

Antecedents and Outcomes of Logistics Cluster Benefits – a Delphi Panel Method

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Abstract

Purpose: This paper aims to identify the antecedents and outcomes of the formation of Spatial Logistics Clusters (SLC) and their performance using a Delphi panel method.

Research background: The logistics industry contributes about 9% to Australia's GDP with \$132 billion value added and 1.2 million people employed, providing the context of logistics clusters. Potential enablers of logistics cluster benefits (LCB), value added logistics services (VALS) and proximity have been partially investigated. However, the role of supply chain integration (SCI) and the contribution of all enablers to LCB and the influence of LCB on the firm's logistics performance (FLP) are unexplored. This paper identifies the antecedents of logistics cluster benefits (LCB) and examines the relationship between LCB with the firm's logistics performance (FLP).

Design/methodology/approach: This study applies a Delphi panel, comprising experts from academia, industry and government, to methodically identify the main sources of LCB and their outcomes impacting FLP.

Findings: The Delphi outcomes enabled validation of a conceptual framework derived from the literature and modifications to constructs identifying, *co-location*, *VALS* as direct antecedent/enablers of LCB and *targeted specific logistics infrastructure* and *SCI* as mediating factors. A positive link between LCB and various aspects of FLP was confirmed by the panel of experts.

Practical implications/Originality/Value

The application of the DELPHI method to identify the antecedent/enablers of LCB, and explore the outcomes of LCB on the firm's logistics performance is the key contribution of this study. The Delphi provides an evidence base for policy makers and strategic planners seeking guidance on resourcing, promoting and developing logistics clusters. This research is of practical value providing ex-ante information to firms who are seeking; logistics efficiencies in a cluster, share in wealth creation in growing logistics conglomerates.

Keywords

Logistics clusters, firm's logistic performance, value added logistics services (VALS), spatial logistics clusters

1. Introduction

A cluster was defined by Porter, Michael E (1998, p. 199) as a “*geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities*”. Porter (op.cit.) extended the scope of a cluster downstream to channels of distribution and customers, laterally to manufacturers of complementary products, institutions such as those performing research and the government and specialized entities.

Industrial clusters are defined by Rivera, Gligor and Sheffi (2016, p. 243) as “*groups of inter-related firms that co-operate and compete to create wealth within a certain geographical area*” interpreting (Porter, Michael E 2000, pp. 15-42). Rivera *et.al* (2016) also argued that logistics clusters (LC) have similarities to industrial clusters and that the above definition can apply to LC. Definitions which differentiate LC from industrial clusters are discussed below.

LC may comprise industrial firms who have a significant part of their operations comprising logistics activities (Sheffi 2010, 2013). Logistics clusters were defined by Sheffi (2010, pp. 11-7) as “*includes companies offering logistics services, such as transportation, warehousing, distribution*”. This simple definition was expanded to a more detailed one (Sheffi 2010, p. 468) to include all firms with “*logistics-intensive operations*”, consisting of three types of companies and activity mixes as follows:

- “*Logistics services providers such as transportation carriers, warehousing, specialized consulting and IT providers, 3PL’s, forwarders and customs brokers. (The terms 3PL/4PL Logistics Service Provider (LSP) are used hereafter to refer to an entity that combines activities of transport, warehousing, special storage, quarantine clearance, surveying, customs, documentation, consolidation, break-bulk etc.)*”
- *Companies with logistics intensive operations.*
- *The logistics operations of industrial firms such as distributors for retailers, after-market parts suppliers.”*

Spatial logistics clusters (SLC) is a term coined by Chhetri, Butcher and Corbitt (2014, p. 231) can be defined as “an area of high concentration of aggregate logistics industries or employment surrounded by other areas of high concentration”. SLC’s are integrated into this research because Chhetri, Butcher and Corbitt (2014) have analysed the composition of industry in this category enabling SLC to be used as the base of a ‘logistics cluster’.

There is an extensive literature on the characteristics and benefits of industrial clusters, but little is known on the antecedent/enablers of logistics clusters, their benefits as well as impacts on the performance of firms in the clusters. This gap also applies to the relatively new SLC concept where research is yet to establish the policy benefits to the logistics industry. This paper therefore addresses these research issues by proposing an initial conceptual model indicating the relationships between the antecedents and outcomes of logistics cluster benefits. A revised model which is

informed by the Delphi panel analysis is presented (this model will be validated by a survey at a later stage).

The remainder of this paper is presented as follows. A review of literature in the section 2 culminates in a proposed conceptual framework, followed by section 3 discussing the research methodology. Section 4 is an analysis of data and discussion of findings. Section 5 concludes with a discussion of future research directions.

2. Literature review and conceptual model development

Research around the concept of hubs and clusters (Bolumole, Closs & Rodammer 2015; Zhou, Wang & Sun 2014) did not specifically mention the concept ‘logistics cluster’ until it emerged in the work of several authors such as Chhetri, Butcher and Corbitt (2014); Rivera, Sheffi and Welsch (2014); Rivera, Gligor and Sheffi (2016). This underscores the relatively recent interest in the field as Rivera, Gligor and Sheffi (2016, p. 242) noted that “*although there is a notable industrial clusters literature, the research on logistics clusters is still in its infancy*”.

