloading train at the log feed-in terminal in Sweden.

Log stacker

Log stacker is one of the most common machines at the pulp mills, big unloading terminals and big sawmills in the Nordic countries. These machines have a high lift capacity (9 – 30 t) and they are very efficient at unloading trucks and trains and carrying logs over short distances at the mills and terminals. The grapple as for the material handlers and high lifts can be rotated improving overall machine maneuverability.

If the log stacks are high, log stackers cannot easily approach log stacks in the same way as front-end loaders without safety risks of logs rolling down. Therefore terminal layout has to be planned so that log stacks can be approached from the top / bottom end of the logs.

Due to grapple size and construction, these machines are not suited for loading logs and you will not find these machines at the terminals loading trains and trucks. Also, higher fuel consumption can be expected compared to material handlers.

The information on internal logictics at terminals can also be found at (Biohub infosheet No 19).

LOGISTICS OUT FROM THE TERMINAL

Deliveries to end-users can be done by truck or train. The transportation option depends on volume, distance, rail road network and whether or not terminal and end user have rail road connections.

Deliveries of comminuted material and sawmill by-products is mainly done with chip trucks as sawmills often are located close to larger towns and other industry. Uncomminuted energy wood is delivered with round wood trucks. Other materials are commonly not delivered uncomminuted to end-user.

LOGISTIC PLANNING

Truck transportation to end-user is most commonly arranged by the biomass producer or deliverer. Train transportation can often be arranged by the terminal owner as he often has all permits for train transportation. This arrangement of train transportation also has to be done far in advance as track times have to be reserved, which also means that train really cannot be used for fast adaptations to demand.

At terminals located at the end-user or close to the end-user also wheel loaders and tractors are used to transport the material, this transportation can either be arranged by the end-user or the biomass producer or deliverer.

Terminals that serve power and heating plants have a large seasonal variation, and during heating season, planning horizon is generally short as the demand depends on the weather. There is usually a general frame contract for a year or several years, but monthly delivery levels are changed afterwards depending on actual demand. The daily and weekly planning is often done between the transportation contractor and the end-user to ensure that the needed biomass feedstock is delivered.

This situation is something that mainly affects terminals located close to end-users and those that are located further away that use trucks for deliveries while it does not really affect terminals that use trains for deliveries.

The deliveries from forest to terminal are somewhat more constant but usually larger at times before anticipated problems (e.g. frost heaving) and when the demand at the end-user is low but material is still produced. This material can include saw mill by-products or energy wood from final fellings that cannot be stored in the forest.

Closed terminals either have the terminal owner making the logistics arrangements or have the biomass producers arrange the transportation. There are some exceptions when a terminal owner buys the right to harvest forest directly from small forest owners.

Open terminal owners do not, as a rule, arrange transport to the terminal and it is most of the time the biomass producers that arrange the transportation to the terminal. Most transportation services both to and from terminal is subcontracted.

LOGISTIC FLEXIBILITY

It is important for the logistic system to be able to adapt to new situations as decreased or increased demand of biomass, and the addition or removal of assortments have a large impact on the system.

There are e.g. trials in Finland with burning fresh wood in winter time, and some believe that this will become common in the near future. This use is something that would have a large impact on the logistics around a terminal. There are also a few large investments in mills and biorefineries that will affect the supply chain.

It is important to arrange a flexible supply chain as changing taxes and subsidies can change the optimal setup. Good planning is important in a logistic system and reduces cost and queueing. Exchange of biomass between different actors can be of interest as it can reduce the overall transportation distance.

For new terminals it seems that location in connection to rail road, roads, raw material sources, end-users and already existing terminals are important to carefully analyse. If the terminal is located close to sensitive area (environmental, buildings), it can limit activities allowed.

DIFFERENCES BETWEEN SWEDEN AND FINLAND

In Finland and the average transportation distance to terminals for primary forest fuels is about 50 km, while in Sweden it is about 100 km. Roundwood and household waste often have longer transportation distances.

Terminals located far away from end-users in Sweden are often used for reloading to long-distance train transportation while the terminals in Finland more often are used for security of supply (e.g. machine breakage). This situation means that more material passes a terminal in Sweden and therefore is a longer transportation distance to the terminal needed.

In Sweden wood fuel is commonly used in the winter and other fuels are used as a base load in

many large district heating facilities around the year. The reason for this is that the plants get paid for the combustion of household waste. In Finland, it also happens that peat is used in the winter and wood fuel in the summer, as peat has higher energy content.

