HERIOT WATT UNIVERSITY

Decarbonisation of the Maritime Supply Chain

Summary Report of a Workshop held at the London Chamber of Commerce

15th February 2011

Introduction

Heriot Watt University's Logistics Research Centre (LRC) supported by the Freight Transport Association hosted this workshop to examine the key issues associated with the decarbonisation of the maritime supply chain, particularly when viewed from the shipper's perspective. The purpose of the workshop was to discuss the LRC's decarbonisation framework (Figure 1) and to identify the decarbonisation options likely to yield the greatest benefits and barriers to their implementation.

The 27 workshop participants represented most of the main stakeholder groups in the deep-sea container supply chain, including shippers, port operators, shipping lines, land-based logistics providers and freight forwarders. The workshop comprised a series of presentations followed by break-out sessions. In the first break-out session mixed groups of participants discussed the feasibility and relative importance of the carbon-saving measures that shippers can apply. In the second session, the various stakeholder groups separately considered how constraints on these measures might be relaxed and what role government could play. All the discussions were recorded and the points raised have been transcribed and coded. The main points arising from the workshop are summarised in this paper.

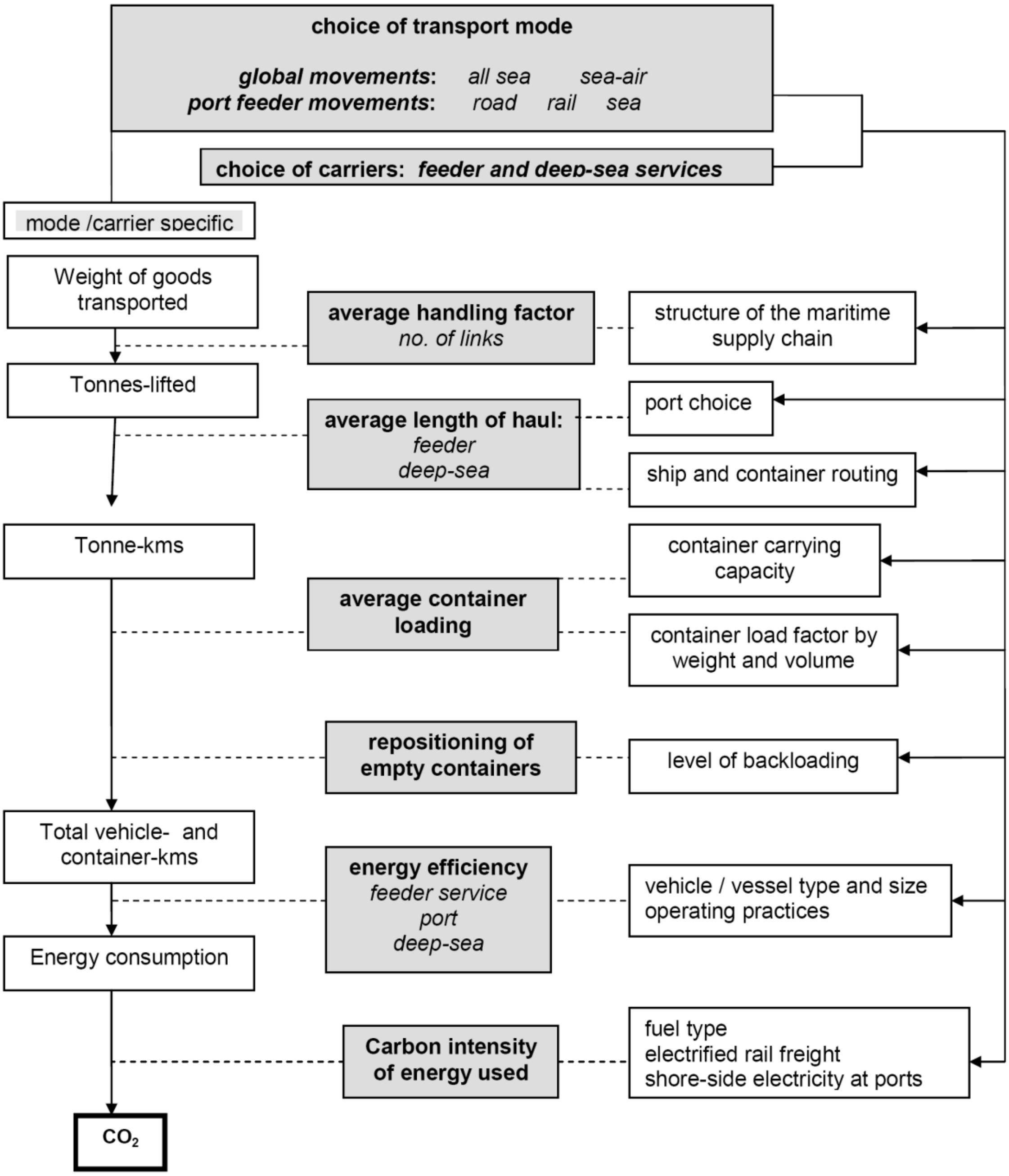
The Decarbonisation Framework

The decarbonisation framework identifies seven key parameters that influence the amount of greenhouse gas emitted by maritime supply chain operations (Figure 1)

- Choice of mode (and carrier) for feeder and deep-sea services
- Average handling factor (the number of links in the supply chain)
- Average length of haul (for both feeder and deep-sea movements)
- Average container loading
- Repositioning of empty containers
- Energy efficiency of transport services used
- Carbon intensity of energy consumed

In the course of the discussion it was agreed that this framework was a reasonable representation of the maritime supply chain within which to measure and manage carbon emissions.

Figure 1: Maritime Supply Decarbonisation Model



However, a number of valid points were raised concerning the interpretation of some of the key elements in this framework.

Emissions Standards

