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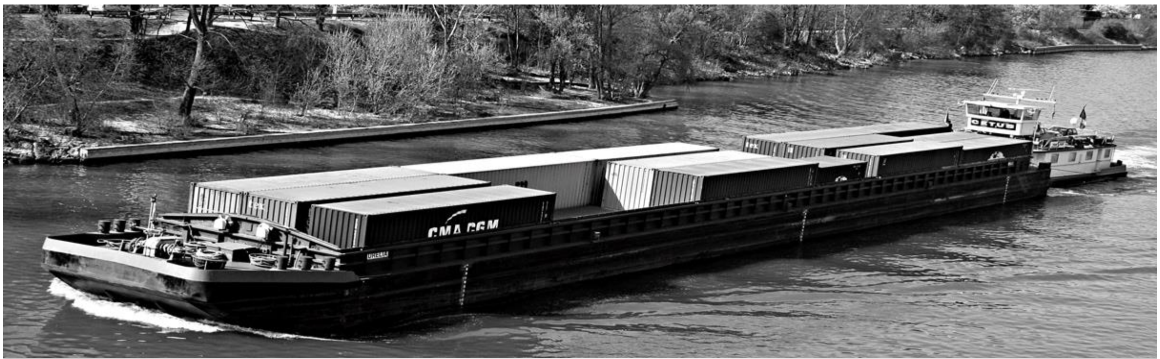

IWW transport of recycling volumes

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An Interreg and EMMA report

This report was authored by M4Traffic AB on behalf of the Swedish Transport Administration.

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1 Introduction

The counties around Lake Mälaren, more specific the counties of Stockholm, Uppsala, Västmanland and Södermanland, together constitute the region of Mälaren Valley (Mälardalen). The region is shown in Figure 1, visualized by the green rectangle. This region is the largest in Sweden with approximately 3.2 million inhabitants, equivalent to above 30 per cent of the Swedish population. It is also one of the fastest growing regions in Sweden.

The Mälaren Valley region will over the coming years face a number of changes to its infrastructure network with the construction of the Stockholm Bypass, the relocation of the main container port to Norvik as well as the closure of at least one of the major fuel depots that serves the region.

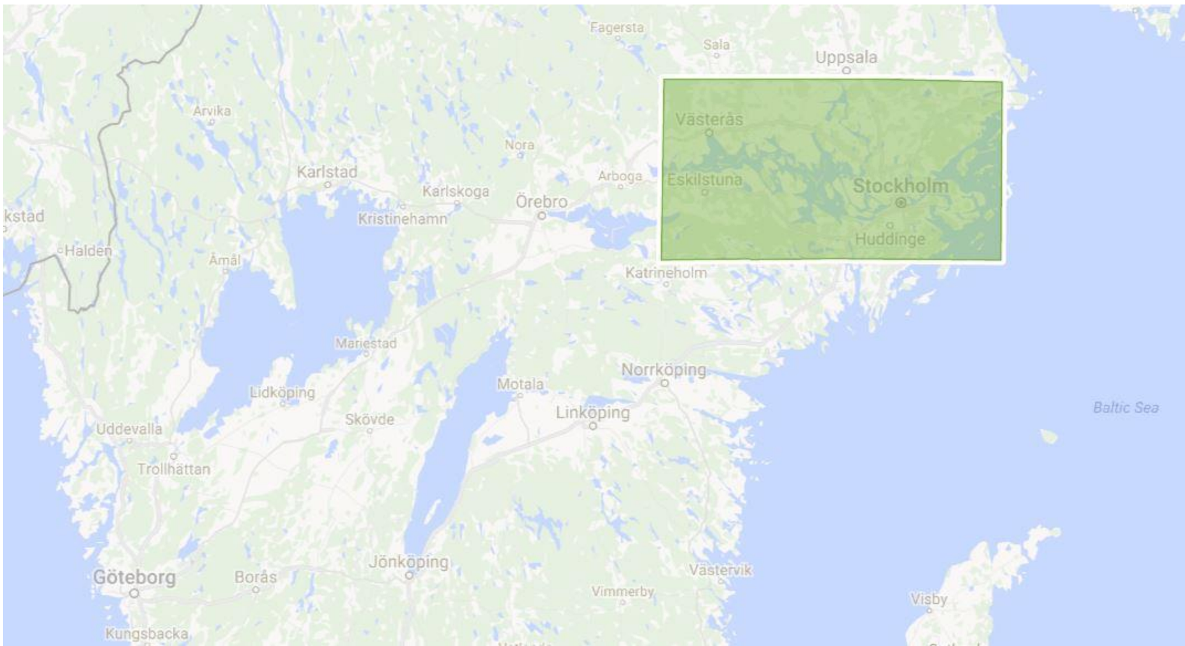

Figure 1 Map showing Mälaren Valley (Mälardalen) in the green rectangle. Source: M4traffic

As a part of the INTERREG Baltic Sea Region project "EMMA", M4Traffic has been given the task to investigate certain goods flows in the Mälaren Valley to find whether it is possible to use Inland Waterway (IWW) as a part of the transport chain.

In collaboration with the client, three such flows were identified;

- Return-packaging
  - Paper, glass, newspaper, metal and plastic
  - Aluminium cans and PET-bottle
- Household waste
- Sand and gravel as well as snow cleared from the streets during winter.

During discussions with representatives from the municipality in Stockholm as well as local businesses, it was understood that a large part of all sand and gravel transports already use waterborne transport. The potential for using IWW for the remaining part of the flows were considered low, hence these flows have not been further investigated.

During winter time, snow needs to be cleared off the streets of Stockholm. Due to lack of space for dumping the snow (as in all larger cities), the water (Riddarfjärden) in and around the Stockholm city centre is used for dumping snow. This procedure has been criticised as the snow looks dirty and pollution from the road traffic therefore affects/pollutes the water. Especially there has been a concern regarding contaminated particles. One alternative instead of dumping the snow straight into the water, is to dump it on a barge, either to be transported out of the city centre, or to be cleaned on site and then let out into the water. One positive effect from the last alternative could be recycling of the gravel that is spread out on the streets. As it is now, this gravel is just dumped along with the snow in the water. In Oslo, this solution is already in use with the barge NCC has constructed, with positive results. Besides cleaning the snow, the solution also reduces the truck mileage as the barge can be places in the very city centre.

In conversations with representatives for the city of Stockholm, it was though understood that the snow cleared from the city streets during the winter does not impact the pollution levels in the water in and around Stockholm and therefor does not need to be transported to other locations. As a result of these talks, also these flows have not been further investigated.

