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Innovation Drivers of Logistics Clusters

The cases of Aragon and The Netherlands South West & Flanders

Yari Borbon-Galvez*

Meng Lu**

*) [Research Fellow, Zaragoza Logistics Center, 50197 Zaragoza, Spain. E-mail: yborbon@zlc.edu.es, Phone: +34 976 070 149]

**) [International Program Manager, Dutch Institute for Advanced Logistics, 4813 DA Breda, The Netherlands. E-mail: lu@dinalog.nl, Phone: +31 76 531 5300]

Abstract

Based on the cases of Aragón Region and The Netherland South West & Flanders the paper presents the analysis of their innovation drivers, externalities, barriers and business models for logistics clusters. The paper presents shows increasing pressure on logistics operators due to declining margins since early 2000s, and the exploitation of efficiency and innovation externalities on their own logistics clusters may not be sufficient in the long term. Complementing their cognitive proximities the regions defined joint actions in advanced logistics, horizontal collaboration, urban logistics, green logistics, knowledge valorisation, and cluster development and internationalisation, from which logistics virtual clusters may emerge. The findings also show that logistics clusters have capabilities to exploit innovation and efficiency externalities located in geographically separate regions. The paper presents structured ways to analyse theoretical constructs, and concludes with collaborative logistics project's practitioners, managerial/strategic, cluster policy, and scientific implications. |

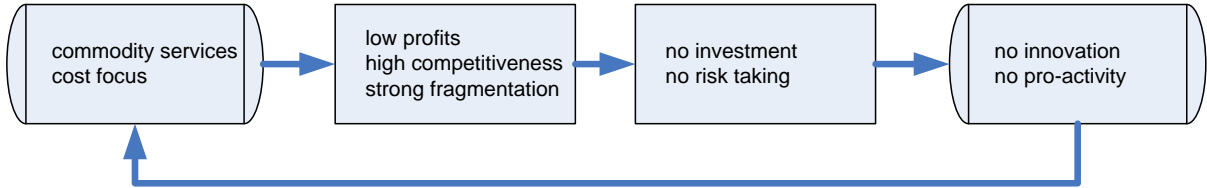
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Introduction

Over the last decade the logistics operators in Europe strived to find ways to cope their increasing operating costs. From 1999 to 2006 the yearly increase in the operating costs per transported ton in Europe ranged from 1% to 4% depending on the transport mode. This, had an effect in inland water transport and in post and courier activities reducing their profit margins in the same period. Other operators however, managed better. The railways operators, road freight transport, maritime, air transport, warehousing, and other transport activities saw increases in their profit margins in the same period (SEALS Final Report 2008). Expectedly there are diverging trends by regions and periods; for instance, while in the EU27 transport and storage sectors the gross operating surplus grew 1.8% from 2008 to 2010, in Belgium, Spain, and The Netherlands it decreased by 3%, 5.1%, and 7% respectively (Eurostat, 2013).

In regions where logistics operators are under increasing costs and lowering margins pressures Cruijssen (2006) argues that it may prevail the aversion to risk and invest, reducing the likelihood of innovation and in turn their capacity to deliver solutions based on other than low cost (see figure 1). Vannieuwenhuysse (2003) had previously identified the use of innovative software, logistics concepts or business models in the Dutch logistics sector to move forward in such vicious cycle.

Figure 1. Logistics operators’ dead loop



Source: adapted from Cruijssen (2006)

Traditionally geographical concentration in logistics clusters in Europe and the rest of the world allow companies to access knowledge spilled over by co-located firms, to build up specialised supplier base, and access to specialised skills, which in turn supports the formation of new businesses (models) and faster innovation (Sheffi, 2013) that allow the logistics sector to grow.

The authors on the other hand, hold the view that scholars had paid already sufficient attention to the notion of ‘geographical proximity’ as a key element to characterise and even prove the existence of clusters (Pounder & St. John, 1996; and Porter, 1998; de Dominicis, et al., 2013; Dupuy & Torre, 2006) and therefore as the need to access to knowledge, skills, scale and innovation.

The question regarding the capacity to absorb and desorb externalities from non-proximate logistics clusters have been largely neglected (with some exceptions, Kesidou & Snijders, 2012). This would not be a concern if clusters did not experience periods of stagnation due to lack of technological heterogeneity, but Menzel & Fornahl (2010) had shown the relevance of learning outside the cluster to prevent locking-in into such stagnation paths. Further when a project business model is difficult to develop or conflicting with the current situation, the

project may find resistance and considered as a threat, rather than as an opportunity (Markides & Charitou, 2004) as was the case with the Dublin airport and incapacity to accommodate conflict business models of Ryanair and Aer Riantas (airport operator) since the years 2000s (McLay & Reynolds-Feighan, 2006). Putting this into a hypothesis, the capacity of logistics clusters to aid its companies in the development of suitable business models and related solutions that benefit both the client and the profitability of the companies in the long term may be enhanced with the establishment of inter-cluster relationships.

This paper contains examples of two logistics clusters building up their relationship - the Aragón Region and The Netherlands South West & Flanders (Belgium) - the innovation drivers, the externalities to exploit, and the emerging business models used to overcome innovation barriers.

Such type of relationship building represents 'virtual regions' as Boisier (1994) theorised based on emerging agreements between complementary mix of non-geographically proximate industry, research institutes and authorities resources, but cognitively and culturally proximate. The authors claim the two study regions could potentially become 'logistics virtual clusters'.