Examples of logistics hubs that are really logistics clusters are inland terminals for cargo consolidation and deconsolidation e.g. Altona, Barnawatha, Ettamogah, Moorebank, Chullora in Australia, where value added logistics services are provided and networked logistics infrastructures of Antwerp, Charleroi, Ostend, Zeebrugge, Liege and Ghent in Belgium Meersman and Nazemzadeh (2017). The examples of Zaragoza and the Pearl River Delta, China Sheffi (2012) as well as Singapore, Dubai and Rotterdam are cited by Chhetri, Butcher and Corbitt (2014). In all such instances Chhetri et.al have attached a connotation to hubs that they are one and the same thing as logistics spatial clusters.

2.1 Logistics cluster benefits (LCB)

Logistics clustering results in five benefits for firms arising from opportunities for; collaboration, provision of value added services, upward mobility of labour, job growth at multiple levels and regional growth Rivera, Gligor and Sheffi (2016).

Sheffi (2013) noted that collaboration is a phenomenon also observed in industrial clusters following Grandori and Soda (1995). Cluster theory has already identified collaboration, growth of jobs and upward mobility as cluster benefits (see Table 1), so the occurrence of these phenomena in a LC is expected. In a logistics context the offering of value added logistics services (VALS) requires collaboration. Opportunities to collaborate around the offering of VALS therefore offers a unique benefit in the LC context. Logistics services in any form are not discussed in economic cluster theory with the exception of Rivera, Gligor and Sheffi (2016).

In the context of a cluster, collaboration takes many forms. Horizontal collaboration is facilitated by the presence of a logistics provider who provides 3PL/4PL services, to coordinate use of ship/aircraft, warehousing capacity, demand based expansion and contraction of capacity and availability of specialized workers. Thus, it can be seen that opportunities to offer logistics management activities (3PL/4PL) is a LCB Sheffi (2013).

LCB may be enabled by future opportunities to partner with an incumbent horizontally and vertically, as happens in ports Notteboom, T and Rodrigue (2005). A firm offering such partnering opportunities is a magnet to other firms who would use its services and is consistent with cluster theory predicting collaboration (Porter, Michael E 1998; Rivera, Gligor & Sheffi 2016). LCB may also result because of strategic reasons, e.g. seeking the benefits of diversification to mitigate risk. For example, shipping lines have diversified by acquiring 3PL/4PL, owning terminals and land transport to control the supply chain. The base for this could be located in a logistics cluster (usually a port) (Notteboom, TE & Winkelmanns 2001);(Rodrigue & Notteboom 2009). Here the LCB of tactical collaboration enables sharing of assets and creates interdependence of firms. Then outcome of collaboration is lower logistics transport costs, customer retention and greater customer intimacy (customer engagement)(Bowersox, Closs & Stank 2000; Porter, Michael E. 1991).

Table 1. Benefits of clusters and logistics clusters in the literature

Benefit or advantage	(Mars hall 1890)	(Ohlin 1933) (Hoover193 7, 1948)	(Weber 1929)	NEG (De Palma et al. 2011; Krugman 1998; Spulber 2007)	(Fujita et al. 1999; Krugman 1990)	(Storper 1995, Newlands 2003)	(Porter, Michael E 1998, 2000)	MAR (Glaesser 1992, Arrow 1962,Romer 1986 Marshall 1890)	Growth pole (Perroux 1950, Parr 1999) Cella (1984)	Logistics clusters (Rivera, Gligor & Sheffi 2016; Sheffi 2012)
Impacting labour										
1) Pooled market for specialised labour	x			x			x			x
2)Availability of non-specialised labor	x						x		x	x
3) Specialised skill pools develop	x			x			x			x
4)Varied labour markets are created		x		x			x			x
5)Knowledge spill overs							x	x		
Technological spillovers	x						x	x		
Mobility							x			x
Spatial										
Transport cost and Accessibility		x	x	x	x			x		x
Proximity	x			x	x		x			x
Collaboration/ networking						x	x	x	x	x
Enhanced buyer/seller interaction	x	x		x						
Scale/scope economy		x		x						
Macroeconomic										
Local competition							x			
Local monopoly								x		
Regional growth					x		x	x	x	x
Logistics specific										
Offer Value logistics added services										x

Job diversification to sub-clusters and value added services that attract other service providers, suppliers was noted by Porter (1998, 2000). Sheffi (2013) gave the example moving up the value chain to provision of value added services. He cited the example of YCH Global Logistics which evolved from a simple passenger transport company to a regional 4PL and then up the value chain

as a niche provider, developing specialised supply chain software which it now sells via a subsidiary Y3. Y3 is similar to UPS which offers dedicated supply chain solutions to customers. Therefore in addition to the horizontal collaboration above it appears that vertical diversification occurs in LC.