Regarding household waste, a well-developed local network is already in place regarding this, and with an infrastructure adapted to road transport. A large share of the households in Stockholm are heated with district/central heating, which in turn in general use bio fuel, gas, oil and household waste as different fuels. Only a few of these heating/power plants are suitable located by the water, as the newly opened plant in Hjorthagen. At the same time, this heating plant does not primarily use household waste as fuel, but different kinds of bio fuel transported to the plant via shipping, train or trucks. In general, the heating plants that use household waste as energy source are located inland, as for example the plant located in Högdalen. As this market was considered mature and well adapted to road based transport as well as individual flows of household waste are small, these flows have not been further investigated.

Regarding the flows of return packaging, these were more complex, and it was also understood that smaller flows were consolidated at a few locations around the Stockholm county, and then transported to larger national recycling centres.

Therefore, this report will be focusing on return packaging, more specifically general household packages and newspapers (FTIAB) and aluminium cans and plastic bottles (Returpack).

In addition, a short survey of existing academic literature was conducted to give some supplementary context, as well as a brief cost benefit analysis in order to compare costs related to different transport systems.

2 Inland waterway (IWW)

Inland waterway (IWW) or more carelessly ‘barges’, is a transport mode popular on the European continent in countries like Germany, Holland, Belgium etcetera where the access to a wide network of rivers and canals are accessible. These ships differ from IMO classified ships as they are only suitable for transports on “calm” waters (only low waves), hence only inland and not over the open sea. Figure 2 below show two examples of standard IWW ships/barges.

Figure 2 Examples of different IWW ships/barges

As all transport modes, IWW seeks to achieve as high fill ratio as possible. This is usually done by combining different flows of goods so that the barge sails loaded in both directions. This would probably be very difficult to achieve on a new market as Sweden as there are currently no flows using IWW.

This leads to that a transport buyer most likely must pay the ship owner full time as the barge cannot be used for other assignments (as there are none). In this regard, the transport buyer seeks to utilise the barge as much as possible and to find the optimum size, to minimise costs.

To get an idea of the yearly transport capacity of different barge sizes, see Table 1 below.

Table 1 Yearly transport capacity, metric tonnes per year

Loading capacity	1 trip/week	2 trips/week	3 trips/week
500	26 000	52 000	78 000
750	39 000	78 000	117 000
1 000	52 000	104 000	156 000
1 500	78 000	156 000	234 000
2 000	104 000	208 000	312 000

Looking at Table 1, this indicates that if you operate a barge in which you can load 1 000 tonnes, over a year you can transport up to 104 000 tonnes of goods given that you do two trips each week. It is assumed the barge operates 52 weeks per year.

This can be compared to a standard lorry/truck which has the loading capacity of 40 tonnes. If used once a week, this truck can deliver a total of 2 000 tonnes per year. If used two or three times a week, the numbers change to 4 200 tonnes and 6 200 tonnes respectively. The smallest IWW ship (500 tonnes) in Table 1 transports the same amount of goods as 12,5 trucks, and the largest ship equivalent to 50 trucks. IWW ships, or barges, should therefore primarily be used where the goods volumes are sufficiently large. One other important factor for using IWW in Holland, Germany etcetera is also the congestion of the road network, something that is not as troublesome in Sweden yet outside Stockholm.

2.1 The Swedish IWW ZONE

The Swedish Transport Agency (Transportstyrelsen) has applied the 2006/87/EG directive to Swedish waters and identified three zones that are to be viewed as inland waterways, see Figure 3. The figure shows the three currently identified zones. However, work with identifying additional zones is ongoing. As basis for their assessment the Transport Agency mandated Swedish Meteorological and Hydrological Institute (SMHI) to investigate wave heights.

This investigation concluded that the wave height along the coast from Dalarö to Nynäshamn is sufficiently low in order to be classified as a zone for inland waterway transport. The investigation also showed that the passage outside the island of Landsort would not be possible given the current regulations. However, vessels traveling from Södertälje to Norrköping would be able to stay in waters where the wave heights conform to the current limits in place.

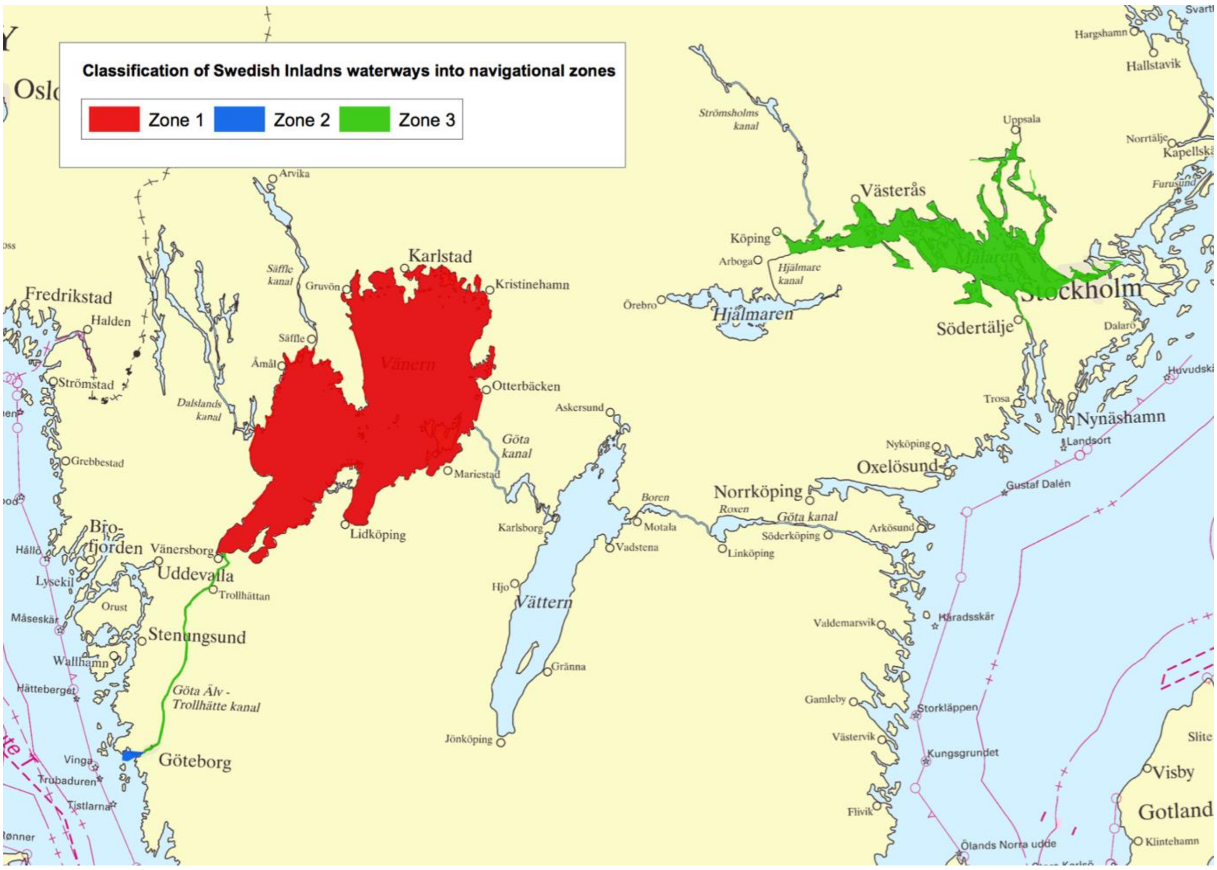

Figure 3 Classification of Swedish inland waterways into navigational zones (Zoner inlandssjöfart, 2016).

