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Abstract

Intermodal hinterland transport solutions of major ports increasingly become a differentiating factor for shipping lines and shippers. Furthermore, rail as alternative solution to road freight provides a price competitive option, which at the same time increases the sustainability of hinterland transport. Major UK ports like Felixstowe have the financial, geographical and relational attributes to overcome barriers of developing extensive intermodal hinterland networks, whereas smaller ports are considerably less fortunate regarding their prospects of intermodal development. The scarcity of intermodal hinterland networks and related research is surprising considering the 2050 sustainability targets the UK set itself. Accordingly, this paper explores the barriers smaller ports face in the development of intermodal hinterland transport solutions in UK through the Scottish ports, as the interfaces between ports and rail transport are among the least developed and utilised. A pragmatist approach synthesised data gathered from 10 semi-structured interviews with key experts, identified a set of common concepts and emerging patterns depicting the barriers to improving the intermodal hinterland transport capability of smaller Scottish ports. Furthermore, our research analysed historical freight volumes and cargo flows, which were extracted from the database of the UK

Department for Transport. Preliminary findings of our research show that environmental impact, is of minor importance. However, infrastructure requirements and volumes are of major concern to independent supply chain actors involved in the development of intermodal hinterland transport solutions. The paper concludes by outlining an agenda for further research and recommends actions for smaller ports on how to overcome barriers to developing their intermodal network.

Keywords: *Port Development, Intermodal Transport, Sustainability, Hinterland Strategy*

1. Introduction

This study aims to explore the barriers smaller UK ports face in developing intermodal capabilities, particularly the development of intermodal links from Scotland to England as it is a key corridor of freight movements by rail. As the development of intermodal solutions requires an agreement between several key supply chain actors like rail operators, transport service providers, port authorities and government bodies this paper incorporates a wider supply chain and transportation literature approach. In Scotland, ~42% of all UK bound transportation is handled by road freight operators whereas rail freight transports only account for ~9% of total volume/km whereas the remainder is transported via coastwise shipping (~30%) and pipeline freight (~19%) (Scottish Government, 2015). These figures are in stark contrast to sustainability targets set by the UK government to reduce 80% of CO₂ emissions due to road freight by 2050 as well as the overarching EU policy which envisions the reduction of road freight by 50% via alternative modes of transport like rail or inland waterways (European Commission, 2011). While there has been an investigation of large retailer driven modal shifts and their rationales respectively (Woodburn, 2012; Monios, 2015), the opportunities and requirements of ports beyond the Scottish central belt to expand their hinterland connectivity and drive the development of intermodal transport solutions has not been explored further. This kind of development can be of interest to regional secondary ports, mainly functioning as feeder ports but nonetheless generating sufficient traffic to attract a smaller number of direct shipments. While these ports commonly do not display the same competitive advantages as the dominant major ports in immediate competitive proximity, tapping into the existing land-bound freight flows currently bypassing the ports via road, an improved intermodal network could increase their competitiveness and attractiveness. Even though developing intermodal transport solutions could generate long-term benefits, increase sustainability of transport and enhance the possibility of the UKs and EUs 2050 carbon reduction and sustainability, particularly smaller ports face difficulties when trying to develop these capabilities. Despite lower cargo volumes and existing market shares, smaller ports to large degrees operate under trust port status, often taking a different approach to their service offering (Transport Scotland 2012).

This paper consequently investigates the existing intermodal transport solutions linking Scotland and England as well as the barriers smaller ports face when to link themselves to

existing networks. The overall aim of this paper though is to identify the factors being considered as most pressing by industry and government experts. Supplementary to these findings this paper aims to offer some recommendations on how to overcome these barriers.

Section 2 reviews the extant literature on intermodal transport networks and offers insights on the contextual background of this paper. Section 3 introduces the chosen methodology and delineates the approach selected by the authors. Section 4 presents and synthesises findings of the conducted semi-structured interviews and additional data sources. Section 5 discusses established themes and concludes with recommendations for future research and the regional development of intermodal transport solutions.