Train transportation is only used for round wood (saw logs and pulpwood) in Finland, while it has recently started to be used also for energy assortments in Sweden. Mellanskog is delivering wood chips to Stockholm Exergy Värtaverken with a specially designed trainset including 26 wagons with 3 * 60 m^3 Containers. This gives the trainset the capacity to transport 4700 m^3 loose.

The transportation distance to end-user is also longer in Sweden than in Finland. Train is mainly used when the terminal is located far from end-user, in Sweden the distance is often 300-400 km when trains are used.

There can also be long distance truck transportation to end-user, but the material is then commonly upgraded (comminuted or mixed) and/or loaded to more efficient trucks that have higher load capacity than trucks commonly used in the forest.

Train transportation can be difficult to arrange as train length and availability is affected by many factors, as geography, loading abilities, signal systems, electrification and train times on the rail road.

Some terminals have limited size and cannot accommodate long trains, while others have problem that the inclination of the track limits the length of the train as the locomotive cannot handle a full set of wagons.

There can be other options that include loading part of the wagons and then turning the wagon set around or splitting them up on to several different tracks on a terminal. All these options add to the loading time and cost of the train transportation. Ideally should a full train set be driven in to the terminal and loaded at once.

SUCCESS FACTORS, BOTTLENECKS AND DEVELOPMENT NEEDS

Size and location were considered important in terms of the terminal's success potential by the interviewed terminal operators. This was not dependent so much on the chosen business concept but common to all types of terminals.

SIZE AND VOLUME

Use already existing infrastructure

Investment in a terminal facility starting from scratch is often not economically realistic. Instead, terminal owners often try to make use of already existing infrastructure such as an abandoned industry or railway area.

To better suit the terminal owner's future needs, the area is often reorganized step by step with limited investments e.g. more paved area. The old infrastructure can sometimes restrict development when new space cannot be made available.

Reserve big enough area

A big enough area should be reserved for future terminal expansion already from the start. This would allow more flexibility in the future development of the terminal.

Terminal flexibility for greater profitability

The volume handled per year is a critical factor for profitability, and all terminal owners want to increase volumes. It is important for the logistic system to be able to adapt to new situations as decreased or increased demand of biomass and the addition or removal of assortments have a large impact on the system.

To quickly respond to a changing environment, it is essential to have good relations with regional suppliers of round wood and wood fuels. This is a guarantee to handle enough volumes for customer satisfaction and terminal profitability. (Biohub infosheet No 34)

LOCATION

Several of the interviewed terminal operators identified location as a key source of competitive advantage. Site of end-use and infrastructure dictate the choice of location.

In Finland location along good (well-bearing) road connections and close to or next to site of end-use is preferred. It is important for terminal operators that logistically raw material is directed from forest to site of end-use so, that unnecessary transports are avoided.

Many terminals on the Swedish side are located 200-400 km away from end-user close to railway and have a main function to increase long-distance biomass sup¬ply efficiency with truck to rail transshipment of round wood.

In addition to site of end-use and infrastructure, one should also think about permits and municipal planning schemes that may limit the options for what can be done and stored at the intended terminal area. For example, closeness to households may limit operations due to noise disturbance and dust-related problems. On the other hand, problems with insect damage in surrounding trees may occur if the terminal is located close to forest (vs e.g. industrial area).

A key factor to consider is the supply of raw material. Is the terminal located in an area with large supply; primary material from forest or secondary material from industries? In the Botnia-Atlantica area, the average transportation distance from forest to terminal is around 20-50 km in Finland and 100 km in Sweden.

SMALL IMPROVEMENTS HERE AND THERE

The development that has taken place at terminals is best described as small improvements here and there to improve efficiency.

Measurement can pose a problem for terminals in stock management and better means of measurement have raised interest. Apart from this, paving or increasing the amount of paved area was a common development need among terminal entrepreneurs with eight out of 18 respondents considering or having need for it. Also, increasing the terminal area or establishing new terminals and achieving bigger volumes for better profitability were raised up.

There were also individual cases where the capacity of the weighbridge, lack of workforce, lack of cooperation with others, installation of new machinery and design of the terminal area had posed problems for the terminal entrepreneur.

DIFFERENCES BETWEEN SWEDEN AND FINLAND

Some differences were detectable between the terminals in Sweden and Finland. Swedish terminal entrepreneurs brought up train related issues, e.g. train hours (that need to be booked in advance and cannot be changed within short notice), better designed wagons for loading and unloading. Often the terminal railway junction is not electrified

and the use of duel trains (diesel and electric) is needed. Investments in better railroad connections can make loading of the train more effective and has also taken place in Sweden.

