LOGISTICS CITIES: A SPATIAL REQUIREMENT FRAMEWORK

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ABSTRACT

This paper focuses on issues surrounding the spatial requirements of a Logistics City, and the contributing investigation, in cooperation with various planning authorities in Melbourne, has been conducted on characteristics and attributes related to this concept. The spatial requirements identified here are segregated into four different layers as a framework which will contribute to the understanding of the behavioural patterns of spatial factors related to a Logistics City. This will enhance the ability of development authorities to support the planning and introduction of a holistic Logistics City and has the potential to improve the quality and effectiveness of these systems in a growing regional economy.

Keywords: Logistics City, Logistics Spatial Requirements, Logistics Cluster, Spatial Framework

INTRODUCTION

A Logistics City is a geographical concentration that is associated with a global trade gateway, contains multiple of logistics nuclei such as freight terminals, freight hubs or logistics villages and has embedded city constructs. Within the context of the logistics sector these geographical areas incorporate a critical amount of related infrastructure in addition to logistics services and supporting activities at international, regional and local functions. The Logistics City is seen as a strategy that addresses well-structured and relevant solutions to the longer term sustainability of a region in the global trading arena (Sengpiehl et al., 2008a; ILSCM, 2007).

Historically, logistics activities were concentrated around trade gateways such as international ports; but logistics activities are now tending to spread and agglomerate along existing trade corridors, especially higher value added logistics and associated activities. This development has occurred because of optimisation of transport function to markets and land scarcity within, and in close proximity to, trade gateways (Sengpiehl et al. 2008b; Van der Lugt and de Langen 2005; Abrahamsson et al. 2003). Therefore, fixing a geographical boundary for a Logistics City can be challenging. For most Logistics Cities, particularly where freight activities are widely dispersed, boundaries will necessarily include larger surrounding historical areas, in which appropriate logistics and supporting activities, such as education and knowledge centres, central business districts and residential zones, are embedded. Nevertheless, the logistics nuclei of a Logistics City can be geographical bounded, and this has a vital role for activities related to specific logistics planning zones and their related buffer areas. Whist clear boundaries should not be over-emphasised at the Logistics City level, benefits arise if the activities of stakeholders are aligned, thus the role of planning and governance in spatial planning becomes paramount (figure 1).