Finally, economic theory offers an insight into another noteworthy benefit of logistics clusters. A cluster can result in the evolution of linkages upstream and downstream as well as horizontal linkages e.g. with LSP's. Such linkages are recognised in economic theory Krugman (1990) as backward and forward linkages which create positive feedback via a self-perpetuating process, "*reciprocal reinforcing feedback mechanism makes it more attractive as it grows*" (Sheffi 2013, p. 481). In simple terms the benefit is that a cluster can become a magnet to firms and perpetuate itself.

2.2 Antecedents or enablers of logistics cluster benefits (LCB)

The antecedents or enablers facilitating LCB are location (proximity), VALS and its components, SCI, are discussed next. The discussion on enablers of LCB is made in the context of related concepts of spatial logistics clusters (SLC) Chhetri, Butcher and Corbitt (2014) and that of logistics clusters (Rivera, Gligor & Sheffi 2016; Rivera, Sheffi & Welsch 2014). Both authors drew on a long history of research on agglomeration theory and cluster theory (co-location) in the industrial organisation literature. They identify the following key sources of anticipated benefits that provide an incentive for logistics related industries to co-locate:

i) Lower transport costs; ii) Skills availability and labour pooling; iii) Agglomeration effects
iv) Potential to collaborate via interfirm networks; v) Leveraging government planning preferences directed towards logistics infrastructure investment which can encourage concentration of like industrial/commercial activities; vi) Efficiency gains from economies of scale and scope; vii) Superior transport services; viii) Potential for future cluster growth and wealth creation.

2.2.1 Co-location

Co-location helps generate logistics clusters with a related stream of benefits. Marshall (1890) introduced the benefit of spatial proximity (nearness) in his seminal contribution to the concept of clusters, postulating that firms experience external economies of knowledge sharing, labour pooling, development of a supplier base and increasing returns called agglomeration economies (AE) when they co-locate in geographical proximity. Traditionally, these Marshallian AE are localization economies that occur when similar plants from the same industry locate in spatial proximity.

Efficiency gains result from co-location of firms, as noted by Chhetri, Butcher and Corbitt (2014), and Vom Hofe and Chen (2006). Chhetri et.al (op.cit) suggested that part of this efficiency gain is from:

1) Co-location creating savings in transport driven by proximity (Banister & Berechman 2003; Fujita & Krugman 2004; Fujita et al. 1999; Fujita & Thisse 1996). The literature does not identify

possible changes and benefits to production fulfilment like implementing just in time production (JIT) which is facilitated by proximity.

2) Efficiencies resulting from the diversity of products exchanged within the cluster. The creation of a logistics landscape based on proximity facilitates diverse transactions Waldheim and Berger (2008) which Chhetri, Butcher and Corbitt (2014) claim Australian logistics service providers have similarly created to benefit from diversity of industry.

3) Efficiencies arising from interfirm networks e.g. Parma Ham and Swiss watch industry, sharing resources and capabilities within the region e.g. activity sharing (Chhetri op.cit.), employee sharing (Rivera, Gligor & Sheffi 2016). Efficiencies that are transport related e.g. consolidation, back-haul utilisation, optimal capacity haulage, cross docking, packaging, labelling, and assembly, rely on proximity and collaboration, and drive cost effectiveness (Rivera, Gligor & Sheffi 2016).

Targeted logistics infrastructure investment by the State's programs Chhetri, Butcher and Corbitt (2014) can be directed at locations whereby the co-location of firms and concentration is most likely to succeed e.g. the Zaragoza facility Sheffi (2012) . Such investment comprises the inter-capital road and rail networks and last mile urban networks; nodes for interchange like seaports and air ports and inland "dry ports" and dedicated infrastructure which has evolved by design or organically where industry locates. This infrastructure can also be funded by private enterprise Bolumole, Closs and Rodammer (2015) as in the Fort Worth Alliance facility.

Infrastructure availability contributes to accessibility and gives rise to agglomeration economies (AE) (Fujita & Thisse 1996, 2013). AE are benefits of wealth creation external to the firm from regional economic growth Sheffi (2012a, 2012b). Wealth creation can result in the success of a cluster making it attractive to potential investors, thereby ensuring perpetuation of the cluster (Krugman 1990; Rivera, Gligor & Sheffi 2016).

However ,such investment may require subsidies Notteboom, TE and Winkelmans (2001) and/or be justified based on wider economic benefits (WEBs) (Banister & Berechman 2001; Barnett et al. 2013; Graham 2007a; Hensher, Ellison & Mulley 2014). Identifying the nett public good (to justify subsidies) in these investments requires analysis of WEBs in decision frameworks. (This is an exercise fraught with difficulties the analysis of which though possible is out of the scope of this study).