Many participants noted that there are a number of different standards for measuring carbon dioxide (CO_2); several argued that there are too many standards currently in use. The method adopted to measure emissions will ultimately affect the reported figure. This creates complications for both the organisation measuring its emissions and the shipper wishing to compare the carbon footprints of different carriers and port operators. The view of the participants was strongly in favour of having a single standard, or very limited number of compatible standards common to all interested parties. There must be a role for government in this process of standardisation, especially if emissions trading is to be applied to the maritime sector.

Some concern was expressed over the use of average figures for emissions. While an average value may be better than nothing, the use of averages can hide key details that may be significant. The port sector representatives highlighted a problem with quoting an average figure for CO_2 emitted per TEU handled and comparing ports on this basis. For example, emissions per TEU for container handling at Tilbury are higher than at Rotterdam, reflecting the fact that Tilbury handles a much higher proportion of refrigerated containers which are highly energy intensive. There is, therefore, a case for disaggregating emissions by activity and container type.

For an emissions standard or perhaps a carbon trading scheme to achieve ‘buy-in’ from the business community, it needs critical mass. There will be a reluctance to commit resources to a scheme that is not widely used.

Container Utilisation

Containers can either ‘weigh-out’ or ‘cube-out’ depending on the density of the product. In the case of the UK, the majority of imports are of low density and tend to be volume constrained. Where volume is the constraining factor, it is important that the available space in the container is used to greatest effect. A point made by many participants was that packaging could be redesigned to make more efficient use of container space. Since containers are standard sizes, this should be a relatively straightforward process but requires an integrated approach to product design and marketing that involves both manufacturing and marketing functions. Two of the UK’s larger export flows are Scotch whisky and scrap, both of which are weight-constrained.

The majority of containers leaving the UK are empty. Despite the large number of empty containers on outbound services, they can still be difficult to source within the UK. Slow-steaming by the major shipping lines has exacerbated this problem as, other things being equal, it increases the number of containers in the maritime supply chain. The repositioning of empty containers is complicated by the locational mismatch between destinations of inbound containers and the origins of the UK's main outbound container flows. It was suggested that there could be a potential role for government in incentivising the location of new business at places where it could make best use of available container capacity.