2.2 Operating modes and loading/unloading times

Usual operating modes range from 14/16 hours per day (semi continuous mode) up to 24 hours per day (continuous mode). In the first case, this is possible using only one barge crew consisting of at least two persons. In the latter case, there needs to be two crews on board (at least four persons), adding personnel and costs.

Loading and unloading times vary depending on the type of IWW ship/barge, type of cargo and type of equipment at hand for loading and unloading (if the loading/unloading is done using on board equipment, or fixed cranes in a harbour). One must therefore examine these times closely when analysing different transport scenarios.

2.3 Current literature

A short survey of existing literature resulted in three relevant papers. All three treated the question of which are the distances where IWW-transport can be a viable alternative to road transport. In doing so all three papers assumed that the market is fully functioning in so that there is enough demand for transport services that any cost-competitive transport provider will be able to be profitable.

The three papers are

- Frémon & Franc, 2010
- Wiegmnas & Konings, 2015
- Lu & Yan, 2015

Frémont & Franc and Wiegmans & Konings concludes that the minimum distance for IWW-transport to be competitive is 200 km while Lu & Yan estimates it to be between 195 km and 210 km.

Theses distances are based on the conditions that the first and last few kilometres must be completed by lorry, necessitating six lifts in total.

3 Return-packaging (FTI)

Return packaging is covered by what in Sweden is termed “producer responsibility” which stipulates that the producer of a good is responsible for the recycling of the same good. This have led to a widespread network of recycling collection points provided by the producers. The industry owned company responsible for the collection of the recyclables is FTI. FTI’s main task is to ensure that plastics, paper products (including newspapers), metal products and glass products are collected and recycled.

3.1 Volumes

As of 2015, FTI recycled a total of 308 000 metric tonnes of glass, paper, plastics, metal and newspaper in Mälardalen. Of these volumes, more than 70% are coming from the Stockholm County. For a more detailed breakdown, see Table 2.

Table 2 Recycled material in the main Mälardalen counties, metric tons per year. SOURCE: FTIAB and Statistics Sweden

	Glass	Paper	Plastics	Metal	Newspaper	TOTAL
Stockholms län	42 990	94 070	17 350	6 110	59 050	219 570
Uppsala län	6 830	14 950	2 760	970	9 390	34 900
Södermanlands län	5 450	11 930	2 200	780	7 490	27 850
Västmanlands län	5 070	11 100	2 050	720	6 970	25 910
TOTAL	60 340	132 050	24 360	8 580	82 900	308 230

3.2 Collection process

The collection process is structured in to three phases. Firstly, consumers leave their used packaging at a vast number of collection points within and in the outskirts of urban areas. The collection points usually consist of a number of smaller containers, labelled for the different products, see Figure 4. These collection points are emptied using lorries on a schedule dependent on the forecasted need, with a frequency ranging from one to seven times a week. In addition to these collection points, supermarkets, larger workplaces, industries etcetera that generate large quantities/volumes of packaging material have their own collection that is also picked up by the lorries emptying the collection points.

Figure 4 Example of a local collection point for return-packaging. Source M4Traffic

Secondly, the collection points, supermarkets, larger workplaces etcetera are emptied, on a regular schedule, and the collected material is taken to a regional distribution centre. For Stockholm, and parts of the wider Mälardalen region, they are located in Sollentuna, Högdalen, Lunda and Västberga, see Figure 5.

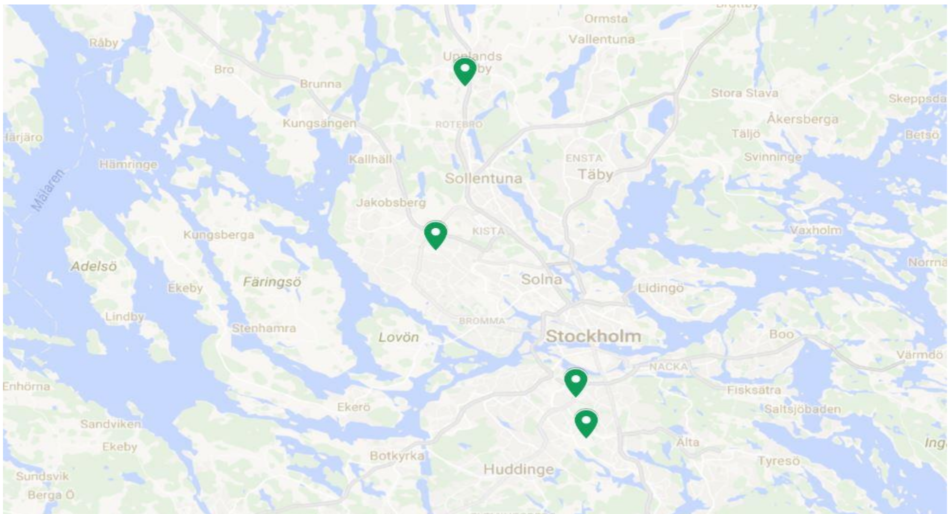

Figure 5 Location of regional distribution centres used by FTIAB.

Source: M4traffic, data collected at (Anläggningar för återvinning , 2016)

At the distribution centre the material goes through a first sorting and is compressed and repackaged in order for it to be delivered to different national independent recycling facilities, depending on the material. These recycling facilities are located in several places in Sweden, seen in Figure 6 below, but also in Germany.