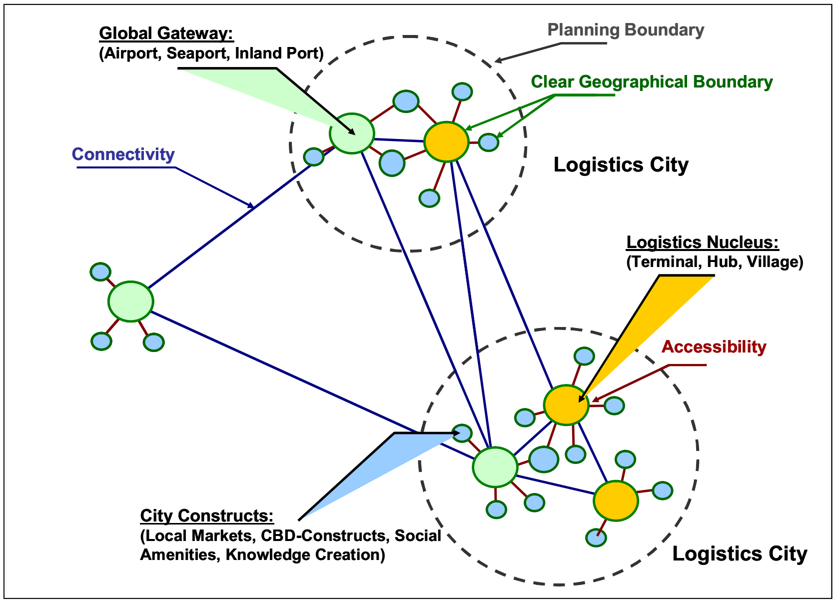

Figure 1: Physical and Planning Boundaries

The lack of a clear understanding for core spatial characteristics and attributes that link to the specific use of a Logistics City and its components creates challenges for authorities in the orderly planning and development of a Logistics City. Planning authorities need to conduct gap identification analysis at the spatial level in existing logistics concentrated areas to generate an indicative layout plan and identify possible future actions that need to be undertaken, such as attracting missing logistics activities or learning and knowledge hubs. Also, 'Greenfield sites' need to be assessed for possible logistics nuclei and therefore to identify existing locations within the planning boundaries of authorities that could favour logistics facilities or related city constructs based on spatial characteristics and attributes. Clearly, the growing importance of logistics and its attendant challenges request the development of an innovative spatial requirement framework (Parliament of Victoria 2008; Premier of Victoria Brumby, J. 2008; LeadWest 2008). The objective of this paper, therefore, is to report our spatial requirement framework, developed in cooperation with local and state planning authorities related to greater metropolitan area of Melbourne, and links spatial characteristics and attributes with the needs of a future Logistics City.

RESEARCH DESIGN

The notion of a Logistics City is an emerging concept, and is being developed in response to specific contexts, experiences and economic needs of practitioners. This constructed nature of the Logistics City, and its relation to spatial determinants, suggest that a constructivist theory of knowledge is appropriate as the epistemological position for the investigation. A constructivist perspective emphasises that the source of knowledge lies with the actors that are most intimately involved with the concept under review, and the methodology, further the method for data collection and analysis, chosen for the investigation must be consistent with this perspective (Fenner et al. 2005; Crotty, 1998). There are several methodologies consistent with the tenets of constructivist epistemology (Hussey and Hussey, 1997), and the controlled environment of planning and developing authorities and the attended change made 'Action Research', of all available choices the most applicable methodology.

Qualitative methods for data collection and analysis have been chosen as the most appropriate approaches for this investigation, and consequently 'Focus Group' data collection method combined with individual 'Interviews', both semi-structured and in later stages structured, were applied. This allowed us to collect data from the perceptions of relevant stakeholders that are involved in the environment of the possible future application. We have followed a general analytical procedure for dealing with qualitative data (Miles and Huberman, 1994) allowing us to become familiar with the data by developing data summaries and reconstructing the data using analytical matrices.

SPATIAL REQUIREMENT FRAMEWORK

Figure , this study identified four different layers relevant to the development of a Logistics City, and the description given below both justifies the importance we place on spatial attributes and assists in the gathering of appropriate data for spatial decision-making by planning authorities.

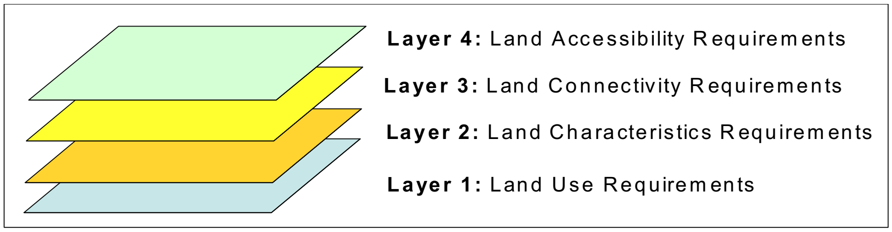

Figure 2: Layers of Spatial Requirement Framework for Logistics City

Land Use Requirements

The "Land Use Requirements" layer is related to the specific land use of the logistics nuclei of a Logistics City and does not take any city constructs into consideration. As the progression of logistics nuclei develop, the "Land Use Requirements" changes from ~30ha (freight terminal), ~80ha (freight hub) to ~130ha (logistics village). This layer is subdivided into four different categories that represent main land use activities which are key operational functions in compliance with services and infrastructure. These four categories can be applied to the gap identification at the spatial level for existing logistics-concentrated areas and generating an indicative layout plan, and can be deployed as checklists for possible Greenfield sites, enabling appropriate development of the identified land. The four categories are (i) Area for Freight Transhipment Activities, (ii) Area for Storage and Handling of Freight, (iii) Area for Professional Business Services, and (iv) Area for Technology Activities related to Logistics.