Issues related to logistics did not dominate the agenda in Finland. The Finnish terminal entrepreneurs brought up diverse issues ranging from roofing (some) of the storage area or better means of covering piles to lack of demand for energy wood, the need to improve possibilities for two-way transportation and the need for a better location next to site of end-use.

ENERGY POLICIES AND DEMAND FOR ENERGY WOOD

A common complaint that came up in almost all interviews on the Finnish side was the lack of long-term and stable energy policies that would provide a stable operational environment.

Increased use of coal in Finnish powerplants has decreased demand for local biomass resources. Some of the operators had contacted politicians at local, regional and national level.

The comment maybe describing the respondents feelings the best, described the situation this way: “In my opinion it doesn’t even matter what the policy is as long as it just is there for long-term. If we have a policy guiding us to certain direction for the next 20 years, at least we know what to expect and can plan ahead and e.g. make investments accordingly. Now, with the energy policy changing all the time, it is impossible to plan ahead; it will become expensive.”

A more stable operational environment coupled with more even utilisation of forest biomass around the year were important factors affecting the ability to make investments (e.g. paving, electricity, machinery and equipment, etc.) and keep skilled labour involved in the operations.

Some of the respondents felt that there was not enough demand for energy wood. The lack of demand was experienced in different ways and varying reasons were found for it. For example, if wood fuel was delivered to heating plants, the capacity of the plants was seen as the limiting factor. As a solution, the development of CHP plants was suggested.

The effect of the planned biorefinery development in Finland was also considered to have an effect on the demand in future as more fuel was expected to be released to a market that was considered already competitive.

In contradiction, some respondents considered there to be sufficient demand for energy wood. The value of locality (the capability of providing forest chips from the region) was taken into consideration by municipalities, e.g. in the eligibility criteria in invitations for tender. This had a positive impact on the demand for energy wood.

FUTURE

Investments in terminal development are done based on demand. However, it is common for terminal entrepreneurs to have permits applied already from the start for different development purposes (e.g. paving, crushing, etc.) in cases demand arises. Some terminals had already made plans for future activities, while for some the visions of future activities were on a more vague idea level.

No one activity rose as the most prominent but de-barking, sorting, sieving or screening and some sort of further refinement of the forest biomass were raised up. Several investments have secured ERDF (ERUF / EAKR) financing for terminal infrastructure during the project on the Swedish side:

- Dåva Företagspark owned by Umeå Energi has secured 38 M SEK for a new railway terminal
- NLC Storuman terminal owned by the municipality Storuman has secured 36 M SEK to develop railway infrastructure
- Rundviks terminal supported by the municipality of Nordmaling has secured 23 M to develop a new terminal

DISCUSSION

There are vast forest biomass resources in Sweden and Finland, and it is known that annual forest increments exceeds demands of existing forest industries (sawmills, pulp mills, heating plants and pellet mills). Thus, there is scope for the bioeconmy to further develop in the Botnia-Atlantica area.

Today most of the unexploited forest biomass resources are located in inland areas. To make more biomass available particular attention should be paid to developing terminal supply chains in these areas for supplying the growing industry demand.

Demands for raw material will probably differ over time and between types of industry, making terminal nodes more important than today. This has several logistical advantages and terminals will probably be more efficient (in cost and energy consumption terms) than current practices.This may contribute to regional development in sparsely populated areas (e.g. the inland areas in Norrland) and provide effective future ways to optimise use of forest biomass. Transport and handling of forest biomass are costly and profit margins are currently low, while loading and unloading are expensive. To make terminals more cost-effective, it will be important to develop and optimize their internal logistic design and management.

A critical factor is to ensure that supplies of biomasses with various qualities can continiously be supplied all the year around. Supplies must sometinmes rapidly be adjusted and adapted to meet shifts (potentially unpredictable) in demand. Terminals can play a key role in the provision of such flexibility. Current terminals are mainly used as transition points, where little upgrading is done apart from comminution. Since raw forest biomass cannot be transported long distances, due to its relatively low value, robust value-upgrading at terminals closer to forests before long distance transportation can develop over time. Such terminals must be quite sophisticated in order to serve as flexible/semi-mobile refineries, i.e. they will need to have access to appropriate infrastructure, electricity, water and personnel.

The regional focus in the Botnia-Atlantica (BA) program limits the number of studied terminals to a rather small geographical area. To obtain a more comprehensive picture, it would be of great interest to expand the mapping to cover the whole of Sweden and Finland.