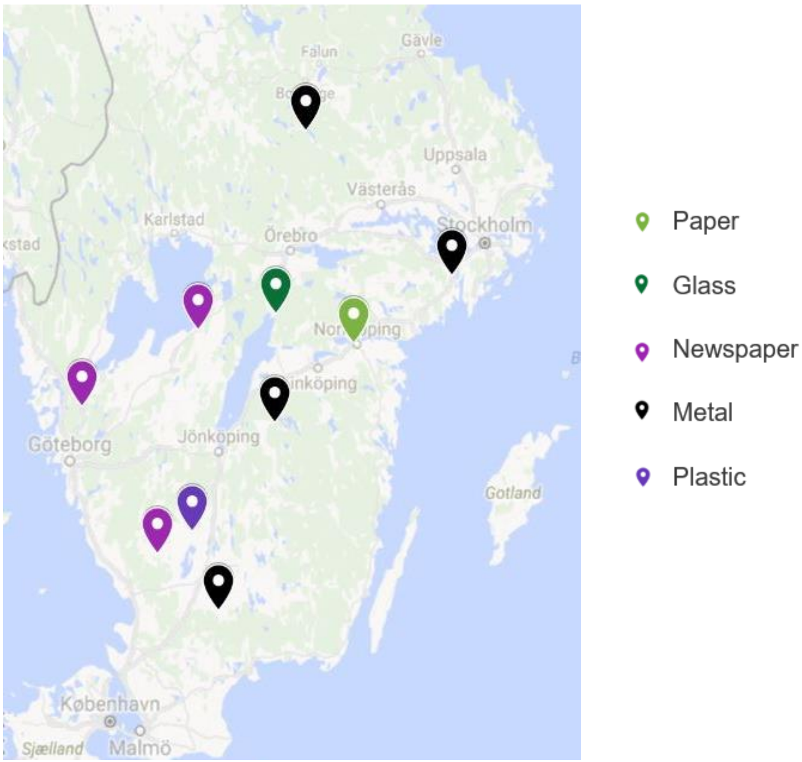

Figure 6 Location of recycling facilities used by FTI, showing only locations in Sweden.
Source: M4traffic, data collected at (Anläggningar för återvinning , 2016)

Collected glass is first transported to the local distribution centre in Högdalen before being transported by lorry to Swedish glass recycling (Svensk Glasåtervinning) in Hammar, see the dark green marker in Figure 6. There it is either sorted and cleaned for further transport to destinations in Sweden, Norway, Denmark or England, or turned into mineral wool. All transports from Hammar starts with lorries but some, such as deliveries to England and to Denmark are completed using bulk vessels.

Paper products are firstly transported to either Sollentuna north of Stockholm or Högdalen in the south where it is cleaned and compressed for further transport. More than 50 per cent of the volumes are transported to the recycling centre at Fiskeby Board in Norrköping, see the light green marker in Figure 6. Other destinations include facilities in Europe and the Middle East. The transports to Norrköping is done using lorries.

Newspaper is collected and consolidated at three locations, Spånga, Västberga and Högdalen. After an initial sorting process, the material is then transported to Katrinfors bruk (at Mariestad), Edet bruk between Gothenburg and Trollhättan and Hylte bruk, 70 km north of Halmstad. These three markers displayed in light purple in Figure 6.

Plastics are transported by lorry to the recycling centre in Lanna/Bredaryd, see the dark purple marker in Figure 6. In addition to this, some volumes are transported to Germany, also mainly by lorries. Some volumes are transported by train.

Metals are collected and transported to Ovako at Smedjebacken, Skrotfrag in Järna and Trania in Tranås. Aluminium are recycled at Stena Aluminium in Älmhult, where the aluminium is melted down and renewed as bullion which in turned are sold to the industry. These four facilities have black markings in Figure 6. Some volumes are also transported to Germany.

Figure 7 below shows a schematic picture of how transports are carried out today. The black arrows represent land based transportation (mainly trucks).

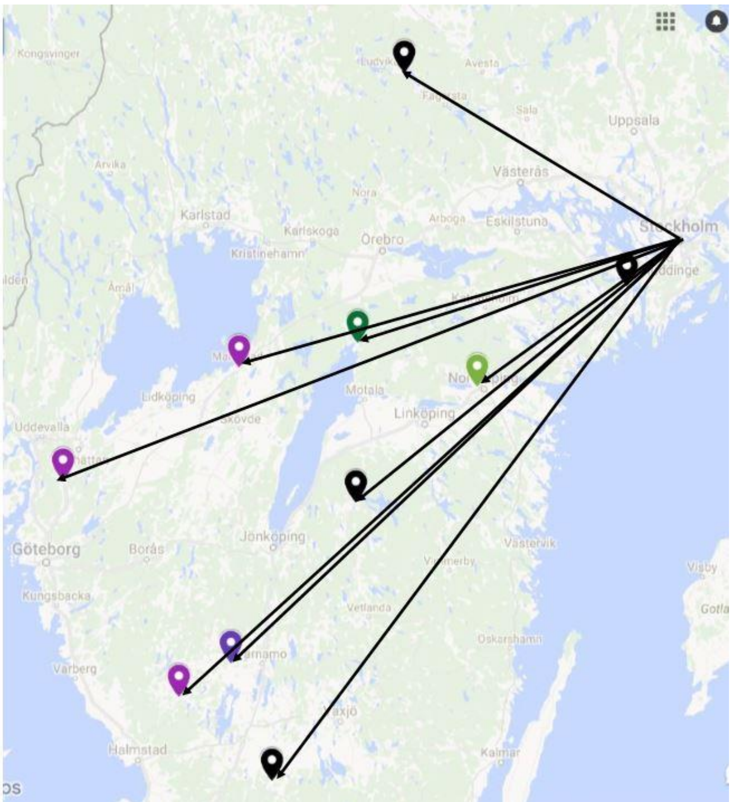

Figure 7 Transportation with trucks. Source: M4traffic

As Figure 6 and 7 shows, all but two national recycling centres are located inland, far away from water. This reflects the transport situation and history in Sweden where most transport routes have been customized for lorries. With different locations, for example close to water or railway access, more transport alternatives would be at hand, which in turn could open up more competition between different modes of transport and in the end possibly result in lower transportation costs.

One of the two centres located with water access, or close to it, is the recycling centre for paper at Fiskby board outside Norrköping. The second recycling centre is the one in Hammar handling glass. Figure 8 shows an alternative solution in which IWW transport has replaced the current land based transport to these two facilities. The blue arrows represent transport links using IWW transport and the black arrows land based transport.

Figure 8 Alternative transport solution. Source: M4traffic

Even though Fiskeby Board have water access, it is far from an ideal one, as it is on the wrong side of Norrköping. This means that land based transport (lorries) are needed both from the regional collection centres at Sollentuna and Högdalen, as well as between the port of Norrköping and Fiskeby Board, increasing the number of loading/unloading activities and hence increasing the cost. The distance between Stockholm and Norrköping along the coast is approximately 96 nautical miles, equivalent to about 180 km. With an average speed of 12 km/h (which is quite common for IWW), the journey takes about 15 hours one way, which in fact is equal to a standard day (14-16 hours) of work for an IWW transport. So, in that regard, the distance is no problem as it takes about one shift to sail down, and another to sail back. Adding loading and unloading time, this would make it possible to conduct two or three trips per week.