2. Literature Review

2.1 Intermodal Transport in Scotland

The access of Scottish ports to intermodal freight facilities is considerably underdeveloped, the share of intermodal freight coming through at the time of data collection (August 2017) is

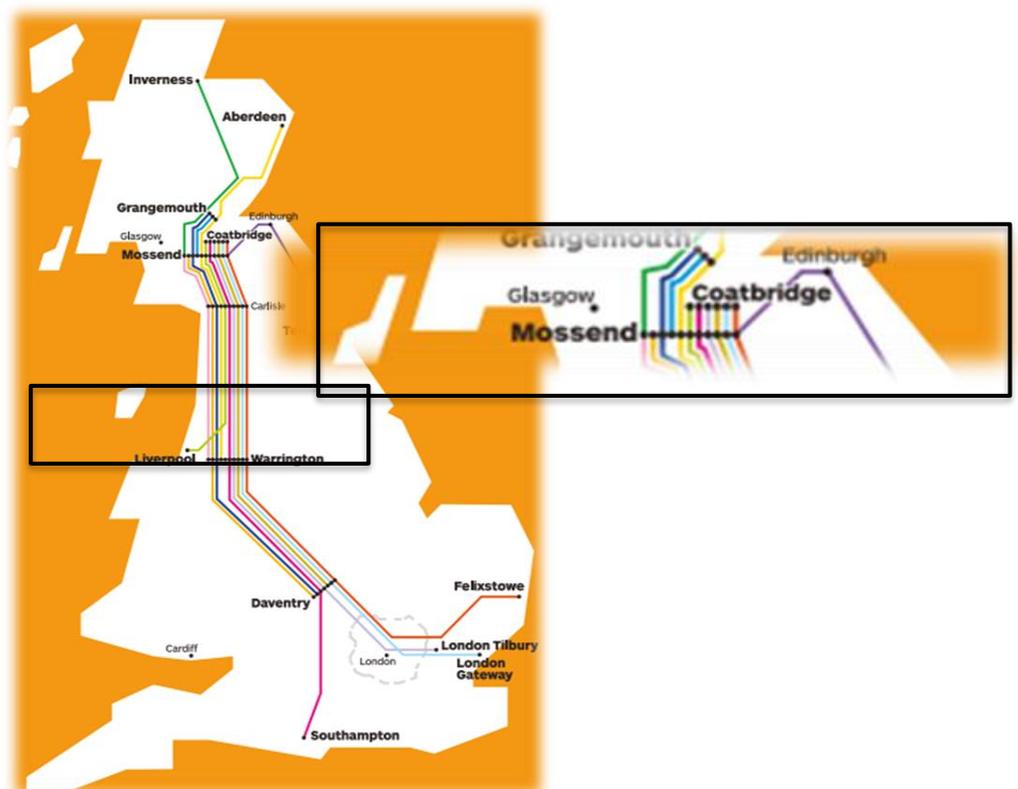


Figure 1: Intermodal links between Scotland and England

Source: Transport Scotland (2017)

insignificant and extensive facilities for an intermodal operation solely exist in Grangemouth, which is operated by Forth Ports, but remains underutilised. Most of unitised freight originating from Scotland leaves the country through either road or rail freight (Figure 1) headed for the seaports located in the South-Eastern part of England (Wilmsmeier and Monios, 2013).

With existing Scottish port infrastructure not matching the requirements of larger deep-sea vessels, container traffic to Scottish ports comes mainly by feeder or short sea vessels, originating from England or Northern Europe, transporting transhipped deep-sea or short sea containers (Monios and Wilmsmeier, 2012). The majority of container freight passes through Grangemouth which serves the central belt of Scotland encompassing Edinburgh, Glasgow and other cities, representing more than two thirds of the Scottish population.