Another factor limiting container utilisation is the restriction of road vehicle weight. Truck weight limits vary from country to country. Assuming that there is at least one road journey in the deep-sea container supply chain, the lowest national weight limit will determine the weight utilisation of the container across the entire movement. A number of participants suggested that a port-centric logistics approach could ease the constraint imposed by road weight restrictions. To maximise the benefits a port-centric logistics it needs to be applied at both ends of the deep-sea leg. However, while the concept port centric logistics may be sound, there is an element of risk for the port that invests in port-centric facilities, since the shipping lines could potentially switch to an alternative port diverting the business.

Limited information is available on container utilisation, particular by cube fill. The physical contents of a container are known to the consignor and consignee, but the carriers and port operators get little or no indication of the volume utilisation. For many of the import trades, where container loading occurs predominantly in the Far-East, the emphasis will often be on the rapid movement of goods rather than the efficient loading of containers. Accurate volume and weight data are required to assess the current degree of container utilisation and potential improvements in load fill.

Information and Collaboration

Improvements in the collection, analysis, reporting and sharing of information could also facilitate collaborative relationships in the maritime supply chain. The workshop participants generally agreed that collaboration between both supply chain partners and competitors presented a major opportunity to reduce carbon emissions and improve transport utilisation. However, collaboration and the use of shared data, especially between competitors will require a high degree of trust and must not infringe competition law. If these barriers to collaboration can be overcome, then a win-win situation potentially exists.

It was noted that some service providers may not be positively disposed to logistical collaboration in the maritime sector. A 3PL service provider may be reluctant to enter into a collaborative arrangement that reduces its net income.

The efficiency of port operations and hinterland transport services could be improved if more advanced information was provided about inbound cargoes. The port of arrival often does not know the contents of a ship or the onward destination of the cargo until 'a few minutes before arrival'.

Delegates suggested various ways of dealing with the 'lack of trust'. It was suggested that the use of an independent 'honest' broker could assist facilitation and this role might be fulfilled by a trade body. For example the Scotch Whisky Association is working closely with the industry and has collated large volumes of data relating to whisky exports. On a cross-sectoral basis, an organisation such as the Freight Transport Association could play a key role. Independent organisations, such as the Clean Cargo Working Group, can also provide a very valuable service in collating, analysing, reporting and benchmarking carbon-related information and offering guidance on best practice. As noted earlier, however, international organisations currently use different approaches and standards in the measurement of carbon emissions. There is a pressing need for convergence on agreed international standards.

It was also noted that freight forwarders or consolidators could play a more active role in exploring and exploiting collaborative opportunities in the maritime supply chain as they have knowledge of the shipping requirements of a wide range of businesses.

Hinterland Transport

For container movements to and from the port, the carbon intensity of rail per tonne-km is around 3 – 4 times less than that of road. It was estimated that 20-25% of deep-sea container freight is currently moved by rail, suggesting that significant potential exists to reduce the reliance on road transport for container movements and thereby substantially cut the carbon footprint of port feeder movements. The following points were raised about this modal shift option:

(i) Port infrastructure has evolved predominantly to unload containers onto road vehicles (either tugs for internal movement on the port site or directly to truck for onward delivery). The infrastructure does not exist for direct unloading from ship to train. Even if the infrastructure existed, the direct loading of containers to rail would require more information exchange such that the vessel could be loaded in a manner that would facilitate direct transfer to rail.

(ii) The advantage of a truck is that it moves a single box and so is not affected by the destination of neighbouring containers on the vessel. Assembling a trainload from containers drawn from different positions on a vessel can be complex. Also, in the absence of direct loading to rail, containers must be moved from the ship to a yard and subsequently reloaded onto rail wagons. This adds an extra container movement and two handling operations, resulting in slower processing and more port emissions. One rail operator noted out that is was often cheaper to use a truck to move containers out of the port to a company-owned rail terminal for onward transport than to use port facilities for the transhipment to rail.