The recycling centre handling glass in Hammar is actually located with direct water access and would therefore be ideal for IWW transport. Unfortunately, though, the location is by lake Vättern, which is only possible to reach from Mälardalen using Göta Kanal. Not only is this quite a long detour, but the many locks along the canal limits the maximum size of the ships to 30 metres in length, 7 metres in breadth and 2,8 metres in draught. This limits the loading capacity to about 250 – 350 tonnes, which is rather small and not competitive with lorries, especially not combined with the long detour.

3.3 Suitability for modal shift

In order to put the volumes in Table 2 in to a larger context Table 3 shows yearly TEU equivalents, converted assuming 15,7 metric tonnes per TEU, which is the national average in Sweden. Container transport could be suitable for transporting these volumes.

Table 3 TEU equivalents per year. SOURCE: FTI and Statistics Sweden

	Glass	Paper	Plastics	Metal	Newspaper	TOTAL
Stockholms län	2 740	5 990	1 110	390	3 760	13 990
Uppsala län	440	950	180	60	600	2 230
Södermanlands län	350	760	140	50	480	1 780
Västmanlands län	320	710	130	50	440	1 650
TOTAL	**3 850**	**8 410**	**1 560**	**550**	**5 280**	**19 650**

Breaking these volumes down on a weekly basis, the figures are presented in Table 4 and Table 5.

Table 4 Recycled material in the main Mälardalen counties, metric tons per week. SOURCE: FTI and Statistics Sweden

	Glass	Paper	Plastics	Metal	Newspaper	TOTAL
Stockholms län	830	1810	330	120	1140	4 230
Uppsala län	130	290	50	20	180	670
Södermanlands län	100	230	40	10	140	520
Västmanlands län	100	210	40	10	130	490
TOTAL	**1 160**	**2 540**	**460**	**160**	**1 590**	**5 910**

Table 5 TEU equivalents per week. SOURCE: FTI and Statistics Sweden

	Glass	Paper	Plastics	Metal	Newspaper	TOTAL
Stockholms län	50	120	20	10	70	270
Uppsala län	10	20	0	0	10	40
Södermanlands län	10	10	0	0	10	30
Västmanlands län	10	10	0	0	10	30
TOTAL	**80**	**160**	**20**	**10**	**100**	**370**

It is then clear that the total amount of material generated per week in the region equates to about 370 TEU, or 185 lorries with trailers, per week. In general terms, this is enough cargo for two weekly IWW-transports to be sustainable, given that all volumes were going to the same destination, or destinations along a loop. Unfortunately, none of the destinations are located in such a fashion, nor are they suitable for IWW transport as they basically lack water access.

An argument could be made for the case of paper transport to Fiskeby Board in Norrköping to which the average weekly volumes are approximately 160 TEU (or 2 540 tonnes). This would be suitable for one larger vessel doing one trip per week, or one smaller vessel doing two trips per week. However, this would force the vessel to leave the zone designated for IWW-traffic, and therefor maybe IWW transport isn’t the best mode of transport? On the other hand, the investigation from SMHI concluded that IWW transports from Södertälje to Norrköping along the coast would be ok considered wave heights.

In addition to the above, enough storage space must be cared for, both somewhere in the Stockholm area as well as in the port of Norrköping as the trucks caring for the "last mile"-transport have significantly less capacity compared to the barge. If the regional recycling centre and Fiskeby Board were located with water access, these storage spaces could be arranged for within the site area.

During discussions with representatives for FTI it has been very clear that their present logistic solution is not designed with the use of IWW-transport in mind. This is mainly due to the fact that the regional distribution centres and the recycling facilities are located in such a way that they are easily reached by lorries but not by barge. This reflects how the planning of logistics have been in Sweden the last years, with a focus very much towards road transport. There is therefore a need of a new mind set in order for a modal shift to take place

However, the representatives have been very open minded to the idea of somehow incorporating IWW-vessels in their logistics solution if a good case could be made. One such option that was briefly discussed was the option to locate the regional processing facilities on barges in the vicinity of the current locations. Depending on the schedule for emptying the local collection points this could facilitate cost savings by having the collection lorries drive shorter distances.

3.4 Future growth of recycling volumes

At the moment, the Swedish population increases with about 1.5 % per year according to Statistics Sweden. However, this number is at the moment somewhat inflated by a large number of arriving refuges and hence a future yearly growth of on average 1 % is more likely.

Assuming the "consumption" per person stays as it is 2015, Figure 9 below shows the future yearly volumes of paper, glass, plastics, metal and newspaper if the population grows with 1 % per year.

By 2040, the volumes of paper leaving Mälardalen will have reached 170 000 tonnes per year. If a relocation of Fiskeby Board has been done for example, these volumes are sufficient to support an IWW transport system of either a 1 000 tonnes barge making three trips per week, or a 1 500 tonnes barge making two trips per week.

Also, the volumes regarding newspaper or glass indicate sufficient levels to support an individual IWW-operation, although, a relocation of the recycling centres are needed.

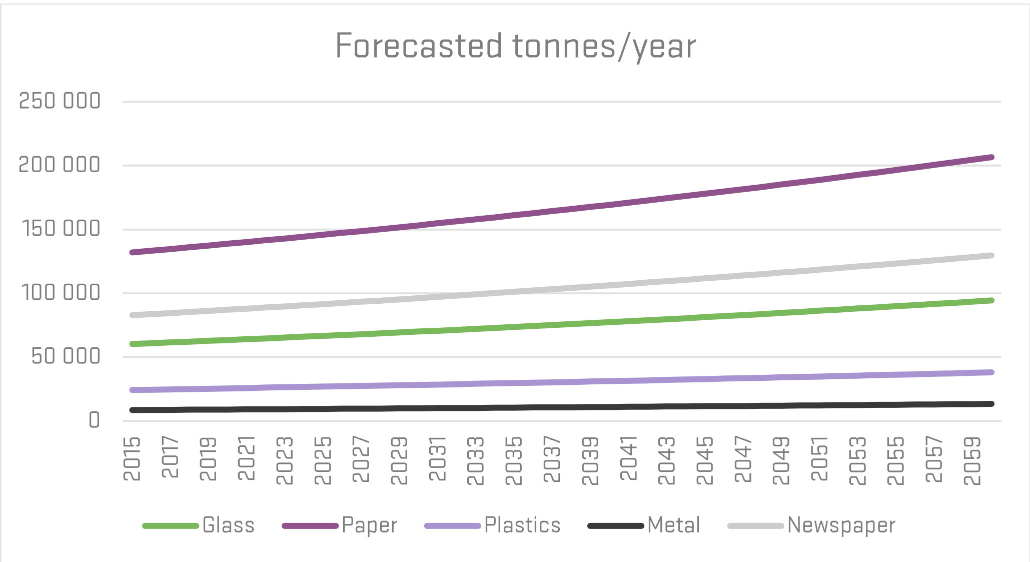

Figure 9 Forecasted growth of recyclable material, 2015-2060

4 Aluminium cans & PET-bottles (Returpack)

Operating under the same directive regulating producer responsibility as FTI, Returpack is owned by companies in the Swedish brewing sector. Its mission is to collect and facilitate the recycling of aluminium cans and PET-bottles which are collected at supermarkets across the country.