Co-location is fundamental to the concept of spatial logistics clusters which are "*areas of high concentration of aggregate logistics industries or employment surrounded by other areas of high concentration*" Chhetri, Butcher and Corbitt (2014, p. 231). Whilst the author's findings accord with the extant literature Chhetri et.al made specific observations relevant to co-location:

1. Harnessing agglomeration effects of logistics hubs (service industry), as a substitute for declining manufacturing industry, to create a transforming growth pole
2. Governments can use cluster based policy to promote growth, optimal freight corridors and create growth poles
3. The co-location and the interaction of firms can lead to further wealth and cluster creation.

The co-location of firms enables the provision of VALS discussed next.

2.2.2 Value added logistics services (VALS)

The provision of VALS meets customer needs of availability, quality of offering and value for money of the offering, enabling supply chain transactions to proceed smoothly.

Value added services in logistics management relies on a strategy of combining service components. in a process called servitisation Vandermerwe and Rada (1988), where firms develop service offerings that support their products to gain differential competitive advantage. As an example, the combination of postponement, agility, reverse logistics services, IT integration and green supply chain management can result in the opportunity to provide value added logistics services (VALS) Rivera, Gligor and Sheffi (2016).

The co-ordination of the above services requires collaboration and services of a 3PL/4PL Sheffi (2013). A logistics cluster is also conducive to collaboration Sheffi (2013) which is a requirement Trentin (2011) for strategies of postponement. Collaboration with a logistics service provider (3PL/4PL Trentin (2011) is critical for the execution of postponement services like tagging, picking, merchandise preparation for retail point of sale display and for quick response capability, all of which are critical to the success of value added offerings.

Postponement, agility and reverse logistics are examples of value added services in a cluster (Christopher 2000; Christopher & Towill 2002) facilitated by proximity as well as collaboration through buyer/manufacturer/supplier integration. Agility is the quick response to meeting customer needs of product availability and is linked to postponement, consolidation of all operations beyond production Rivera, Gligor and Sheffi (2016). Supply chain agility (SCA) is important because volatility, uncertainty and variable demand conditions characterising a rapidly changing business environment require quick and timely response which agility provides Li et al. (2008). A logistics cluster is conducive to agility because of the proximity of firms and availability of a mobile skilled work force, both of which are present in clusters.

The opportunity to provide reverse logistics activities supports the provision of value added services Rivera, Gligor and Sheffi (2016). The authors (op.cit.) cited how a manufacturer collaborated with FedEx (providing 36 hour turnaround on repairs), and a 4PL that invested in Panama to enable cost effective refurbishment and repair for its US client. Selling the services to other manufacturers enabled economies of scale for the 4PL. The example also illustrates how collaboration enabled backward and forward linkages which resulted in both cost savings and customer benefits.

Hazen, Cegielski and Hanna (2011) examined the adoption and impact on competitive advantage of green supply chain management practices (GSCM) in particular, green reverse logistics (GRL) commenting (p. 375 op cit) that “*employing GRL for implementing GSCM may be thought of as an innovation because it can provide new business opportunities*”. They identify reuse (unused or lightly used, no upgrade needed), remanufacture (repair, refurbish) and recycle (recovery of anything requiring value or environmentally driven compliance) as components of GRL. GSCM which uses reverse logistics contributes to LCB because it boosts the environmental footprint of the

cluster and the collective corporate social responsibility of firms in the cluster whilst contributing to the environmental credentials of the Firm's logistic performance (FLP).

The ability to perform reverse logistics and GSCM is attractive to firms choosing to locate in a cluster because it creates other opportunities like knowledge-based services and opportunities to on-sell offerings and is thus an enabler of LCB. Collaboration relies on the ability to integrate externally which is now discussed in the next section on supply chain integration.

2.2.3 Supply chain integration (SCI) strategies and processes

The idea that Supply Chain Integration (SCI) requires the management of activities, seamless linking of processes within and outside the organisation was identified by Flynn, Huo and Zhao (2010); Yuen and Thai (2017a). That SCI should also include a joint approach to planning the supply chain as well as partnering in the process is noted by Cao et al. (2010).

Yuen and Thai (2017b) noted connectivity and simplification as critical elements of SCI. Connectivity is the linking of external operations between firms and operational units intra-organization. Simplification is the elimination of superfluous processes and activities that do not add value (Chen, Daugherty & Roath 2009). In order to achieve connectivity and simplification Yuen and Thai (op.cit) identified the importance of integration at levels of information, operations and relationships.

SCI relies on the principle that internal integration (II) and external integration (EI) impact efficiency and long term customer relationships (Kim 2009; Yang, Yeo & Thai 2015; Yuen & Thai 2017a, 2017b). In the context of a cluster where the intent is to be efficient, collaborate and optimally use resources, it can be seen that SCI helps achieve these goals.

The elements of II and EI according to Yuen and Thai (2017b) are:

- II - Information integration which comprises, systems collaboration, EDI, warehouse management and automatic replenishment systems, demand forecasting.
- Operational integration being, intra –firm process simplification through joint activities and work processes e.g. vendor managed inventories, integrated production planning.
- Process integration helps connectivity and simplification and requires a commitment to long term relationships.
- EI - A commitment to long-term relationships.