To build up and develop a terminal includes many considerations. To assist terminal entrepreneurs and developers to create value-added business, the BioHub model has been developed. Link: www.biohubmodel.se

For further guidance in terminal development and biomass logistics, we recommend reading related BioHub infosheets, Forest Refine infosheets and results from previous cross border projects.

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ANNEXES

PERMITS AND REGULATION LINKED TO TERMINAL DEVELOPMENT

There are several permits and legislation that should be taken into consideration when planning a terminal. These are described shortly below. For a more thorough description of the permit processes and legislation linked to terminal development in Finland, please follow this link (https://www.luke.fi/puuterminaaliopas) to a terminal developer's guide provided by the Finnish Forest Centre and Luke.

Land use and regional and municipal planning schemes

Regional and municipal planning schemes limit the possibilities for land use. When choosing a site for the terminal, current terminal operators brought up the need to be aware of possible limitations set by the schemes.

Road and railroad construction and permits for junctions

On the Finnish side permits required for road construction were of importance if e.g. the terminal required a junction to public road network. The junction permit can be applied from the road maintenance authority. Traffic safety, traffic flow, impact on road maintenance, and the potential effects of the junction on future land use are considered during the permit process.

On the Swedish side permits linked to railroad development (e.g. triangular junction) were of interest. For a building and planning permission, the terminal entrepreneur should contact the municipality.

The Swedish Transport Agency (Transportstyrelsen) may grant permits to companies that wish to operate traffic on the Swedish railway infrastructure.

There are three types of permits for railway undertakings:

- Licence
- Safety certificate part A and part B
- Special permits

For further information, please see:
https://www.transportstyrelsen.se/sv/jarnvag/Tillstand/Tillstandformer-jarnvagsinfrastruktur/

Several contracts are required for the permits, for example the safety certificate from the Swedish Transport Agency is broad and includes a maintenance agreement (underhållsavtal), an adherence agreement (anslutningsavtal) and a contract for the use of railway infrastructure (trafikeringsavtal) with the Swedish Transport Administration (trafikverket). The preconditions for applying for the use of railway infrastructure and capacity are explained in detail on the Transport Administration's webpage:
https://www.trafikverket.se/for-dig-i-branschen/jarnvag/jarnvagsnatsbeskrivningen-jnb/

The environmental permits (miljötillstånd) linked to railroad development are acquired from the municipality and regional council (länsstyrelsen).

A landscape work permit (marklov) is required if the storage height of any assortment is higher than 80 cm. The permit can be acquired from the municipality.

Environmental permits and nature conservation law

It is common to require an environmental permit for example due to vicinity to water areas and ground water areas, possible noise disturbance and dust related problems from chipping and crushing.

Here a terminal developer has to think about the disturbance not only on humans but also animals, e.g. fur farms (noise disturbs the animals during whelping and limits the possibilities for chipping/crushing).

An environmental permit might also be required for the treatment of waste wood, but this depends on the type of waste wood handled. It is the nature conservation law (Ympäristönsuojelulaki) in Finland and the Swedish environmental code (Miljöbalken) in Sweden which applies to terminal development.

Insect problems and law on forest damages

In Finland, the measures to prevent insect problems have been defined in the law on forest damages. If located close to forest, insect damages in surrounding trees were avoided most commonly by covering the storage piles (either with covers and/or a layer of birch). In Sweden, it is the environmental code (Miljöbalken) that lays the rules for terminal establishment.

Storage records and the feed-in tariff for electricity produced from forest chips in Finland

The new feed-in tariff in Finland sets stricter requirements for storage bookkeeping due to the separation of feedstock into two subsidy classes (60 % for industrial roundwood / saw logs and pulpwood and 100% for energy wood assortments).

A separate bookkeeping of raw material belonging to the different subsidy classes is required. For example, variations in moisture content and other losses during storage may lead to a situation where the energy content delivered to the terminal does not match that of delivered to the end-user (power plant).

If the storage values are corrected at the terminal either according to measurements done at the terminal or at the power plant, the corrections should be done equally to fuel (feedstock) belonging to both subsidy classes (60 % and 100 %).

An exception to this rule can be made if the assortments eligible for different subsidy are stored physically separate, which enables separate storage bookkeeping. Even though the actor responsible for the documentation is the receiver of the subsidy (power plant), the requirements may also affect terminals through which the raw material is supplied to the end-user (e.g. via contracts signed between the parties).