4.1 Volumes

During 2015, Returpack processed approximately 53 000 cubic meters of recycled cans and bottles in Mälardalen, which corresponds to 13 200 metric tonnes (Ofwerstrom, 2016).

4.2 Collection process

The used cans and bottles are collected at various supermarkets around the region and are then transported by lorry to Eskilstuna or Västerås for cleaning and further processing. They are then transported to Norrköping for recycling.

The 13 200 tonnes equate to approximately 330 lorries with trailer (40 tonnes of cargo) per year, 140 from Västerås and another 190 from Eskilstuna. In Figure 10 the regional distribution centres in Västerås and Eskilstuna are shown in black while the recycling facility in Norrköping is shown in purple.

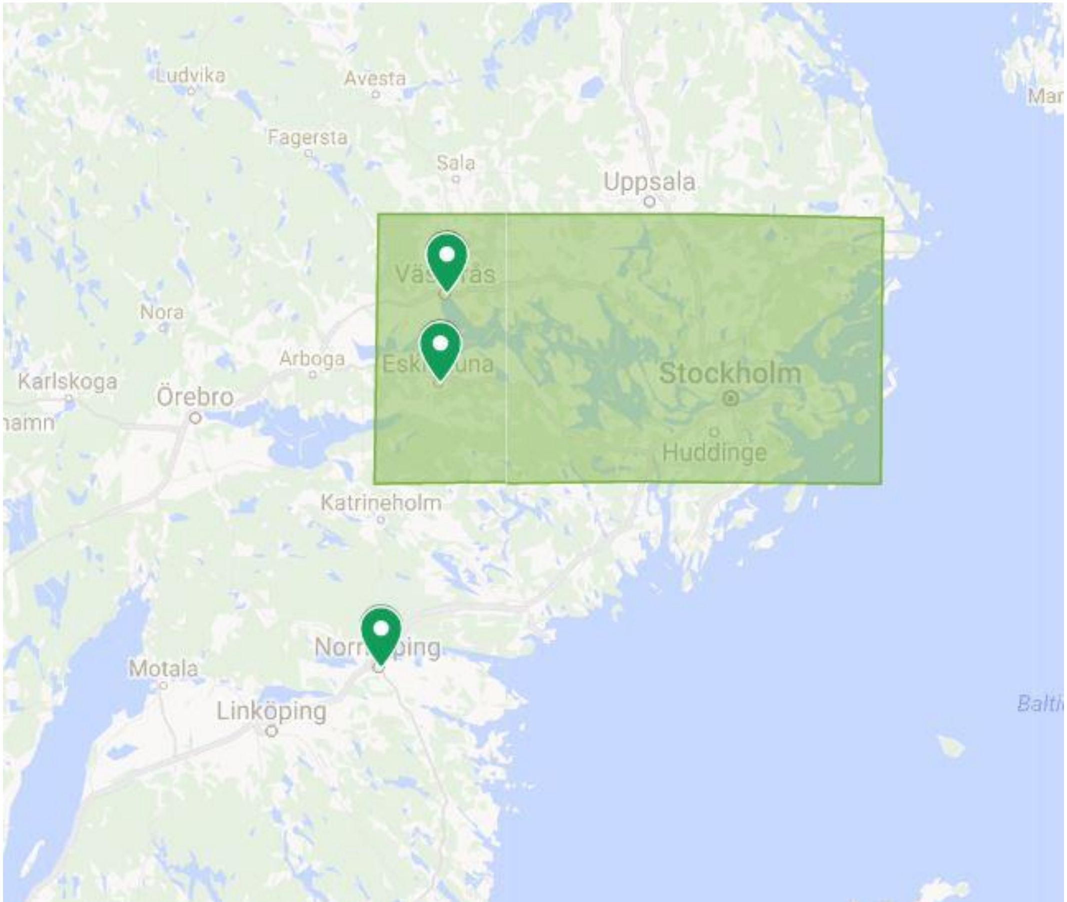

Figure 10 Regional distribution centers and recycling facilities used by Returpack. Source: M4traffic, data collected from (Ofwerstrom, 2016).

4.3 Suitability for modal shift

Analysing the supply chain regarding used cans and bottles and where different facilities are located, it is clear that barge transport could replace lorries regarding the first part of the supply chain as most cans and bottles are collected in Stockholm and both Västerås and Eskilstuna are close to lake Mälaren. However, with weekly volumes of 108 tonnes to Västerås and 146 tonnes to Eskilstuna, 254 tonnes in total (or 16 TEU), this isn't enough to support a barge transport. These volumes need to be combined with other in order to constitute a sufficient basis for a barge/IWW transport.

The second part of the supply chain, from Eskilstuna and Västerås to Norrköping, is for the same reasons as for the first part, neither suitable for barge/IWW transport. Furthermore, a journey to Norrköping from lake Mälaren necessitates that the vessel would leave the zone as of today, designated for IWW-traffic. It is also a longer route compared to land based transport, which is quite close between the three cities.

This cargo flow, based on the volumes handled 2015, seems therefore not suitable for a modal shift.

4.4 Future growth of recycled volumes

Assuming the same basic population growth (1 % per year) as above, and also that the consumption and recycling rate as it is of today, Figure 11 below shows the forecasted volumes.

As can be seen in the figure, the forecasted volumes are not sufficiently large volumes to on their own support a barge transport solution (compare with volumes listed in Table 1).

Maybe the consolidated volumes going from Västerås and Eskilstuna to Norrköping would be enough, but only if other volumes to complement the volumes of cans and bottles can be identified. Because not even the consolidated volumes are large enough on their own.