Process integration helps connectivity and simplification and requires a commitment to long term relationships. According to Yuen and Thai (2017b); Kim (2009), there needs to be a strong commitment to integrate processes evidenced by a commitment to long-term relationships. Such long-term relationships can span the boundaries of a firm and be networked with outsiders yet embedded into the firm's networks (Lin, Yang & Arya 2009; Prajogo, Oke & Olhager 2016).

Effective SCI beneficially impacts the delivery of VALS which also requires effective collaboration. EI and II are process components of SCI which enable the delivery of VALS such as postponement, agility and reverse logistics, partnering with a 4PL to strategically perform the EI. Successful execution of SCI in this context also includes the management of customer relationships and customer service via the servitisation of offerings. The examples cited by Rivera, Gligor and Sheffi (2016) in respect of FEDEX and a 4PL who invested in Panama as well as the instances in respect of green reverse logistics (Hazen, Cegielski & Hanna 2011) are evidence on how SCI enables VALS. Therefore in this context LCB are generated by SCI indirectly via VALS.

Prajogo, Oke and Olhager (2016) argue that where the logistics processes are highly integrated then, the buyer and supplier embed strategic resources to develop capabilities and relationships and improve processes. The unique difference is that such highly integrated activities are hidden from competitors and thus not imitated and thereby confer competitive advantage. This is similar to the resource based view (RBV) (Barney, J, Wright & David J. Ketchen 2001; Barney, JB 2001) but, because it emphasises cooperation and collaboration it is referred to as the *relation based view of* (R)RBV Prajogo, Oke and Olhager (2016). In this instance it is the development of capabilities that is most important as it leads to efficiencies. Efficiencies are best explained by the firm's desire to achieve the optimum levels of cost of operation deploying appropriate capabilities.

Therefore SCI enables the most efficient use of resources and the use of strategic relationships to enable delivery of LCB both directly and via a mediated influence on VALS.

2.3 Firm's logistics performance (FLP)

A logistics cluster generates macroeconomic benefits and those specific to firms in the cluster (Porter, Michael E 1998, 2000; Rivera, Gligor & Sheffi 2016). This discussion examines the outcomes on the logistics performance of firms as a result of benefits arising from VALS, co-location and SCI.

Table 2 categorises variables identified in the literature, which are grouped under headings that may be used to measure FLP. Specifically, productivity/timeliness, quality, cost etc. can be summed up to represent efficiency.

It has been discussed above that a logistics service provider (LSP or 3PL/4PL) can leverage VALS, SCI and proximity to deliver LCB. Such LCB can impact improvements in a firm's logistics performance, specifically, lower logistics and transport costs brought about by proximity as well as better productivity and quality of services offered.

FLP can be influenced by the use of SCI as a "*strategic lever for performance improvement*" (Kim 2009, p. 329) through:

- External integration (EI), by creating customer benefits because of a focus on better collaborative processes, which results in supporting positive customer experience, for example, meet end-user needs of availability, quality of offerings and extent of offerings.

- Agility, which contributes to efficiencies in the firm’s logistics performance on cost and customer experience (Chen, Daugherty & Roath 2009; Stank 2000).
- Internal integration (II), which eliminates duplication, non-value-adding tasks.

Table 2: Measurements of FLP

Measure	Reference
<u>Productivity (Timeliness)</u>	
Service effectiveness shippers and consignees, Delivery: speed, flexibility, dependability, lead times, problem solving, documentation Agility	Christopher, Harrison and van Hoek (2016); (Chen, Daugherty & Roath 2009; Prajogo & Olhager 2012; Stank 2000) Lai, Ngai and Cheng (2002); Lu C S (2003); Gimenez & Ventura (2003,2005); Wong, Boon-itt & Wong (2011); Boyer and Lewis (2002);Green.et.al (2008)
<u>Cost</u>	
Cost reductions –order management, facilities, warehousing, transport, logistics admin, Efficiency -Asset utilisation improved, working capital	(Prajogo, Oke & Olhager 2016; Prajogo & Olhager 2012);Chhetri, Butcher and Corbitt (2014, p. 225); Vom Hofe and Chen (2006); Leuschner et al(2014)
<u>Quality</u>	
Flexibility- customisability of offering, Customer service	Wong, Boon-itt and Wong (2011);Gligor, Holcomb and Stank (2013)-cite Zhao (2001)
External integration(EI) collaboration, quality, availability and extent of offerings	Leuschner et al(2014); Christopher, Harrison & van Hoek 2016)
Other - Financial growth /Sales growth	Kim (2009)

Customer choices and measures of corporate social responsibility (CSR) can also impact measures of a firm’s logistics performance. The choice of techniques of green supply chain management (GSCM) and the use of reverse logistics, influence metrics on CSR and the firm’s environmental credentials.