Logistics Clusters: Innovation, Business Models and Externalities

Innovation had been analysed by many scholars from variegated traditions including industrial and evolutionary economists (Freeman and Soete, 1997; Dosi & Nelson, 1994; Abernathy and Clark, 1985; von Tunzelmann & Wang, 2003), resource-based view (Teece, Pisano, & Shuen, 1997; Lamming, 2000), organisation and knowledge theories (Senge, 1990; Nonaka & Takeuchi, 1995; Lichtenthaler & Lichtenthaler, 2009), and geographical economists (Storper, 1993; Cooke, 2001). In sum innovation may be 'a variation in a product, process, service, technology or system that is recognised by the market through business transactions'.

Logistics innovation drivers consist of ways to continuously create value for customers to remain competitive (Flint, Larsson, Gammelgaard, & Mentzer, 2005) by logistics service providers. This happens with improved operations, co-production in regional contexts, reduced competition, supply chain optimisation, and enhanced strategic performances (Grawe, 2009).

According to Porter (2000) and Raschke (2009) there are innovation drivers, out of which the ones more relevant for logistics innovation are (SoCool@EU D2.1, 2013):

- Increasing or sustaining market shares,
- Increasing range and quality of product, processes, services, technologies, and systems and replacing the old ones
- Reduce the time to respond to customer needs
- Reduce costs
- Enter new markets
- Reduce environmental impacts
- Meet regulatory requirements
- Improve health and safety

Externalities are mechanisms that logistics clusters and intensive regions have for drivers to reach their full potential. Karlsson's (2008) adaptation of Johansson's (2005) framework includes series of externalities that clusters can exploit to increase efficiencies and introduce more innovations.

Karlsson (2008) distinguished between efficiency and innovation externalities. The efficiency externalities include *price mechanisms* affecting the prices suppliers charge to customers; *cost mechanisms* affecting the input costs; formal and informal *cooperation mechanisms* allowing joint projects between two or more companies; *scale mechanisms* allowing the exploitation of market sizes and availability of specialised skills. Innovation externalities on the other hand include *vertical mechanisms* allowing knowledge to flow along the supply chain (see also Borbon-Galvez, 2011); *horizontal mechanisms* allowing same sector companies joint R&D activities or throughout spillovers - the difference with efficiency cooperation mechanisms is the focus on innovation rather than on efficiency-; *size and diversity mechanisms* allowing customer engagement in solutions developments or knowledge workers inflows with specialised skills (Karlsson, 2008).

Logistics innovation barriers on the other hand, may also be present in a cluster, preventing drivers to exploit full potential externalities (see for instance Oke, 2008; Ross, Mitchell & May, 2012). A set of barriers applicable to a wide range of logistics operators and intensive logistic sectors include (SoCool@EU D2.1, 2013):

- Uncertainty of demand
- High cost of innovation
- Lack of innovation culture
- Lack of qualified human resources
- Lack of cooperation partners for innovation activities
- Lack of finance for innovation
- Long amortisation periods
- Monopolistic or oligopolistic markets limiting competition
- Deficient information
- Risk of product/service/technology/process/system copies in the market
- Easy of being a fast follower
- Poor availability of external sources of services/know-how

Logistics clusters, and clusters in general, are required to identify the business models of their firms, if they were to set inter cluster initiatives to nurture innovation and exploit the full potential of the clusters' externalities. Business models have been described mainly for its service provided as 1PL and up to 4PL (Ojala, Andersson, & Naula, 2008) or for its architecture from traditional, to networked, to outsourced, so on (Neubauer, 2011). But the fundamental part of a business model is the way revenues and profits are earned (EPISIS Final Report Task 2, 2011).

For instance in road projects with Design, Build, Finance, Operate (DBFO) business models, the road operator provide the road in exchange for toll paid for traffic use. The road operator incurs in the capital expenditure on fixed capital asset. These are long term contractual arrangements that allow the amortisation time for the operator to come to an end (Bartlett, 2004). Other business models in use are included in companies that manage the clients' resources and knowledge contractually committing to continuous improvement of the production processes, in terms of reduction of resources consumption (human, financial, equipment, energy, solvents, coatings, lubricants, gases, adhesives, water treatment chemicals, and so on), whilst maintaining or enhancing the clients' output. The clients outsource managerial, administrative, installations, and resourcing functions to the performance-based management company, which profits from the net resources and knowledge savings, renting, and/or supplying the inputs for production, such cases include TX Logistik AG in Germany and Veloce Eco-Logistic Center in Italy.

Resource sharing companies temporarily lease out or just share assets, products, tools and so on, to different users. These user-oriented services may include traditional rental mechanisms, memberships, or informal agreements which pose closer ties between the resource sharing companies. The resource sharing company holds the ownership and remains accountable for the efficient lifecycle (acquisition, maintenance, and end-of-life procedures) of the product/service. Under a profitable transactions, there are incentives for the resource sharing companies to maintain the efficiency of the product/service, and minimises underutilisation of assets (see for instance Mobility CarSharing in Switzerland and datacite.org). Further studies describing logistics operators or projects business models paying attention on new ways to generate revenue or profits, are missing, and therefore establishing links between innovation, externalities, and potential business models is challenging. The following sections in this paper contributes with the analyses of these three elements within the context of our two logistic clusters/regions, and the ways they strive to create a 'logistics virtual cluster'.

Methodology

The present research followed a four stage process methodology according to Seuring (2006), suitable for supply chain and logistics research.

The first stage consists in identifying research questions, grounded in the FP7 SoCool@EU project, and enquires on the conditions to set up research-driven logistics clusters in EU regions. In the same stage includes the literature review mainly of the resource-based view and the innovation systems. From the review, the research concepts emerged, they were selected, and tested for their theoretical and project practitioner's relevance.