Similarly, Scotland generally displays a lack of infrastructure development as well as corresponding government initiatives which might facilitate the exploration of intermodal solutions by ports or other supply chain actors in the region (Baird et al., 2010; Monios and Wilmsmeier, 2012; Wilmsmeier et al., 2011). Baird et al. (2010) particularly emphasise that the development of intermodal transport solutions and hinterland connectivity requires an

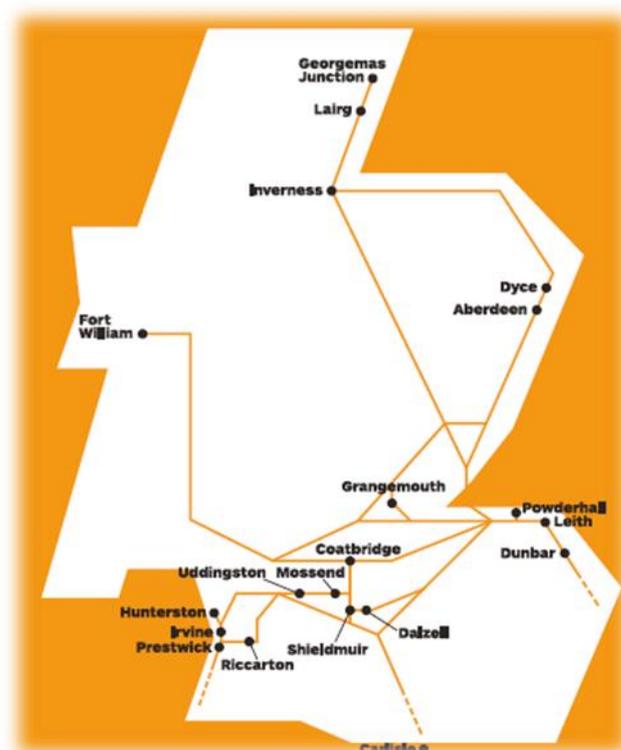


Figure 2: Scottish Intermodal Terminals

Source: Transport Scotland (2017)

improved coordination between involved or interested parties. As discussed earlier, current intermodal terminals are mostly underused existing capacity can be considered as sufficient for the time being. Monios (2015) analysing the feasibility of intermodal transport in Scotland, particularly rail freight found that existing Scottish intermodal terminals either are not in close enough proximity to freight flow origins or not ports capable of distributing such freight are not connected to the wider intermodal network or hinterland as Figure 2 illustrates.

Therefore, innovative approaches are needed. Those include balancing the flows to and from England – by establishing strategies for sourcing backhauls and repositioning of empty containers and rolling stock (Wilmsmeier et al., 2011) attracting large customers to build depots near rail connected sites and more efficient management and cooperation system between carriers (Song, 2002). Monios and Wilmsmeier (2012), argue that greater collaboration within the Scottish network can help to attract maritime flows directly to Scottish ports, leading to a better integrated system in the future.

In the existing intermodal, rail freight utilising network the Coatbridge terminal of Freightliner is the busiest facility in Scotland by a significant margin. Coatbridge as illustrated in the earlier figures links Scotland rail transport network to the deep-sea ports in Felixstowe, Southampton, London, Tilbury and as well as running three domestic container services to and from Daventry (Transport Scotland, 2017). While Coatbridge represents the biggest and most utilised dry port of Scotland, in 2015 it operated at 33% below its capacity and handled approximately 80,000 TEU (Transport Scotland, 2017). Monios (2015) alongside other factors emphasises the disparity between geographic location of manufacturing/shipping organisations and existing intermodal facilities as significant barrier preventing a more pronounced modal shift. Consequently, the following section will review part of the dry port concept and identify rationales and barriers for its development.