(iii) A further limiting factor for rail transport is that it requires a relatively high trade volume to operate efficiently. While a truck will operate with a single container, a train requires much larger volumes of containers bound for the same inland terminal to permit a competitive frequency of service. In the UK marketplace, therefore, it is only the largest container ports that are able to exploit the benefits of rail transport.

(iv) Loading gauge restrictions confine container trains, particularly those carrying higher boxes, to a limited network. In addition, the rail network is a mixed traffic system with passengers and freight competing for rail access. Passenger trains take precedence, with freight trains subject to frequent stopping and starting, significantly lengthening average transit times. Repeatedly stopping and starting freight trains is a very energy inefficient practice which erodes some of rail's carbon advantage.

(v) Future port development could be more closely aligned with the rail network. However, the recent removal of Freight Facility Grants by the UK government sends the wrong signal to potential users of rail freight services. Rail freight is not a vote winner, and as such it is not likely to receive much attention from government.

(vi) To date much of the focus on modal shift in hinterland transport has been at the UK end of the maritime supply chain. In the UK, however, port feeder distances are relatively short, transport infrastructure is of a relatively high standard and freight operations are comparatively energy efficient. Potentially much greater carbon savings can be achieved by modal shifts in countries at the opposite end of the supply chain which are often less developed and much larger than the UK. In the Far-East, for instance, road transport legs can be thousands of kms long.

Cost of Carbon

Putting a monetary value on carbon emissions could help to reduce emissions. As fossil fuels become more scarce, their market price will also rise. This market mechanism alone will depress carbon emissions. However, assigning a financial cost to carbon would reinforce this effect. If transport and logistics were brought within the emissions trading scheme and the market price rose to a much higher level than at present, it would promote greater supply chain optimisation. If it reached a very high price it could weaken the relative cost advantage of manufacturing in the low labour cost countries and restrain the growth of deep-sea container traffic. There was general agreement that operating costs and carbon emissions are positively correlated. This has certainly been supported by both business experience and academic research. It is also clear that the simplest and cheapest carbon reduction measures will be adopted first. As time progresses, additional carbon-saving measures will become more difficult and more expensive to implement. Carbon reduction in the maritime supply chain may also be subject to a law of diminishing returns.

Once the ‘low hanging fruit’ has been harvested, there will be a need for stronger government intervention to incentivise decarbonisation through financial incentives or carbon taxation .

Arguably, consumers can exert the greatest influence on carbon emissions in the supply chain. For the foreseeable future their buying behaviour is likely to be determined much more by price and quality considerations than by the amount of embedded carbon in a product. An extension of the emissions trading scheme or carbon taxation would make low carbon products cheaper. For most products, however, it would be the carbon intensity of the production operation rather than the maritime logistics which would differentiate consumer products in terms of their sensitivity to carbon costs.

Equipment Lifecycles

Ships, railway rolling stock and port equipment require large capital investments and have long replacement cycles. Indeed, for ships, railway locomotives and wagons this lifecycle is typically in the region of 20 – 25 years. This raises two issues. First, many assets in service now will remain so for many years to come. The long renewal cycle means that capital investment decisions taken today will only influence a small proportion of the fleet and take many years to have a substantial impact on carbon emissions. Second, companies are often deterred from making long term investments in new, more carbon-efficient assets, by uncertainty about future changes in technology, market conditions and public policy.

Other Issues

There were many further issues raised during the course of the workshop. It is not practical to list them all in this short summary report. Some of the more significant ones are listed below.

(i) The main focus of decarbonisation is reducing emissions of CO_2. However, in the maritime supply chain there can be significant emissions of other greenhouse gases. It was observed that as well as being energy intensive, reefer containers contain refrigerant gases some of which have a global warming potential several thousand times that of CO_2. Reefer traffic warrants greater attention.