The second stage consists in selecting the cases and developing the instruments for data collection. The cases selection was constrained to two out of five logistics clusters in the SoCool@EU project. The Aragon Region and The Netherlands South-West & Flanders were chosen due to their similarities in terms of their importance for the regional economy as well as for its dissimilarities in terms of performance; which easy contrasting the effects of the logistics clusters conditions and their efficiency and innovation externalities, and business models. The instruments to collect data included online questionnaires, face to face interviews, firms and experts forums, and desk research. Each one of the instruments were developed and validated by professionals and experts from all the SoCool@EU partners, Aragón Region, The Netherlands West & South Flanders, the Rhein-Main Region (Germany), Øresund Region (Denmark/Sweden), and Mersin Logistics Cluster (Turkey).

The third stage is collecting data. The desk-research was for identifying logistics clusters background information and business models. Online questionnaires were sent to logistics and other logistics intensive companies within the cluster for identifying innovation drivers, barriers, and externalities. Interviews with logistics companies in the clusters helped to identify potential areas of inter-cluster collaboration based innovation; and workshops with logistics clusters companies and experts for preliminary definition of inter clusters joint fields of action. The third stage was the collection of information, which took place from January 2012 to August 2013.

The fourth stage is the organisation and presentation of the data. The data was reduced to tables and organised to identify similarities and dissimilarities across cases, as suggested by Koulikoff-Souviron & Harrison (2006) and Stuart et al., (2002). The two cases were presented in content-analytic tables, traditionally used for single case studies (Miles & Huberman, 1994). This process helped identifying and classify business drivers, barriers, and logistics

clusters externalities according to their business models. The use of this analytical approach is not comparative, but is to provide an organisational scheme for future research.

Preliminary findings

Supporting logistics clusters is strategic for the Aragon Region (AR) and The Netherlands South-West & Flanders (NSW&F) since companies planned to drive down costs and handle and deliver value taking advantage of the agglomeration economies. In Aragon Region (AR) started since early 80s with the creation of the logistics clusters, Transport City Zaragoza, and consolidation in the mid-90s with the creation of PLAZA in 2002, PLHUS in 2009, PLATEA in 2008, and PLFraga in 2009, and the Enterprise Pilot Award to the Excellence in Logistics given yearly since 2001.

In The Netherlands South-West & Flanders (NSW&F) started earlier and fully consolidated with the creation of Top Team Logistics (e.g. Logistics Action plan for The Netherlands in 2008; Strategic Platform Logistics in 2009 and Top Sector Policy in 2011). Our findings show that the more the strategic drivers become complementary between logistics operators and companies with important logistics operations, the more likely it is to identify business models for logistics inter-cluster collaboration for innovation, “logistics virtual clusters”.

ARAGÓN REGION (AR)

AR is located at the convergence of transportation routes that link the economically vibrant regions of Spain and South-West Europe; it built up substantial logistics infrastructures and favourable business environment, attractive markets, and industrial efficiency, which helped its competitive position among the top five logistics regions in Spain. Aragón in 2009 had a 26,700 EUR GDP per capita, 14% over the EU average, yet it faces the challenge to develop and strengthen its position as a logistics hub worldwide, given that it has only 0.6 employees in the transportation and storage sector per squared kilometre in the region (Eurostat, 2013). Companies in AR have tried to overcome the challenge by taking advantage of their efficiency and innovation externalities, yet with various limitations.

Drivers for absorptions of efficiency and innovation externalities of the logistics clusters

Price and cost efficiencies externalities (PCE). The search for monopolistic profits in AR in 45% of the surveyed logistics and related companies was through higher market shares which in turn may affect downstream the price suppliers charge to customers. Another way prices may have been improved downstream the supply chains, was through improved quality, effectiveness and efficiency of products, processes and services, which was reported in more than 25% of the companies. On the other hand, solid and stable supply chains may have allowed upstream externalities to lower input costs of the companies, which was reported as a strategy in circa 45% of the surveyed companies in AR. Furthermore, such cost reductions released additional resources used to increase the investments in wider range of products, processes and services reported in around 40% of the companies (SoCool@EU D2.1, 2012).

Cooperation efficiencies externalities (CE). The capability to cooperate of the AR companies is weak, but picking up. There are lessons to believe that specific sectors like land transport and warehousing, and air transport and water transport, which had long standing and consolidated cooperative capabilities between them correspondingly, may be taken as models for the rest of the region. Overall, in AR the advantage of cooperation externalities is more likely to happen with their supply chain partners and not much horizontally, and although to a lesser extent, also happens with end users and suppliers of leased transport equipment. There are limited experiences of AR companies in cooperating and networking with European partners (SoCool@EU D2.1, 2012). On the other hand, reportedly horizontal collaborations in AR have been emerging lately for the development of long-distance transportation solutions (CO3 Project, 2013) and logistics infrastructure operations.

Scale economies efficiencies externalities (SE). The logistics clusters have grown to an extent to represent one of the 5 key sectors to be part of the AR Smart Specialisation Strategies, and which will eventually be subject to receiving EU structural funds. It is unlikely however in the short term to change the fact that AR has a low population density, with 28 per km². On the other hand the province of Zaragoza concentrates 72% of the population of Aragón and has a population density of 56 per km², and the municipality of Zaragoza concentrates more than 50% of the population of Aragón with a population density of 296 per km². The latter is where the highest concentration of logistics and related companies are located in the AR. Additionally, the geographic position of AR is important to overcome this lack of local economies of scale, and in fact it is one of the factors leading the logistics clusters to look abroad. Even though AR only represents 2.89% of the Spanish population, it loads 4.6% of the Spanish cargo by road shipped to the rest of the EU-15; it moves 3% more cargo than the EU average by rail for a total 70,500 tons moves in 2005, compared to the Spanish average of 63,400 tons, and in 2009 the region moved 7.4% of the total Spanish air cargo (Eurostat 2013; INE, 2012).