2.2 Rationales and barriers for dry port development

Dry ports according to Cullinane and Wilmsmeier (2011, p.360) are “a place inland that fulfils original port functions” the can further be for this study considered as extensions of existing ports, offering greater hinterland accessibility and intermodal connectivity. In line with our conceptualisation, Roso et al. (2009, p.341) defines the concept of a dry port as a “seaport directly connected by rail with inland intermodal terminals, where value added services match

those of a seaport and the containers can be dealt with in the same way as if they were in a harbour". Roso et al. (2009) further delineates dry ports into three distinct concepts based on their functionality and proximity to the original port engaging in its development. Namely close range, midrange and distant dry ports. In close proximity, they mainly are meant to relieve capacity constraints within the port and improve port productivity through more efficient freight flows between quayside and storage facilities.

Distant dry ports are mainly distinguished from midrange ones by their proximity to the port with Roso et al. (2009) differentiating midrange as being closer than 500 kilometres to the original port and distant dry ports as being beyond this measure. Considering the size of Scotland any dry port according to the considerations of Roso et al. (2009) could at best be considered a midrange dry port. Distant and midrange though share several attributes as both serve as a consolidation and modal shift points for cargo. Furthermore, their benefits often are a direct result of the modal shift from road to rail, resulting in decreased transport costs and reducing congestion at the seaport gates and its surrounding area (Song et al., 2012). Resulting from the use of more efficient intermodal options, the environmental impact of transport along the route can be significantly reduced. Coatbridge as well as the Mossend facilities can therefore be classified as midrange dry ports/rail terminals within the Scottish context. They both provide a road/rail interchange and for specific routes offer a cost-efficient or time-efficient alternative to road freight operations. Wilmsmeier et al. (2011) point out that a port's potential hinterland can only be considered as extended through the development of a dry port if it enables transportation along the new network at cheaper cost or shorter transport times than through another alternative.

Regarding the direction of development, according to the model of Wilmsmeier et al. (2011), the Scottish inland terminals are a result of inside-out development, having been developed to provide access to global transport corridors (Baird et al., 2010; Monios et al., 2012). Most sites dating back to the time before rail privatisation, act solely as gateway to these larger ports but they are not immediately connected to any Scottish ports. Transport links existing between Mossend, Coatbridge and Scottish ports consequently are almost non-existent except for the rail terminal in Grangemouth and an existing rail head in Aberdeen harbour which is not utilised. Considering the sustainability targets of the UK government and the European Commission as well as the potential of smaller ports to gain access to a wider hinterland, the

complete lack of developments regarding additional close or medium range dry ports with direct port links must be facing considerable barriers or limitations.

As the context of this study is rather specific, the following short section will introduce existing approaches to reduce the barriers for intermodal transport in Scotland (UK) through funding bodies and support regarding knowledge exchange between government and industry.

2.3 Support for development of intermodal transport solutions

Significant incentives for modal shift can either artificially stem from government legislation, imposing a new set of rules governing the transport sector, or the opposing approach of government bodies providing financial assistance for switching from road to rail. This can be applied for on a case by case basis to stimulate the development of intermodal terminals (Wilmsmeier et al., 2011).

Modal shift funding in Scotland is complicated by the fact that it must be based on the shift of existing road flows. A multi - user terminal operator cannot qualify for this funding because it is the individual operator or logistics provider that is carrying the traffic. Furthermore, if a new site is developed then there is no existing flow to shift therefore funding cannot be sought. These two factors according to Monios (2010) are the main reasons why most of the annual modal shift budget remains unspent, for example 3.7 m spent out of a budget of 15.4 m in 2008-2009.

However, there is an advantage in leaving the decision for dry port terminal to the private sector, new terminals would not be built unless investors are convinced of the feasibility in advance. As private sector ports in Scotland are mainly risk averse regarding development in vertical cooperation, since the privatization of the rail and port sector, there was little development (Wilmsmeier et al., 2011). A noteworthy exception in the Scottish context is the development of the Mossend terminal which links Scotland with the Channel Tunnel (Baird et al., 2010; Monios and Wilmsmeier, 2012).

To explore the nature of these barriers and the factors the various supply chain actors consider as most challenging for the realisation of future intermodal solutions the authors consulted and interviewed a range of participants as discussed in the following section.