EU waste directive

According to the EU waste directives package (4.7.2018), at least 55 % of all municipal waste should be recycled by the year 2025, 60 % by 2030 and 65 % by 2035. Today, Finland recycles around 41 % of municipal wastes. The directive on packaging materials (wastes) states that 65 % of these should be recycled by 2025 and 70 % by 2030. Separate goals have been set for different packaging materials.

The Ministry of Environment in Finland finds the targets set for recycling of plastics and wooden packaging materials (wastes) especially challenging, as the set targets (30 % of wood packaging wastes and 55 % of plastic packaging wastes by 2030) require more than doubling the recycling of these materials by 2030.

The share of recycled packaging wastes is calculated based on weight (the total weight of packaging wastes that have been recycled in to same or other purposes in a given calendar year from the total weight of packaging materials that have been released to market during that year). The materials should be treated so that new products, materials and substances are made out of them either for original or other uses. Energy and fuel use are not included as recycling under the directive. In future, this can affect (limit) the possibilities of using waste wood assortment in energy production.

The Ministry of Environment has started to renew the national waste legislation based on the directive. The directives need to be implemented nationally by 5.7.2020.

Links:

Ministry's info package on the issue (in Finnish):

http://www.ym.fi/jatesaadospaketti

https://www.ymparisto.fi/fi-FI/Kulutus_ja_tuotanto/Jatteiden_kierratys_kuntoon_ja_vauhtia_k(49284)

The directive on recycling of packaging materials:

https://eur-lex.europa.eu/legal-content/FI/TXT/PDF/?uri=CELEX:32018L0852&from=FI

The law on measurement

The new law on measurement in Sweden has to be taken in consideration when a biomass producer (supplier) receives forest biomass from individual forest owners (small holders), that is, at the first point when the material is sold from the stand of the owner to someone else.

The law on measurement doesn't require a specific measurement method or equipment to be used but requires the measurer to be able to show a high level of accuracy of the measurements. Companies providing measurement services need to have set sufficient routines and own control for the measurements.

The forest owners should always receive a measurement receipt with certain information on it regardless of the company who has done the measurement.

Today, the measurement unit used is m^3 loose which can make it convenient to chip at forest roadside and measure the biomass there. The forest service has to control and accept the used measurement procedure.

The aim of the new (2013) law on measurement in Finland (laki puutavaran mittauksesta) is to guarantee the reliability of the measurement methods and results, and functionality of measurement equipment. Measurement of energy wood has been adopted into the measurement law from the beginning of 2014.

The measurements at site of end-use (power plant) are subject to control by public authority (Luke) and the end-user is obligated to fill in a measurement form. The measurements are required when they form the basis for payment. The measurements focus on volume, weight (including dry weight) or pieces (number of logs) while measurement of energy content or heating value are not included in the law.

Previously deals (payment) with private forest owners were based on solid m^3 with various conversion factors (for kg) depending on how fresh or dry the wood was.

Links:

The law on measurement:

http://finlex.fi/fi/laki/alkup/2013/20130414

https://www.finlex.fi/fi/laki/alkup/2014/20140566

https://www.finlex.fi/fi/laki/alkup/2016/20160725

Instructions and information in layman's terms provided by Luke:

https://www.luke.fi/avoin-tieto/metsa/puutavaranmittaus/

https://www.luke.fi/avoin-tieto/metsa/puutavaranmittaus/energiapuun-mittauslaskuri/

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BIOHUB PROJECT

ACCELERATING INNOVATIVE BUSINESS MODELS

The overall goal is to better serve the emerging biorefining industry and to ease the transition to bioeconomy in the Botnia-Atlantica area.

The project will develop methods and business models for forest terminals. The goal is a business centre, BioHub, which delivers the right assortment to the right place at the right price. To increase the value of the forest, future terminals can bark, crush, chip or sort biomass. Raw material can also be pre-treated by e.g. drying and torrefying.

Cross-border cooperation ensures that knowledge and experiences of both countries will be utilised effectively. Results can be adjusted to regional circumstances. This will develop the bioeconomy of the whole Botnia-Atlantica region, including rural areas.

PROJECT TIME: 1.6.2016–30.6.2019

CROSS-BORDER COOPERATION: Finland, Sweden

LEAD PARTNER: Natural Resources Institute Finland

PARTNERS:

Finland: University of Vaasa, Seinäjoki University of Applied Science, The Federation of Education in Central Ostrobothnia

Sweden: Swedish University of Agricultural Sciences, Bastuträsk Terminal, BioFuel Region

BUDGET: 2 308 997 EUR (EU funding c. 1,4 M€)

BioHub project

https://biofuelregion.se/projekt/biohub

BioHub model

https://biofuelregion.se/biohubmodel