Further findings show that in 2012 and over the next 5 years the region represents an important source of growth for the logistics and related activities (SoCool@EU D2.1, 2012). Increasing logistics and logistics intensive activities requires the availability of the specialised skills at the right time, and although in AR there is available labour, it is largely unskilled; which is why whilst around 85% of the survey respondents said it was important to have skilled labour, only around 60% perceived their labour to have the required skills (SoCool@EU D2.1, 2012), which means the presence of a skills gap of 25% in the logistic and logistics intensive activities.

Knowledge flows externalities. The flow of knowledge towards and from the logistics clusters in AR is substantial along their supply chains (KEV). 60% of the companies reported often to acquire knowledge upstream from their suppliers, whilst downstream from their clients was reported in around 35% of the companies. End customers are also part of downstream knowledge externalities for the logistic clusters reported in around 30% of the companies. Service firms to 60% of the companies in the survey have also oftentimes been important sources of knowledge.

Horizontal flow of knowledge (KEH) is more difficult to depict in AR, as companies tend to be secretive of their activities, yet it had been reported that 35% of the companies often acquire knowledge to reach the markets in innovative ways from competitors, and 50% from informal contacts, which are primitive but still very important forms of informal

collaboration. The authors consider important to highlight the often use of R&D institutes as sources of knowledge for around 30% of the companies in AR (SoCool@EU D2.1, 2012).

Barriers for absorption of efficiencies and innovation externalities

In AR, collaboration tend to happen for innovations in product, services, or processes. However companies have reported the presence of various barriers to innovation limiting the possibility of collaborations to happen. The main barriers are costs (57%), uncertainty of consumer demand (46%), limited finance (29%), lack of culture (29%), long term projects (17%), risks of emerging market followers (14%), limited human resources with the right skills (11%), dominant companies would not easy cooperation (9%), deficient information that limits the capacity to assess cost-benefits/efficiencies (9%), better to wait, see and follow (6%), and not enough reliable cooperation partners (6%) (SoCool@EU D2.1, 2012). Interestingly enough, no company argued the availability of services or know how to be a problem. Thus, the underlying assumption is that given the presence of services and know how in AR, the main risk for the companies in the region is any barrier to emerge before the amortization of the innovation investments. In this respect, the objective of ALIA, the industry association of Aragon including companies from all the logistics clusters of AR, is to participate in a coordination action to overcome the barriers and potentiate the drivers to absorb both efficiencies and innovation externalities. The next lines show various successful business models in AR where drivers offset the barriers within the amortizations periods for the projects/companies.

Emerging business models in AR

As seen in the literature, one can describe many elements of a business model, yet, the reader may agree that the strategy of an organisation to profit as much as possible from a given project may be the core element. This is, even with high revenues, if the company' profits lessen it risks in the long run to go bankrupt; on the other hand, even if the company has low revenues if there are high profits, it is more likely to survive in the long run. Collaborating for innovation between logistics companies or clusters requires compatible business models; this is, they do not interfere or they may even complement each other in their capacity to generate extraordinary profits in ways that individually would not be highly likely.

The business models of the AR logistics operators and logistics intensive companies or projects show similarities also to those discussed in the literature: logistics performance based models, joint shareholding with independent operations of logistics facilities, guaranteed savings, horizontal collaboration, Design, Build, Finance, Operate, Lease or Transfer (e.g. give away the operational responsibility or the ownership of an asset), risk and venture, and pay per service. Table 1 summarises some of the companies and projects in AR and their business models.

The next section presents the NSW&F case, with their most renowned business models in the last 10 years, and which together with the AR case, will advance our understanding of the relevance that certain business models play in the logistics clusters development.

The reader may recall the AR drivers to innovation in collaborative fashion to absorb the regional positive externalities. But the presence of barriers oblige AR and NSW&F to identify successful business models to help inform potential or expected venues to set up inter-cluster

collaborative projects and possibly to overcome such barriers. Truth be told; as it will be seen in the next section the companies in AR feel stronger barriers than the companies do in NSW&F.