3. Methodology

In this section, we delineate our data collection and analysis methods. Furthermore, we introduce the rationale for our approach and elaborate on our sample size before we present our findings in section 4.

3.1 Method and sample selection

The main aim of this project is to explore the barriers smaller ports in the UK face regarding the development of intermodal solutions, for example close or mid-range dry ports respectively. Furthermore, we explore the suitability of funding available to actors willing to engage in the development process. To pursue this research aim, our research design utilised a pragmatist research paradigm. Examining the understanding of a specific set of supply chain actors in Scotland (UK), transport service providers (road/rail), terminal operators, government bodies and port representatives formed the basis for our pragmatist inquiry employing a qualitative research methodology informing our interaction with interviewees during site visits (Guba and Lincoln, 1994). Consequently, as reality is perceived differently by each interviewee the collected knowledge is fragmented and not objective which in turn lead us to reject the possibility of a positivist approach. This study's approach is of an abductive nature as it adopted elements of induction and deduction (Eriksson and Kovalainen, 2015)

Furthermore, this study employed case study-based research was employed, like Carbone and Martino (2003) who investigated the process of integration between Le Havre port and the automotive supply chain of Renault. For the research project purposeful sampling (Patton, 1990; Juga et al., 2008) was identified as the most suitable method of participant selection as they required adequate knowledge of the Scottish intermodal context and be familiar with one or more potential intermodal developments which faced and/or overcame existing barriers. This yielded a sample size of 10 experts. Even though a smaller sample size is often considered as lacking in regards of comparability, Yin (2013) argues that analysis and synthesis benefit from an in-depth study rather than sole focus on quantity. Equally, Demirbas et al. (2014) in their exploratory study of supply chain interfaces between a port user and port operator utilised an identical sample size which did not limit the conclusiveness of their analysis but rather enhanced the descriptiveness of the research project.

3.2 Data collection and analysis

As introduced in the previous section, the data for this study was collected through 10 face-to-face semi-structured interviews with executives representing port authorities, Scottish government, rail network operators, port authorities and transport service providers. The semi-structured interview consisted of three interdependent sections. Initially, the intermodal network in Scotland and UK respectively were discussed and reviewed with interviewees regarding its effectiveness and efficiency. Following, participants were encouraged to consider the case of developing new intermodal terminals (dry ports) in Scotland which could connect existing smaller ports to the wider rail network. Finally, after establishing the participants views and exploring the possibility of additional intermodal terminals in Scotland, the interviewees reflected on barriers they faced when considering such developments or having been part of their conceptualisation and implementation.

After each interview, responses of participants were transcribed and summaries capturing the main themes were immediately established to aid the probing for even more specific information on identified topics. Following the completion of data collection, the researcher re-familiarised himself with the data and employed thematic analysis (Braun and Clarke, 2006) to generate themes relevant to the research aim. The developed themes followed the categorisation of the interview guide itself while also particularly differentiating factors acting as barriers for the development of intermodal transport solutions. The thematic approach allows for the analysis of interview through the development of common and synthesised themes while also discarding irrelevant information. The researcher on average spent 45 minutes interviewing the participants but following the data collection and preliminary analysis contacted selected interviewees to further explore certain themes or verify themes developed by the researchers.

4. Findings

Following the data collection which employed semi-structured interviews the obtained information was analysed utilising a thematic approach to allow for the development of rich and descriptive themes (Bryman and Bell, 2015). The developed themes structure the collected information and enable the researcher to categorise findings appropriately (Eriksson and Kovalainen, 2015). Following, initially expressed rationales for the development of intermodal transport solutions in Scotland are presented and secondly existing barriers are further segmented based on identified themes.

4.1 Rationales for the development of intermodal transport solutions in Scotland

Regarding the rationales, interviewees voiced several perspectives of how intermodal transport solutions, the development of dry ports in Scotland, can enhance the existing transportation landscape for smaller ports and other supply chain members alike. Considering the number of supply chain actors needing to be involved and on board with the development and operation of an additional dry port in Scotland the variance in interview responses is not surprising. Nonetheless, there is an immediate distinction to be made between government bodies, smaller ports and other involved parties.