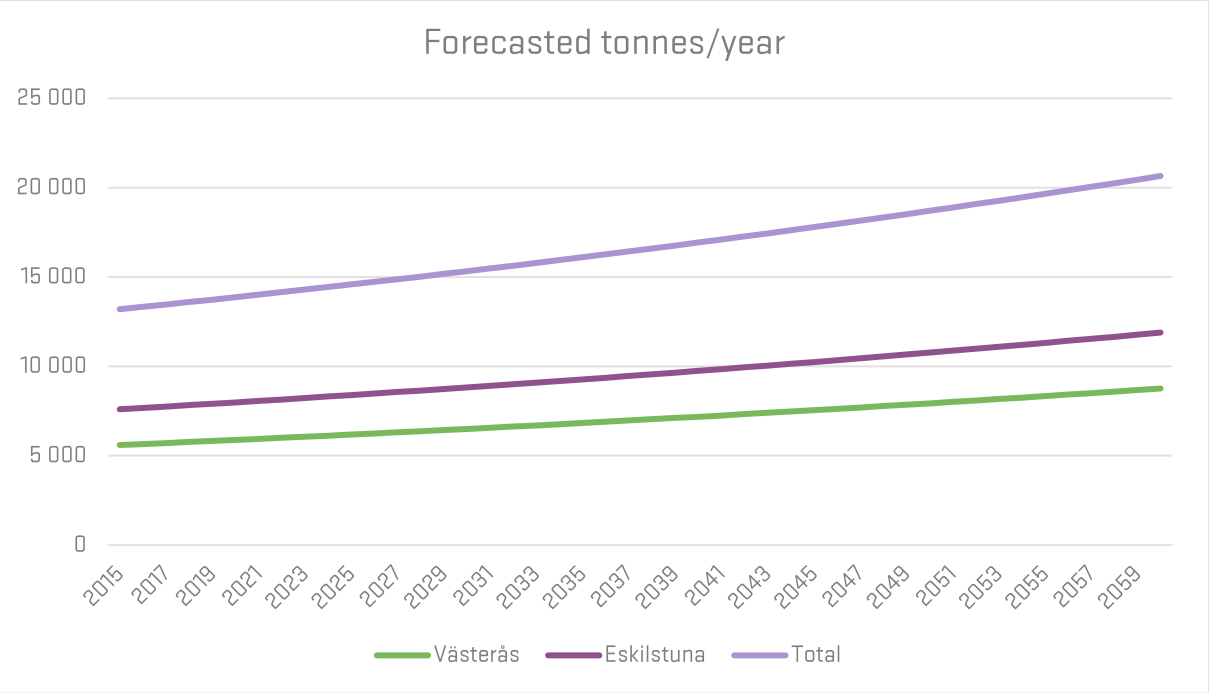

Figure 11 Forecasted growth of aluminium cans and PET bottles, 2015-2060

5 Cost benefit analysis

In this chapter a brief cost benefit analysis (CBA) of the transport chains of IWW compared to truck transport is presented. The chosen supply chain is recycling of paper to Norrköping from Sollentuna and Högdalen, mainly as this flow has the largest volumes.

All cost parameters are based on estimates and recommendations made by the Swedish Transport Administration regarding CBA's (ASEK), except for cost parameters regarding IWW as these are absent in ASEK. For these cost parameters, earlier CBA's for IWW are used.

Based on forecasted volumes presented in Figure 9, the transport distance (and transport time) as well as different transport capacities presented in Table 1, a ship/barge size with loading capacity 1 500 tonnes has been chosen. Regarding the loading capacity for the lorry this has been assumed to be 40 tonnes per vehicle.

For both transport alternatives, it has been assumed that the lorry or barge only transports paper down to Norrköping and then goes empty back up to Stockholm. It is calculated that the transports continue 52 weeks per year. It has also been assumed that the average speed of the lorries is 70 km/h and for the barge 12 km/h.

Today, paper-products are transported from the regional distribution centres in Sollentuna and Högdalen by lorry to Norrköping for an average distance of 166,5 km one-way. The alternative scenario envisages that the paper is transported from Sollentuna and Högdalen by lorry to a nearby landing-site where a barge can be loaded. The barge then travels to the port of Norrköping via the channel of Södertälje for the transport to be completed by lorry the last 5 km. The average distance to the landing-site is assumed to be 10 km and the barge transport is assumed to be over a distance of 180 km. This route is along the coast of the Baltic sea, which means that there need to be a change of the IVV zones.

In Figure 12 it is shown that the distance dependent costs for the alternative scenario with IWW is significantly smaller than today. However, this is offset by the large increase in terminal costs, due to the increased handling as neither the recycling centres in Sollentuna or Högdalen, nor Fiskeby board are located adjacent to a port.

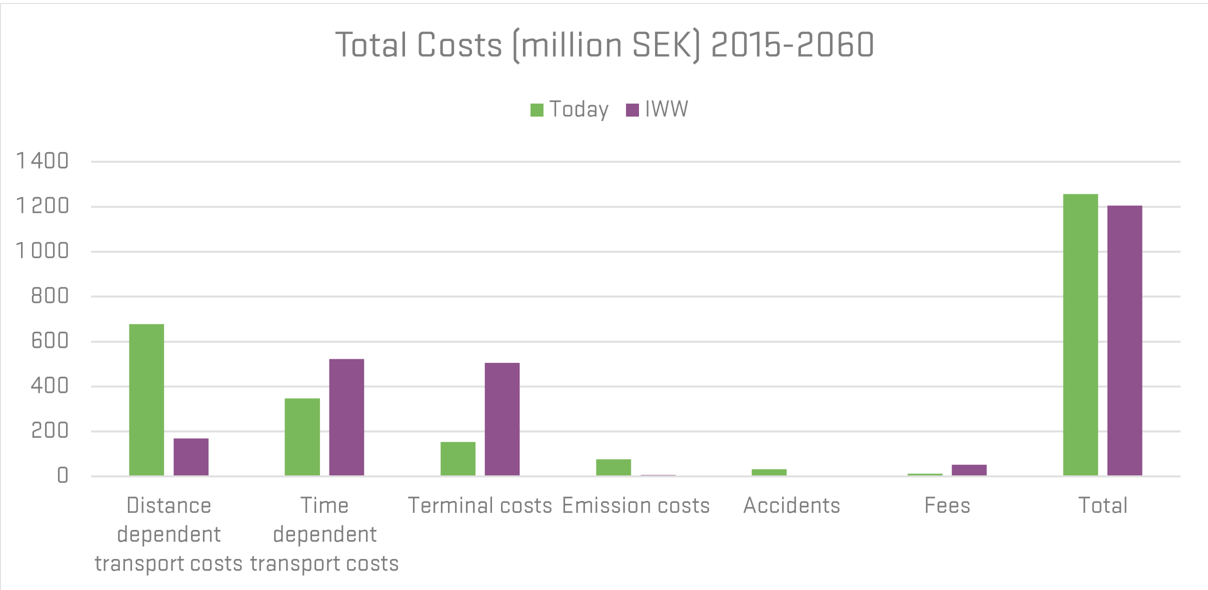

Figure 12: Total cost 2015–2060, paper (SEK)

In total, the costs associated with today's supply chain are about the same compared with a solution based on IWW transport. In total, the costs today equal to 1,25 billion SEK for the period 2015 – 2060 compared to 1,21 billion SEK for a IWW based supply chain for the same period. One must also remember that the costs presented above does not reflect the business economics costs, but the socio-economic costs associated with these transports.