Table 1. Business models in the AR Logistics Clusters from the 2000s to date

Company/projects	Performance based	Shareholding	Guaranteed savings	Resources sharing/reduction	Horizontal collaboration/ Joint Ventures	Design	Build	Finance	Operate	Risk and Venture	Lease/Transfer	Pay per service
Puente del Ebro Road transport infrastructure project connecting various industrial clusters and urban areas. Owned and the toll paid by the Aragón government per vehicle using the road.						✓	✓	✓	✓			✓
ADIF Logistics Center Zaragoza PLAZA Intermodal platform designed, built, financed, and owned by ADIF and leased to NOATUM Rail Terminal Zaragoza for its operation at its own risk						✓	✓	✓		✓		
PLAZA, PLATEA, PLFRAGA, PLHUS Public-Private Partnerships logistics platforms distributed in various locations in AR. Profits for selling at over the costs prices or leasing at price/time long enough for investments amortisation.		✓				✓	✓	✓	✓		✓	
Grupo Sesé 4PL operations with “non-contractual” guaranteed savings upon which fees are reviewed for better terms and conditions for the company. Road transportation with fees adjustable according to KPI performances agreed a priori between the company and the client. Clients’ outsources value adding services for a fixed fee handled by the company generating extraordinary profits by identifying continuous cost reductions with the same quality delivered by the company.	✓		✓	✓								
Oerlikon An industrialist company generating extraordinary profits from cost reductions based on reduced stocks and safety stocks.				✓								
Valeo Manufacturer and distributor with R&D capabilities with supplier development strategies applied to their clients, for identification of price/cost saving based on reengineered components and materials. Extraordinary profits from sharing the savings derived from cost and material use reductions from new developments.			✓	✓								
TAIM-TFG Designing, Build, Finance, and Operations of large scale logistics operations project developments (e.g. ports, mining operations, large volume general cargo storage) under performance based fees. The clients own the projects and pay for it. Extraordinary profits come from managing the operations at an adjustable fee to periodical performance reviews. If the operations are transferred together with the whole project, the extraordinary profits remain from interest charged from financing the projects.	✓					✓	✓	✓	✓		✓	
TAP Consultoría EPR, CRM, Logistics, and Information management process re-engineering design, and Software as a Service (SaaS). The service provider benefits from a fee paid per use, and the amount depends on the functionality of the software being queried. If the software provides value, it will be used by the client, hence generate extraordinary profits. The client does not have to pay for the software, and parts of its IT systems and process re-engineering fixed costs turn into variable costs.						✓						✓
Apyl-(Inditex) Apyl is an Original Design Manufacturer of minor processes for Inditex, also it designs and manufactures its own textiles. 90 % of its business is to handle, warehouse and manage logistics of outsourced textile from Inditex. It is a horizontal collaboration whereby Inditex and Apyl built an underground tunnel connecting their facilities for accelerating their logistics operations and solve the warehousing and stocks needs of Inditex. Apyl profits from its extraordinary stable relationship with its client, and reduces its costs with the reduced logistics operations throughout its underground connected facilities.				✓	✓		✓		✓			
ABB Power Technology-Carreras Engineering-To-Order manufacturing required to move bottlenecks with backlog capacity along the entire supply chain without oversizing the fabric. ABB required the logistics service provider, Carreras, to be part of the project managing the external warehouse and material delivery to keep backlog capacity at its optimum. The project evolved to require Carreras to operate “In-House” materials supply to assembly lines and warehousing. The project end to end resembles a seamless Engineering-To-Order/Assembly Line Delivery-To-Optimal Backlogs to reduce resource utilisation and cycle times of the supply chain. Both companies profit from cost and overhead reductions, and Carreras from extraordinary profitability throughout longer contractual terms.	✓			✓					✓			
Cooperativa Farmacéutica Aragonesa (ARAGOFAR) A joint shareholding with independent operations of logistics facilities from the AR pharmaceutical companies operations with an independent distribution centre capable of generating extraordinary profits from automated logistics operations resources reduction by		✓	✓	✓								

reducing reverse logistics, which would be otherwise impossible from each individual pharmaceutical company to achieve.																				
MANN+HUMMEL España. Extraordinary profits generated through a performance based monthly fee consisting on the possibility to order online and guaranteed a delivery time 50% lower than the industry average.	✓																			
Mercadona-Caladero Joint venture whereby Mercadona acquires Caladero and centralises its warehousing and processing operations in a facility in PLAZA Zaragoza with automated operations. Caladero is a dedicated supplier of fresh fish, and is expected to act upon Mercadona's distribution strategies. Extraordinary profits for Mercadona emerge from reduced cost and increase price premiums from strategic distribution of product anywhere in Spain from Zaragoza				✓	✓															
Cerler Global Electrónica Extraordinary profits emerging based on cost reductions from reduced material and warehousing utilisation, and the released resources and spaces allowed for increasing its productivity by 8%				✓																
ADIF-BSH Informal joint venture with formal agreement for a performance based project. Adif generates extraordinary profits from a sustained relationship with a large volume client by agreeing to provide quality and reliability and dedicated intermodal services platforms. BSH generates extraordinary profits from price premium from value added of reliable delivery and from reduced resources utilisation derived from reliable scheduling.	✓				✓															
ALIA Logistics cluster for formed to respond to the specific project needs of its members. Projects so far requested by its members are joint purchasing for scales economies and reduced prices for its members (e.g. multi-client trains), national and international inter-cluster collaboration (e.g. SoCool@EU) for better access to participate in ground breaking inter clusters companies projects		✓		✓	✓															

Source: Elaborated based on corporate information and information from the Aragón Pilot Award to the Logistic Excellence.

THE NETHERLANDS SOUTH-WEST & FLANDERS (NSW&F)

The NSW&F Cluster represents one of the central hubs for seaborne intercontinental goods flows entering and leaving the European Union. In 2010, Rotterdam ranked largest port in Europe and third largest port in the world in terms of total cargo volumes (429,926 million tons), with Antwerp (178,167 million tons) on second and 17th place respectively (American Association of Port Authorities, 2010). The cluster region is located in a geographically advantageous position in the centre of Europe, with a highly developed intermodal transport infrastructure and access to a wide, multinational hinterland. A strong logistics industry and a multifaceted company landscape, together with an advanced position in multiple fields of logistics and supply chain management research and education, make the region a leading knowledge and competence centre for global logistics. However, the cost of doing business is clearly a problematic issue for companies in this cluster.

Drivers for absorptions of efficiency and innovation externalities of the logistics clusters

Price and cost efficiencies externalities (PCE). 39% of the survey respondents considered the cost efficiency of regional companies to be very good or good, while 58% would attest very good or good quality awareness to them. Logistics value can be reached through decreasing logistics costs, and/or increasing services. Five types of logistics innovation can be distinguished: 1) product (or service); 2) process; 3) transaction; 4) relationship; and 5) business model. Innovative companies are often targeting to improve service and quality, to create new markets, to increase market share, to extend service package, to reduce resources, costs and environmental damage, to conform to regulations (SoCool@EU D2.1, 2012; Crujssen, 2006).