Scottish Government (SG) representatives responsible for transport/infrastructure planning reiterated that their current approach does not entail the actual planning or development of new infrastructure as this might distort market structures and favour certain supply chain actors more than others. Contrastingly, representatives also stressed that “the main challenge is to get smaller businesses which predominantly use road freight services to consider a modal shift” (SG 1) which is incentivised with subsidies which in turn might distort the competition between smaller businesses. At the same time, SG elaborated that funding can only provide when project can prove to be sustainable from the outlook. Predominantly, the interest rested on the reduction of road freight volumes through incentivising modal shifts, decreasing carbon emissions without exerting pressure on industry as intermodal terminals and their locations are solely market driven.

For transport service providers and network operators the main rationales were found to be an improved service offering, greater market connectivity and generally access to additional cargo volumes being shifted from road to rail. Foremost though, any engagement in such an endeavour would need to be economically viable. Environmental sustainability was of no greater relevance for the decision-making process.

Rationales port representatives (PR) for the development of intermodal transport solutions differed significantly from SG perspectives. Even though smaller ports in Scotland generally are trust ports, subscribed to servicing their wide range of stakeholders including the region and public, environmental sustainability while playing a role was found to be of lesser importance than social and economic sustainability. Main rationales for the development of a dry port were found to be the improvement of port productivity, expansion of storage and an increased port attractiveness respectively competitiveness based on a wider service portfolio and increased hinterland connectivity. Nonetheless, the rationale to enhance regional development and integrate smaller ports into national intermodal networks, PR 1 elaborated that “well as a service that enhances our own portfolio we’d be willing to accept a financial performance lower than what you’d expect of a logistics service provider”. Similarly, the development of a dry port with direct links to smaller ports might attract cargo from smaller feeder vessels if the service offering can be competitive on time and cost. In stark contrast to transport service providers or rail operators, PRs considered the development of an intermodal transport solution as competitive advantage since it acts as differentiating factor, distinguishing the ports intermodal capabilities. Being part of such a development was further understood as prestigious and “putting the port on the map” (PR 2).

4.2 Barriers for the development of intermodal transport solutions in Scotland

For the analysis and synthesis of barriers which interviewees either experienced themselves or knew of regarding the development of intermodal transport solutions in Scotland the key emerging themes were existing infrastructure, social factors affecting interaction between supply chain members and ultimately the economic feasibility of the endeavor.

Infrastructure

A frustration voiced by almost all interviewees are the constraints that existing loading gauges pose for the UK compared to continental Europe. A transport service provider regarding these developments emphasised, “They have invested in several upgrade schemes, but we just haven’t gotten there yet” (TS 1). These constraints pose a significant challenge in the transportation of deep-sea containers, as many routes linking ports to their hinterland have not progressed beyond a W8 (classification of maximum height and width of railway vehicles) loading gauge which only allows for the transportation of standard containers but not hi-cube. This was understood as significant problem for the future development of intermodal solutions as high-cube containers are believed to experience a significant increase in volumes but require a W10 loading gauge. To be able to transport hi-cube containers over the UK rail network, “the enhancement of rail gauge to W10 or the acquisition of special low ride wagons is required” (TS 2). While these conditions impede the UK wide modal shift, Scottish routes were considered even worse which also is the case for some sections of the West Coast Mainline, often used for freight traffic diversion throughout peak periods in the rail network. Going even further North beyond the Scottish central belt the network linking Aberdeen, Inverness and Fort William mostly feature W6 gauge which only allow for the use of cost-ineffective low ride waggons. According to more than half of interviewees, a wagon-based solution would be more cost effective but further would require significant support from the government. Furthermore, disregarding the current state of the network, all participants agreed that a major barrier are the non-existing intermodal facilities in proximity to shippers in the North-East of Scotland. While significant amounts of whisky are produced in the region, the available intermodal terminals are either not in close enough proximity to offer an economically viable alternative, the frequency of operations is too low as the terminal does not capture large enough cargo volumes or under existing circumstances the road network is understood as more reliable and flexible.