Since SCM has focus both on environment management Burt, Dobler and Starling (2003) and managing customer relationships which relates to the quality of offering, such measures/goals, may actually assist environmentally responsible companies to gain competitive advantage by cost savings arising from reduced waste and collaborating with global partners who similarly value environmental awareness (Sarkis 2006) (Rao 2003). Additionally some firms have identified the benefit of managing impact on the environment because customers do not wish to negatively impact the environment (Huscroft et al. 2013, p. 319) as “*compliance withregulations and updating*

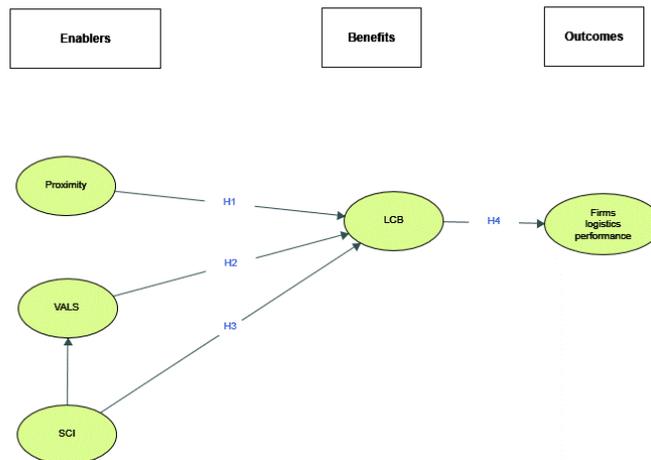
policiesis one our largest activities”. Consequently, metrics relating to GCSM are of relevance to the FLP.

Therefore variables relevant to FLP are, productivity, efficiency, quality of service and GSCM/CSR.

2.4 The proposed initial conceptual framework (CF)

The proposed CF derived from literature comprises, enablers or antecedents of LCB comprising, co-location, VALS and SCI; and outcomes relating to FLP.

Figure 1: The initial conceptual framework



3. Research Methodology

To initially validate the conceptual framework in this research, a Delphi panel of Australian based experts was used. Delphi techniques entail the use of small groups of independent experts who may meet face to face or provide inputs remotely Dalal et al. (2011). In this research, the panel comprised eleven participants from industry (peak associations, logistics service providers, manufacturing firms), government (representatives from the government department in charge of economic development) and academia (academics in the field of logistics and supply chain management) in Victoria, Australia. The initial participants were purposively chosen with snowballing techniques used to access others who met the required profile criteria of industry knowledge and experience. Each participant met a minimum requirement of at least 20 years' experience in their area of expertise. The Delphi panel has expertise in manufacturing of industrial products, carriage of

industrial goods, terminal operations, government policy, transport economists, consumer good distributors and academia. Details of the Delphi panel are in Table 3

A panel discussion schedule consisting of seven questions relating to research constructs and their relationships in the conceptual framework was circulated among members of the panel to elicit their expert view and perception. One round of face-to face individual meetings was held. Upon return, their responses were collated and synthesized, then forwarded back to them for confirmation or amendments if required, until a consensus was reached. The Delphi panel may be used among others, for pre-testing a survey questionnaire.

Table 3 – Delphi demographics

	Manufacturing/ Extractive	Academia	Terminal operators	FMCG retail	Specialised transport operators	Consultants	Government
<u>Participants</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>unusable</u>	<u>1</u>	<u>2</u>	<u>2</u>
<u>Experience</u>	<u>Managers 20- 30 years' experience</u>	<u>Professors</u>	<u>Manager</u>		<u>Managers with 20 + years' experience</u>	<u>30 years' experience</u>	<u>Director & international expert 30 years' experience</u>

4. Analysis and Findings

The Delphi results have been analysed from two perspectives. Firstly, the extent to which the panel found the conceptual framework constructs to be relevant to be taken further was examined. Secondly, themes and the extent to which they recurred in responses were identified. The themes, together with the extent to which the panel is in agreement with the constructs, will be used to obtain consensus on the key issues that need to be further explored in the next stage of this research.

4.1 Delphi panel agreement on constructs

Most panelists agreed with the constructs and the relationships they were asked to comment on, specifically on

- The ability of VALS to enhance or facilitate LCB,
- The ability of SCI to enhance or facilitate LCB,
- The ability of SCI to enhance or facilitate VALS, and
- The ability of SCI to enhance or facilitate FLP.

4.2 Themes identified by Delphi panel

Table 3 provides a summary of LCB identified in the literature as well as concurred by the Delphi expert panel. A detailed view of benefits in classical economics was provided in Table 1, which are now summarised in the column “classical economists” for convenience of the reader. Table 3 additionally maps Delphi responses to the themes in the literature as well as identifying “new benefits”.

The key finding is that there is a strong fit between the views of experts on the constructs chosen and the supporting literature for these constructs, with some modifications required. The panel identified several specific themes which resulted in the initial conceptual framework being modified with changes to constructs.

4.2.1 Enablers

Co-location

“Co-location” has replaced proximity as a construct. Both connote nearness but co-location was more tangible and easily understood.