Cooperation efficiencies externalities (CE). A latent willingness to collaboration and exchange is present. However, cooperation is difficult, as companies often view each other as

competitors. In addition, an interview partner argued that cluster development at European level is imperative, as cooperation at local level is often not sufficient. Nevertheless, initiatives organised by the European Union with participants from many countries are mainly viewed sceptically, as it often resembles a forced collaboration without truly shared goals. Outcomes are mostly limited in terms of pushing content forward and looking beyond the companies' boundaries. Furthermore, a major shortcoming of EU projects is the extensive bureaucratic burden. Projects yield more benefits when conducted in a small scale, with flexible structures and timeframes, minor bureaucratic load and targeted at stimulating a few leading firms (SoCool@EU D2.1, 2012).

Scales economies efficiencies externalities (SE). The image of the logistics sector is of high importance for the economic welfare of the area. In public opinion, it lacks the image of a fast-moving, innovative industry. This has direct adverse consequences for multiple aspects, e.g. for the attractiveness of the sector for the skilled labour force. The strong demand for skilled workers cannot be matched by the labour force supply in the cluster region, and future scenarios mostly expect a further increase in labour demand. It becomes obvious that educated professionals are scarce and the competition for highly skilled labour is fierce (Commissie Van Laarhoven, 2008; Meerjarenprogramma Infrastructuur, Ruimte & Transport (MIRT) en Verkenning Antwerpen Rotterdam (VAR) & Visieafspraken MIRT-VAR, 2011; NEA en ABN AMRO, 2012; TNO, 2008).

Knowledge flows externalities. Although the region has broad logistics experience in the form of knowledge and educational institutes with many opportunities for practical and theoretical education in the logistics sector, labour problems remain, such as the low inflow of students in logistics education as well as the loss of experts to other sectors (NEA en ABN AMRO, 2012; TNO, 2008). Employment in the sector is not very attractive, given the specific requirements in terms of flexibility, pay and career path. A closely related issue is the general image of the sector, which is in need of improvement (NEA en ABN AMRO, 2012).

Barriers for absorption of efficiencies and innovation externalities

Economic factors, such as the lack or uncertainty of customer demand for innovation as well as the costs of innovation, stand out as the largest barriers for innovation. In contrast, regional companies are not afraid of being copied. The regional industry further seems not to suffer from a weak support and knowledge base, as the availability of external services and know-how was rarely seen as limiting for innovation (SoCool@EU D2.1, 2012).

Profit margins are shrinking, especially in the transport-intensive commodity producing sectors, efficient logistics management can be the decisive success factor for a company. The main barriers for shippers are time compression, reliability (of deliveries), standardisation, just-in-time (inventory strategy), flexibility and customisation. The main barriers for LSPs (Logistics Service Providers) are the severe difficulties with new demands, declining profitability of Dutch road transport companies over the last 10 years. It turns out that since 2002 road transport companies on average are losing money. The most prominent reason for this slack financial performance of LSPs is that they cannot transfer the increased operating costs to their customers. This unbalanced market power creates the dead-loop for LSPs (Crujssen, 2006).

Emerging business models in the NSW&F

Table 2. Business models in the NSW&F Logistics Clusters as of 2010

Selected R&D and demonstration projects and initiatives / triple-helix involvements	Performance based	Shareholding	Guaranteed savings	Resources sharing/reduction	Horizontal collaboration/ Joint Ventures	Design	Build	Finance	Operate	Risk and Venture	Lease/Transfer	Pay per service
SCF2.0 It aims to examine new SCF models and tools that look into collaborative pre-shipment financing both short term and long term. Partners: Nyenrode University, Eindhoven University of Technology, Involvation Interactive, Asyx International, Philips, ASML, Heineken, DHL, Friesland Campina						✓	✓	✓	✓	✓	✓	✓
ProSelo It aims to perform research for innovative solutions for service control towers in order to achieve significant better system up-time whilst at the same time reducing TCO (Total Cost of Ownership) and improving competitive advantage Partners: Eindhoven University of Technology, Erasmus University Rotterdam, University of Twente, Service Logistics Forum, ASML, Ceva Logistics, DAF Trucks, Fokker Services, Gordian Logistic Experts, IBM, Océ Technologies, Marel Stork Poultry, Processing, Thales, Vanderlande Industries	✓					✓	✓			✓		✓
4C4More The key idea behind 4C (Cross Chain Control Centers) is to create economies of scale and scope through inter- and intra-supply-chain collaboration. Partners: Eindhoven University of Technology, Bakker Logistics, Cordys, AT Kearney or EyeOn, IBM, ING, Itude, Kuehne en Nagel, Nabuurs, Unilever Benelux, RSM/EUR, Universiteit Twente, Vrije universiteit	✓	✓	✓		✓	✓	✓					
Ultimate- Efficient Multimodal Hinterland Networks The objective is to develop a viable multimodal hinterland network concept, based on the Extended Gate that fits with global supply chain requirements, optimises the use of all available information in that supply chain, removes all operational and administrative bottlenecks in sea ports and builds on new concepts of cooperation between operators. Partners: EUR/RRSM, Erasmus School of Law, Eindhoven University of Technology, Erasmus School of Economics (RHV BV), ECT Participations BV, Havenbedrijf Rotterdam, Modality Software solutions BV, Brabant Intermodal BV, Portbase BV, Keyrail BV, Haven Amsterdam, NV Regio Venlo	✓	✓	✓		✓		✓		✓			
Cross-chain order fulfilment coordination for internet sales The project aims to develop new concepts, models and solution methods for a number of challenging innovations in the internet order fulfilment process, as well as to better explain the 4C concept in the context of internet orders. Partners: EUR/RRSM, VU University Amsterdam, University of Amsterdam, Neckermann.com, mYuice, Centraal Boekhuis, Scanyours.com, Sectorinstituut Openbare Bibliotheken (SIOB), Vereniging Openbare Bibliotheken (VOB)	✓	✓	✓		✓	✓	✓					
Extended Single Window The objective of the project is to create reliable, secure, and cost effective logistic chains throughout The Netherlands supporting all applicable regulations and procedures, by embedding events for government controls in supply chains based on safeguards in processes of certified supply chain partners, re-use of business transaction data by government agencies, and enabling existing Port Community Systems to behave as one Information Service Bus with innovative IT. Partners: TNO, Universiteit Tilburg, Technische Universiteit Delft, Fontys Hogeschool, NHTV, ACN, Arrow, Cargonaut, Dohler, EVO, Frugiventa, Gaston Schul, Herballife, NV Regio Venlo, OCE, Portbase, Schiphol N.V., FloraHolland, Mattel, Havenbedrijf Rotterdam, Havenbedrijf Amsterdam	✓	✓	✓			✓			✓			
Planning Services This project will make Spare Parts Planning Control Tower Technology available to Small and Large Scale Maintenance Organizations and solve the HR problems (availability of required skills), as well as improve the actual planning performance of outsourcing companies, improve their (internal or external) service levels and reduce their operational and capital costs. Partners: Gordian Logistic Experts, Eindhoven University of Technology, Nederlandse Defensie Academie, NedTrain, Alstom Transport, Defense Materiel Organization, ECT, Fujifilm	✓					✓	✓		✓	✓		
Logistiek in de Bouwsector It aims to demonstrate a new logistic 4C concept in the construction sector. Large companies and SMEs will work together across supply chains to realize important efficiency benefits and reduce logistic costs. Partners: Ballast-Nedam Sustainability Services B.V., Unidek B.V., Keller Keukenfabriek B.V., Oskomera Solar Power, Solutions B.V., Verweij Houttechniek, Berkvens B.V	✓	✓	✓		✓	✓	✓		✓			
Value Creation by closing the loop	✓	✓	✓		✓	✓	✓					