Social

Capturing sufficient cargo volumes to justify the development of an intermodal terminal and the ambition to drive such a development were perceived as major barriers which are caused by aspects of a social nature. Regarding the integration of small ports into supply chains of their port users one PR asserted that Scottish ports are very conservative and that “they are in the business of loading and discharging ships, that’s all they want to get involved in” (PR 3) even though SG representatives and transport service providers found there to be a shift of perception in recent years with ports trying to secure cargo flows and reduce costs through stronger interaction with their users. In terms of the ports in North East Scotland, the matter is further complicated by the fact that port`s supply chain focus on container traffic, and the only port that handles containers there is Aberdeen.

According to SG representatives, there is unwillingness among the industry to switch from road to rail, that is predominantly linked with various reliability issues that existed in pre-privatisation times. Most of businesses, especially smaller business they are trying to subsidise and motivate to switch their mode of transport tend not to realise the fact that a lot has changed since then and logistics service providers today are known for their reliability (Song and Panayides, 2015). Consequently, misinformation, unawareness and a potential lack of understanding of contemporary solutions limits the willingness of smaller shippers to funnel cargo through intermodal terminals. This reluctance of changing existing patters was further highlighted SG and Logistic Service Providers (LSP) representatives stating that in the case of Inverness, it took the operation of 10 years prior to reaching planned capacity and establish itself.

Furthermore, our study further found that trust ports were generally seen as more accommodating to developments which might not immediately yield returns if they support the existing activities in the port and provide a benefit to stakeholders and port authority alike. This perception was a stark contrast to some of the concerns interviewees voiced regarding the priorities and conduct of private port management organisations.

Economic

Regarding economic factors there was general consensus that any development would need to appear financially viable. The main difference though was identified in what the individual supply chain actors understood as financially viable.

For smaller ports the development of a dry port facility was understood to offer a generally larger appeal because of the integration into existing rail networks and the thereby created opportunity of tapping into a different range of cargo flows. Because of these circumstances, the focus on financial viability is closer to allowing the project to be sustainable rather than to generate significant profits in a joint venture. This was exemplified by statements such as “we’d be happy to break even and put the port on the map” (PR 2). Again though, with smaller ports generally being trust ports they are subject to different investment and return strategies as all generated profits would ultimately have to be reinvested into the development of the port and its contribution to the regional economy.

From a LSPs perspective “the provision of a service needs to at least be cost neutral or to provide cost benefit, without compromising service levels” (LSP 1). Economic feasibility though was considered exceptionally hard to achieve for dry port developments which are not immediately linked to major ports in the region because smaller ports and their users mainly operate independently and do not communicate or cooperate with each other which increases the difficulty of meeting volume requirements for such an endeavour. At the same time, the willingness for up-front investment by LSPs or network operators is limited because their ability to draw in enough commitment from smaller businesses is limited while at the same time the power dynamics of interacting with major retailers was understood to be just as challenging.

In addition, interviewees pointed out that while SG operates various modal shift grant schemes and the freight operators in Scotland have knowledge of these schemes, the modalities of acquiring funding are based on the shift of existing road flows. This was found to certain extents prevents modal shift on a larger scale, as any new site development would create new flows rather than switch existing ones. Equally, funding by several interviewees was perceived as only to be available to projects which have proven their financial viability whereas SG representatives stated, “we’ve previously funded and are still able to fund pilot schemes or

trials to explore long term viability” (SG 2). SG representatives though also reasserted the government perspective of the private sector being responsible of driving change and coming up with viable proposal which they in turn then would be willing to provide funding for.

Overall several of these barriers and aspects have been discussed at earlier instances in the literature but nonetheless, the spatial limitations and financial constraints on small businesses in Scotland presents a context which was found to strengthen some these barriers. These will be further reviewed and concluded in the following section.