Figure 12 points out two major areas;

1. That IWW transports are, compared with road transports, much more efficient and cost effective regarding the distance based costs, that is to say, more fuel efficient. Transports using water are in general much more fuel efficient per transported tonne, and Figure 12 clearly reflects this.
2. The second area is the big difference in terminal costs, which reflects the current supply chain and its focus on road transport. This in turn raises terminal costs for the alternative scenario as the goods need to be handled more times if IWW is to be used.

5.1 Sensitivity analysis

As a comparison, a simple sensitivity analysis has been made where it has been assumed the receiving recycling plant in Norrköping has been relocated, which in turn cuts the last lorry transport out of the picture. The result is shown in Figure 13 below.

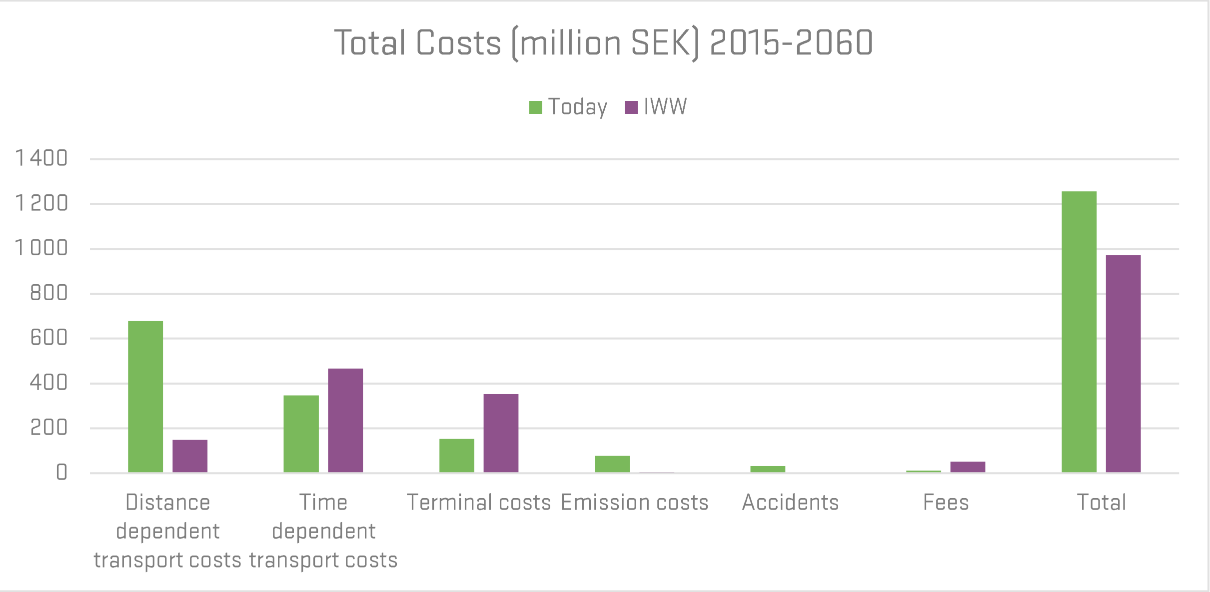

Figure 13: Total costs, sensitivity analysis, 2015–2060, paper (SEK)

The results in Figure 13 shows that the difference between the alternative has increased as the terminal costs have fallen for the IWW based supply chain. The total costs regarding todays solution is still 1,25 billion SEK as nothing has changed regarding this alternative. But for the IWW-based alternative, the total costs have fallen to 0,97 billion SEK (from 1,21 billion SEK). In order to achieve this reduction, a substantial investment needs to be made in order to relocate the recycling facility in Norrköping.

6 Conclusion

As of 2015 the volumes generated by FTI and Returpack are not sufficient on their own to support a IWW-based transport service with one exemption which is the facility for paper recycling in Norrköping operated by Fiskeby Board which receives about 8 460 tonnes (or 160 TEU equivalents) per week. Norrköping is also located by water reachable by IWW-vessels, something other facilities are not. However, the Norrköping facility is located in such a way that the last few kilometres would have to be completed over land. A modal shift would also necessitate the zone designated for IWW-traffic to be extended to enable passage from the Port of Södertälje to Norrköping.

At the same time, even if present hurdles could be overcome, the distances involved are such that IWW-transport would have a difficult time competing with road-based transport on an open market, all according to recent research. On the other hand, there are numerous examples of IWW transports functioning at shorter distances.

A modal shift, from road transport to IWW would necessitate an integrated solution developed in close cooperation with the recycling sector in order to minimize loading and unloading costs. Figure 12 show that the competitive edge of the alternative solution is found in the low distance dependent costs of the barge. What Figure 12 also shows is that the largest cost, and hence one of the biggest obstacles to overcome in order to make an IWW transport become reality, are the high loading and unloading costs (terminal costs). As the logistics are not adapted for IWW traffic, using this mode of transport requires more goods handling, adding to the total costs.

As seen in Figure 13, it is possible to lower the total costs associated with an IWW based transport system. But in order to do this, substantial investments have to be made in relocating plants/recycling centres, something that even if the money could be found, probably would be very difficult to realise due to other reasons. For example, the recycling centres are not very popular neighbours to residential areas.

During conversations with the owners of the cargo it has been made clear that they are not in any way adversely positioned towards IWW-transport. On the contrary, they view it as a potential cost saving measure that could be implemented if and when the logistical arrangements change and the volumes increase to a high enough level. This short report backs this view, but the cost savings in the transport comes with investment costs.

As a whole, the society would most likely benefit from using IWW transports where this is adequate/the volumes are sufficiently large. But in order to realise these benefits, investments need to be made, and it is not clear who should do these investments. In order to change some of the recycling volumes today transported by lorries, these obstacles need to be overcome. And in this comparison, there are better/easier cases to start with in order to get IWW transports rolling.

Another opportunity to facilitate IWW transport would be to find additional volumes that could either be consolidated with the recycling volumes, or used as complements. If more volumes, for example going from Norrköping back to Stockholm, could be found/added, this could cut costs for the recycling transports as the distance and time based costs can be split by larger volumes.

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