It aims to develop a framework of conceptual models and algorithms for 4C in the context of closed loop supply chains, and a working Product Routing Algorithm, as well as to launch a 4C business. Partners: EUR/RSM, University of Tilburg, 12Return, Logitech, EVO, Spring Global Mail, PincVision																			
4C4D It focuses on collaboration in distribution and coordination between logistics service providers and between LSPs and retailers, i.e. the bundling of physical good flows into (urban) areas, resulting in fewer negative impacts (decongestion, less nuisance in cities). Partners: Tilburg University, TU Eindhoven, TU Delft, TNO, Ahold, Cornelissen Transport, Etam Retail Services, Ortec, Peter Appel Transport, TNT, Transmission, TLN-KDN	✓	✓	✓	✓	✓	✓													
Da Vinc3i It aims to strengthen the international leading competitive position of the Dutch horticulture sector in a global, virtualised trade network by researching (1) the opportunities for new coordination, consolidation and collaboration concepts in extended international tradeparc networks and (2) the possibilities for making chain information directly and real-time available and usable to support decision making of all authorised partners in the horticultural network. Partners: Wageningen University, Technische Universiteit Eindhoven, Vrije Universiteit van Amsterdam, TNO, Stichting DLO, ArgusI, StartLife/CoE DAFNE, Floraholland, VGB, Productboard of Horticulture, Transport Logistiek Nederland, Gro4U, Rijnplant, Oriental Group, Hamplant, De Gooijer International, Greenport Logistics, Stet Heemskerker, Te Baerts, Platform Agrologistiek, GKC Ketens en Agologistiek	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Sense and Response It aims to develop and demonstrate concepts and value-added services related to supply chain control in international multi-modal transportation for high-sensitive products, and the underlining techniques and tools for real-time monitoring Partners: Antaris Solutions B.V., Panalpina, Nycomed, AirFrance KLM Cargo, Antaris Solutions B.V., 4TS Corporation Oy, Universiteit Twente, Ambient Systems, Cargobox							✓	✓		✓	✓								
SIEEG (Secure information exchange extended gate) It aims to achieve an efficient and secure information exchange through standardised protocols combined with an extended gate functionality in available and accessible forms for all logistical operators and agents, and to increase time efficiency by 60%, and thereby the ability to handle a larger volume of goods. Partners: Combi Terminal Twente, Bolk Transport, Burger Logistics Services, MCS Meppel B.V., Universiteit Twente							✓	✓	✓	✓	✓								
SALOMO (Situational Awareness for Logistic Multimodal Operations in container supply chains and networks) It aims to develop a theoretical model to understand situational awareness and collaboration in supply chain planning and decision making, and a toolbox for planning and decision making; Partners: TRAIL Research School, TBM/TU Delft, CLST/Open University, TBA, In There, Rotterdam World Gateway, APM Terminals, Maasvlakte 2, Teamsupport	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓				
Bundelen bij de bron Bundling the source aims to make the store ready consignments of fashion in the production source in China. The advantages are lower handling costs for the supplier and bundled transport to the store. Partners: Greenway Logistics, Ewals, AMFI, TU Eindhoven, Eyefreight, MODINT	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Logistic Accelerator It aims to strengthen the position of logistics and supply chains, and therefore, to stimulate the economic growth. Partners: Dinalog, Tilburg University, NHTV, BOM, REWIN, EIZ, Syntens and other Dutch companies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dinalog Incubator It aims to stimulate new business spinoffs within the logistics and supply chain management sector. Partners: Dinalog, Dinalog Academy, Dinalog Campus, Dinalog Laboratories, Dinalog Experience, Dinalog KDC's, Sarterslift Erasmus Universiteit, KvK, Syntens, ROM's, NHTV, Universiteit van Tilburg, TU Eindhoven	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kennis DC's The aim is to create a national network of logistics knowledge DCs with a smart interdependence and cooperation to achieve between the field and the logistics HBO knowledge institutions. Partners: NHTV, Fonhys, HAN, Hogeschool Amsterdam, LPL, Hogeschool Rotterdam, Windesheim, TLN, Agrologistiek, DHL, EVO, Dinalog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dinalog (Dutch Institute for Advanced Logistics) Dinalog was founded in 2009. It is a national logistics cluster and a foundation for R&D and demonstration projects, as well as for national and international initiatives (e.g. Urban Europe JPI) in the area of logistics and supply chain management.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Inter Cluster Fields of Joint Action