The Delphi process revealed that co-location has several interdependent attributes, the concentration of firms, their optimum location and levels of inter firm co-operation. Additionally the Delphi found the optimum location was determined by transport cost (cost per ton-km to markets), the dispersion of users and accessibility.

Logistics infrastructure investment

Co-location was also found by the Delphi panel to be influenced by the availability of “targeted logistics infrastructure” investment. Specifically investment by private industry and the state in roads, ports, rail, and inland freight terminals was identified to be important. The literature Rivera, Sheffi and Welsch (2014); Bolumole, Closs and Rodammer (2015); Mangan, Lalwani and Fynes (2008) notes the nexus between infrastructure, location and logistics cluster benefits.

The Delphi’s expectations of investment between the role of the state and that of the private sector differed. The state was seen as gate keeper cum facilitator with expectations that it would minimize regulatory impacts as well as promoting public good. In contrast a distinct role for private sector investment was restricted to, asset specific rolling stock, special haulage for chemicals, specialised freight terminal facilities.

Both the private and public sector investment were expected to generate identical benefits such as; public good, business benefits, certainty of the investment pipeline, better market access and potential value creation by facilitating collaboration via the availability of VALS services. Stakeholders had expectations of the above benefits materializing irrespective of source of funds (state versus private investment).

The Delphi panel noted that co-location can generate value added. This view is consistent with the findings of cluster theory (Table 3). The value added was noted to be of benefit to the region as

well as the firm. Accordingly this value added is a link between growth, FLP, cluster and community/region that has measureable macroeconomic implications.

Table 3: Comparison of Delphi panel versus literature relating logistics cluster benefits

	Classical economics	Logistics clusters (Rivera, Gligor & Sheffi 2016; Sheffi 2012)	Delphi, exploring Logistics clusters (Australia)	Remarks
			<i>Investment pipeline certainty</i>	New benefit
			<i>Business Benefits</i>	New benefit
Impacting labour				
1) Pooled market for specialised labour	x	x	x	
2) Availability of non-specialised labor	x	x		
3) Specialised skill pools develop	x	x	x	
4) Varied labour markets are created	x	x	x	
5) Knowledge spill overs	x		x	
Technological spillovers	x		x	
Mobility	x	x	x	
Spatial			<i>Market access</i>	New benefit
Transport cost and Accessibility	x	x	x	
Proximity	x	x	x	
Collaboration/networking	x	x	x	
Enhanced buyer/seller interaction	x		x	
Scale/scope economy	x			
Macroeconomic				
Local competition	x		x	
Local monopoly	x		x	
Regional growth	x	x	x	
Logistics specific				
Offer Value logistics added services	x	x	<i>Value creation by LSP offerings</i>	New benefit

VALS

The importance of VALS was identified by the Delphi panel together with its components of reverse logistics, collaboration, and presence of facilitators such as 3/4 PLs. Specific assets benefitting the provision of VALS identified by the Delphi panel have been discussed under the provision of “targeted logistics infrastructure”. The panel additionally identified, in the context of VALS, specific rolling stock, trucks, container types, service facilities, technologically advanced services and the deployment of synergistic complementary services as important elements of VALS as an enabler. In Table 3, technological spill overs and knowledge spillovers are consistent with the concept of technologically advanced services referenced by the Delphi panel.

The Delphi identified a link between VALS and LCB and SCI and VALS, but were unsure of the direct nexus between SCI and LCB. An explanation appears to be that SCI was not fully understood.

4.2.2 Logistics cluster benefits

After analysis of Delphi responses, logistics cluster benefits can now be re-categorised as:

- Public good outcome (agreeing with the literature),
- Skilled and mobile workforce is a result of clustering (agreeing with the literature),
- Value creation by offerings from LSP (*new* but an application of “collaboration” in the literature),
- Better market access (*new* but an application of market access in the literature),
- Customer benefits – *a new benefit*,
- Business benefits – *a new benefit* and
- The certainty of an investment pipeline - *a new benefit*.

The description of logistics cluster benefits have changed. The re-worded benefit “Public good outcome”, captures three attributes identified by the Delphi panel – ‘public good results, regional impacts including externalities and growth of the cluster’, all of which better convey nuances of the theme of public good outcome. The descriptors identified now include, state or economy wide macroeconomic benefits, previously identified regional impacts, specific locational benefits of more firms being attracted to the cluster and growing the cluster. Table 3 illustrates that there is good fit with the literature.

“Value creation by LSP offering” is the amended term for the benefit that better captures the connotation of “collaboration”. Responses of the panel attached significance to the benefits of collaboration than mere use of the term “collaboration”. The panel’s focus was on application of the concept of “collaboration” in practice. In the context of LSP (3PL/4PL) offerings, an LSP may collaborate by coordinating logistics specific infrastructure as well as collaborating with SC partners to provide VALS Rivera, Gligor and Sheffi (2016). This is an illustration of the concept “value creation by LSP offering”.