5. Conclusion

Contrasting our findings and drawing from the available literature there appears to be a considerable disparity between the Scottish government’s ambition to facilitate the modal shift of small to medium sized enterprises (SMEs) from road to rail and the prevalent approach which is taken to encourage such development. SMEs were found to often lack the knowledge of existing schemes as well as the network to generate required cargo volumes to achieve feasibility of the project. Small ports, particularly trust ports because of their governance model and obligation to consider the regions development, could step-in as facilitator and instigator of collaborative practices which in turn could reduce social and economic barriers. Not acting solely altruistic, small ports by co-developing dry port solutions can tap into additional cargo flows and diversify their cargo portfolio which in turn increases their resilience to volatility in the market. Furthermore, by extending their hinterland connectivity and offering intermodal transport facilities they increase the ports effectiveness and attractiveness (Woodburn, 2012; Brooks and Schellinck, 2013). Given the nature of small/trust ports being known amongst peers, having developed a good reputation and being considered trustworthy by other supply chain actors, participation respectively instigation of such developments can help alleviate common barriers of dry port development. like lack of trust, willingness to cooperate, cost allocation and availability of cargo volumes similar to the role Monios (2015) described for 3PLs in such developments. While 3PLs are considerably more able to aggregate sufficient cargo from various retailers/manufacturers while coordinating their transportation activities, the governance structure of trust ports allows for a different approach for doing business as financial returns have to be reinvested in port development (Transport Scotland, 2012).

To further address the aim of this project to identify the barriers small ports face when pursuing the development of intermodal transport solutions, it is interesting to note that even though “lack of willingness to adapt” and “concerns of reliability” are often mentioned in the literature (Woodburn, 2012) and by government reports (Transport Scotland, 2016) interviewees not representing the Scottish Government displayed great interest and enthusiasm regarding the development of such solutions. A main barrier according to several interviewees rather was the initially required up-front investment and consequently the risk they would be subject to. While funding to alleviate these risks can be available through several grant schemes of the Scottish government, their position of only promoting these schemes but leaving it up to the private sector to develop viable proposals limits the grants suitability for SMEs and smaller ports. Even though there are grants available for trial runs meant to test viability of developments, the cost for planning, infrastructure development would rest on the individual supply chain actors. Nonetheless, support schemes which are designed to assist companies with the additional capital and revenue costs associated with moving freight by rail or water instead of road could assist the modal shift required according to interviewed experts.

Last, while having reviewed the potential role as facilitator of small/trust ports for the development of intermodal transport solutions, the problem of achieving critical mass to guarantee the feasibility of such a project was perceived to be significantly amplified compared to Grangemouth, the largest Scottish container port. Considering that Mossend and Coatbridge are both situated within the central belt of Scotland a medium range dry port in the North-East of Scotland, allowing SMEs and small ports to utilise it as consolidation point, might be a possibility as suggested by an interviewee. Not considering the actual development of new intermodal solutions though, there was some consensus by industry experts that the existing infrastructure and gauge restrictions are a significantly limiting factor for future intermodal activities and development which cannot be influenced or circumvented by supply chain actors.

Limitations of our study were the small sample (as discussed in section 3.1) and the comparability of our results with other regions of the UK as we focused solely on Scotland. Future research could incorporate a larger sample, representing a more diverse set of regions or specifically focus on distinctly developed regions in England. Considering that the presented project explored supply chain actors’ views on barriers, these might have been distorted by the pre-existing condition of gauge limitations, particularly in the North-East of Scotland.

In conclusion, several factors limiting small ports to develop intermodal solutions in the Scottish context have been explored as well as possible advantages of small trust ports compared to large private ports when initiating such project have been discussed. Future research could incorporate findings of Monios (2015) and the presented research to explore the perceptions of manufacturing/retailing SMEs regarding the suitability and possibility of a more profound modal shift in Scotland and UK.

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