AR and NSW&F, together with the Rhein-Main Region (Germany), Øresund Region (Denmark/Sweden), and a mentored region, Mersin Logistics Cluster (Turkey), have the objective to potentiate the development of their logistics and related companies. Within the context of the SoCool@EU coordination action AR, NSW&F and the rest of the regions put forward 6 fields of joint action from which intra and inter regional logistics clusters collaborations are expected to emerge between AR and the NSW&F (SoCool@EU D3.2, 2013), assuming the business models of the participants complement each other.

The first field is *Advanced Supply Chains and ICT*; it consists in the design and optimisation of supply chains, this is a central issue for the European logistics industry, demanding ever more sophisticated and integrated solutions. Increasing the interoperability of information systems of actors in a supply chain is the key to persist in the global competitive race for supply chain reliability, time and cost.

The second field is *Cluster Development and Internationalisation*; this promotes cooperation between actors of the triple helix in European logistics cluster opening up new possibilities to promote firm internationalization, capitalize on the European marketplace, integrate knowledge bases and push on common agendas.

The third field is *Green Logistics*; optimising logistics activities under the premise of ecological sustainability will become a key asset in the future logistics market and a prerequisite to reach the goal of reducing greenhouse gas emissions in the European Union.

The fourth field is *Intelligent hubs*; efficient transport and storage are highly dependent on shared infrastructure assets for economic development and an essential competitive advantage of European citizens and enterprises.

The fifth field is *Knowledge transfer and valorisation*; the ability to transfer and integrate external knowledge is increasingly important for logistics companies to stay ahead in the global race for innovation. There is still potential for companies to make better use of research institutions and their work in practice.

And the sixth field is *Urban logistics*; innovative urban logistics concepts are necessary to provide a sustainable supply of goods and services to the customer in highly complex and concentrated urban living environments (SoCool@EU D3.2, 2013).

In sum, the logistics virtual regions seem to need combinations of business models supporting resources and knowledge sharing, mainly horizontally, and with the design, build and operation of pay per service interoperable infrastructures (incl. software). The fees could be paid per use either by the private and/or the public and the amortisation of investments protected by setting up long term contractual arrangements between the operator of the solutions and the public/private users. The combination of business models may bring flexible solutions for the complex and sustainable environments of the future in EU.

Conclusions

From the emerging fields of action in which AR and the NSW&F are building up their commitments to establish logistics virtual clusters, several potential complementary business models emerge, including performance based, shareholding with independent operations, resource sharing and reductions, horizontal collaboration/joint ventures, and pay per service. The business models for BDFO, Risk and Venture, and Lease/Transfer require excessive time frames for the amortisation of investments, unless public entity is willing to finance DBO projects, given the current crisis drove most of the logistics operators and its clusters at the edge of their profitability.

The experience that logistics operators and logistics intensive companies have, especially in the NSW&F, can be used to pull relevant knowledge to respond with the most recent business models required for multiple projects, thus with the potential to set a sustainable 'logistics virtual cluster' between AR and the NSW&F.

According to the results, the externalities of AR and NSW&F can complement each other to create logistics virtual cluster, AR benefiting from the scales economies in the NSW&F, and NSW&F from the price and cost efficiencies externalities in AR. Although, given that AR is driven more by tangible products/processes/services/technologies/systems, and the NSW&F by profitability, both can equally benefit from cooperation efficiencies, specialised human resources, and horizontal flows of knowledge.

In conclusion, authors suggested initially to pay more attention to clusters with cultural and cognitive proximity, and the AR and NSW&F cases presented offer ways to assess proximity of logistics clusters based on their availability knowledge of new business models.

Thus, the capacity of logistics clusters can aid its companies in the development of suitable business models and related solutions benefiting the client and the profitability of the companies sustained in future inter-cluster relationships, 'logistics virtual clusters'.

Future research, managerial, scientific and cluster policy implications

The following steps in this research include the identification of the companies in the logistics clusters interested in setting and joining inter-cluster projects, all within the context of SoCool@EU coordination action. Further, the authors will be able to identify the most suitable business models for each emerging project based on empirical evidence. This has several implications: 1) *practical*, it allows to have clearer understanding of the inter-clusters project development; 2) *managerial/strategic*, the projects business models would be comparable with each other and with the individual companies'. Also, business models can be evaluated throughout the life cycle, bringing light on the ways they interact and change over time, and their relation with the innovation drivers and externalities being exploited; 3) *scientific*, the authors can report on logistics services and logistics clusters business models based on empirical evidence, and 4) *cluster policies*, policy makers will be able to disentangle the most successful business models and the way they evolve, for devising mechanisms to promote and support inter cluster collaborations along the entire life cycle.

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