“Better market access” is the collective benefit comprising the attributes identified by the panel to be; proximity/location, network optimality of users which is closely related to the dispersion of users and market access. These benefits are consistent with the literature (Table 3) and are related to the enabler co-location.

“Logistics investment certainty” is a new benefit comprising market knowledge of targeted investment and a temporal aspect of anticipating roll- out of investment leading to land banking e.g. along prospective rail and port corridors. Investment certainty and anticipation of planned investment was identified by Krugman (1990). A government economist on the panel identified the converse, relating to the atrophy of firms when an area is abandoned because of poor infrastructure.

Two other new benefits have been identified after the Delphi interviews namely, “customer” (service and quality improvements) and “business benefits” (improvements to productivity and cost). Support of these benefits in the literature appropriate to the logistics context is being undertaken.

4.2.3 Outcomes

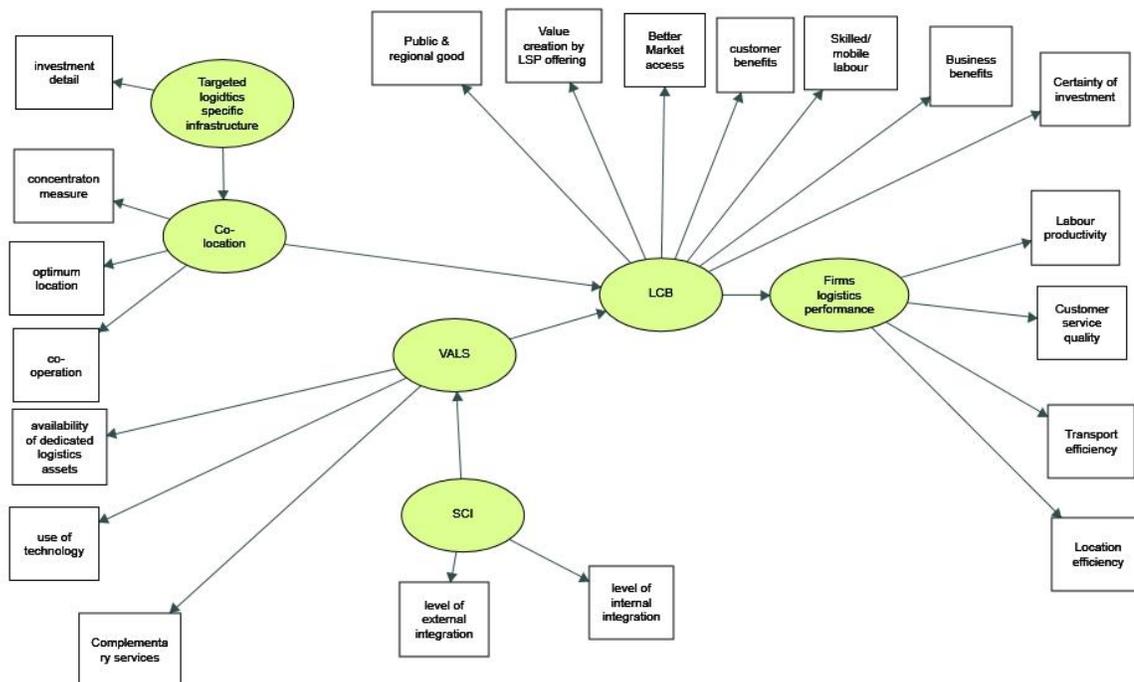
Firm's logistics performance (FLP)

The panel understood that LCB would have an identifiable impact on both FLP as well as on the immediate region and community in which the firm operates.

Responses by the Delphi panel on the firm's logistics performance exhibited a universal theme. FLP needed to be measurable to be of value with panelists identifying, labour productivity, customer service quality, transport efficiency and location efficiency as key areas of focus. The importance of cost and productivity related to backhaul freight and the need to quantify such KPIs as an ongoing exercise to meaningfully track achievement of FLP was noted by many panel experts. The panel suggested the importance of the lowest common denominator for metrics e.g. cost per ton km and the use of matrices to cross tabulate location, cargo value and cost amongst other things.

The amended constructs (ovals) in conceptual framework and variables (boxes) which were discussed above are shown in Figure 2.

Figure 2: Amended conceptual framework



5. Conclusions

The objective of this research is to identify antecedents of logistics cluster benefits and examine their relationships with the firm's logistics performance. To this end, an initial conceptual framework was devised following a thorough literature review process. The Delphi method was employed to initially validate the proposed conceptual framework. It was found that Delphi panel experts expressed a high level of consensus with most of the initial research constructs and their relationship, although some modifications were also suggested. Based on this, a revised conceptual framework was developed which will be further validated quantitatively in a survey.

This research has both academic and managerial implications. On the one hand, it helps to shed light on the question of what can be done to create and enhance benefits in a logistics cluster, and how the firm's logistics performance would be affected by these cluster benefits. Once validated, findings from this research may provide insights to both government departments and firms' senior management on policies relating economic development to facilitate the growth of logistics clusters which in turn would benefit firms in the clusters.

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