(ii) It was felt by some that the ‘green’ agenda is little more than a box ticking exercise to satisfy carbon reporting requirements. On the other hand, new recruits to the logistics profession are far more environmentally focused than many of their established colleagues. As this new blood rises to boardroom level, environmental and sustainability issues will feature more prominently on the corporate agenda.

(iii) Many businesses in the maritime supply chain now measure their carbon emissions. In general, this reporting is undertaken within company boundaries; i.e. it is a silo approach. The efforts to measure carbon are commendable, but to co-ordinate decarbonisation initiatives across the supply chain, it will be necessary to adopt a holistic approach to measure carbon across company boundaries. Maximising the carbon efficiency of individual firms may not minimise the carbon footprint of the maritime supply chain as a whole. It will be desirable to agree on a fair method of apportioning carbon emissions across the maritime supply chain and co-ordinating carbon-reduction initiatives.

(iv) The terms of trade (Incoterms) determine the boundaries of responsibility for transporting goods as they move through the supply chain from producer to consumer. Using the appropriate terms can give greater control of the transport process, and hence related carbon emissions, to the shipper.

Conclusions

The workshop explored the various measures that may be applied to reduce carbon emissions from the maritime supply chain. It confirmed that a broad range of measures is available and that, in combination, they could substantially reduce the carbon intensity of supply chains containing a deep-sea movement.

There was a general consensus that the shipper has an important role to play in the decarbonisation of these supply chains. The decarbonisation framework illustrated in Figure 1 was broadly endorsed, though it was noted that more reference could be made the steep growth in reefer container traffic and its impact on GHG emissions.

It was generally agreed that a modal shift from road transport to rail on port feeder links offers significant potential to cut carbon emissions though this is limited mainly by infrastructural constraints both at the ports and on the rail network. The greatest CO_2 benefits from modal shift within port hinterlands are likely to occur in the Far-East, where land based transport legs are often long and transport energy efficiency much lower than in the UK.

Improving container fill was also identified as a worthwhile option to pursue. Since the majority of imports to the UK tend to 'cube out' before they 'weigh out', it is important to maximise the use of available space. There was much support for the principle of designing product packaging to fit a standard container, thereby minimising wasted space in the container. This has significant implications, however, for both the manufacturing and marketing functions in the supply chain.

The adoption of a port-centric logistics strategy can eliminate links from the maritime supply chain and was generally seen as a carbon-reducing option.

The workshop concluded that there was a urgent need to establish a common standard by which to measure carbon emissions across the supply chain. There are currently a number of different standards in existence making it difficult to compare reported carbon emissions on a consistent basis. There was some disagreement over the average amount of CO_2 emitted per TEU passing through major ports. This may partly reflect the range of port-related activities included in the calculation as well differences in the carbon-intensity of these activities.

There was strong support for collaborative initiatives to improve operating efficiency and cut carbon emissions. A lack of trust and unwillingness to share shipping data across the maritime supply chain remains an obstacle and will be difficult to overcome.

Government has a significant role to play in reducing carbon emissions in this sector. There was wide agreement that these emissions should be assigned a cost, preferably through an emissions trading scheme or some other market-based instrument. This will clearly require government intervention. Government can also help to set standards for carbon measurement and continue to incentivise modal shift on port feeder movements.

The life-cycle of transport assets, particularly for rail and shipping sectors, means that the uptake of low-carbon technologies is going to be a relatively slow process. To accelerate the rate of carbon reduction, investment in new vessels and rolling stock will need to be supplemented by retrofitting and improved utilisation of the existing assets.

Overall, it was recognised that the importance attached to carbon emissions in the management of the maritime supply chain will steadily grow and that the shipper can exert a strong influence on the nature and scale of its decarbonisation.

Acknowledgement:

The organisers wish to express their sincere thanks to everyone who gave up their time to attend the workshop and participate in the discussions. These discussions were very informative and will make an important contribution to the LRC's research in this field.

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