Concentration of freight related activities, beside transhipment activities, can be subsumed under the umbrella of freight storage and handling. A freight terminal does not have the single purpose of international freight consolidation or deconsolidation, and therefore does not necessarily require warehouses and empty container yards. In this respect, storage and freight handling areas only apply to higher progressions other than at the terminal level. Some higher value-adding logistics activities such as light assembly can be integrated in this category if executed in warehouses, but if these are located in other facilities that need a specific area, they fall into the "Area for Professional Business Activities'.

Professional businesses, though of secondary nature in a Logistics City, are intimately related to the value-adding functions performed by the core logistics services and should be located in close proximity. These activities include maintenance organisations, recruitment agencies, restaurants, hotels, cafes, consultancy companies, marketing organisations, as well as banking, finance and insurance-related industries. Most of these activities are related to the later progressions and do not need to be considered within the spatial planning at freight terminals or freight hubs level. However, technology activities that are linked to the logistics sector also need to be considered. These activities, like the professional business activities, have specific spatial conditions for efficient co-operation with the traditional logistics activities, and their activities are demanded by the traditional logistics activities as well as by professional business activities. These four categories of the "Land Use Requirement" layer are summarised in Table 1.

Land Characteristic Requirements

To achieve a comprehensive understanding of possible investment costs and required time, land characteristics for the development of the logistics nuclei must be considered. It is important to note that these "Land Characteristic Requirements" are mainly linked to the geographical bounded logistics nuclei but can be easily translated to any other site that is related to geographical bounded city constructs. This layer is subdivided into three sections: (i) Ownership and Land, (ii) Zoning, and (iii) Additional Land Conditions.

The first consideration is the ownership of the possible area and surrounds for further expansion, since planning should allow handling capacity of future mid and long term projections of freight volume and logistics facilities development. This will involve investigations of the current ownership of the expansion area and will clarify related costs and ease of land acquisition.

Knowledge of existing urban zoning will play an important role in any planned expansion since locating logistics activities will critically depend upon zoning regulation. If current regulations impede the establishment of logistics activities, a revision of the existing zoning might be required because any land adjoining the nucleus terminal or hub must allow for future expansion. In addition, land use controls around the precinct of the public access terminal or hub should provide for compatible use so that the capacity of the terminal or hub is not impaired. Land conditions of potential sites should also be checked to pinpoint environmental and geological constraints. Emission of particulate matter may be a consideration, and action may be needed to lower the constraints or to clean the process. Contamination issues should also be considered, since these might lead to high decontamination cost and reclamation time. Further the availability of infrastructure such as electricity, gas, water, broadband, sewage and drainage will allow savings in terms of set-up investment capital. Table 2 summarises the "Land Characteristics Requirement" layer.

Table 1 "Land Use Requirement"

Land Use Requirement		Freight Terminal	Freight Hub	Logistics Village
Area for Freight Transhipment Activities				
Platforms	**Platform for loading and unloading containers to and from trucks**	√	√	√
	Platform for loading and unloading containers to and from trains	√	√	√
	Platform for handling break-bulk cargo	√	√	√
Area for Storage and Handling of Freight and Buffer Zones				
Storage	**container yard for temporary storage**	√	√	√
	empty container yard for consolidation purposes	N/A	√	√
	break-bulk storage area	√	√	√
	bonded storage area	√	√	√
	dangerous goods storage area	√	√	√
	parking zones for trucks	N/A	√	√
	areas for warehousing	N/A	√	√
Handling	**area supporting customs administration, duty / tariff payment processing**	√	√	√
	area supporting quarantine and inspection	√	√	√
	buffer zones	√	√	√
	areas for freight pooling and consolidation / deconsolidation	N/A	√	√

Area for Professional Business Activities				
Offices	export / import agents	N/A	N/A	√
	recruitment agencies	N/A	N/A	√
	logistics consultancy	N/A	N/A	√
	logistics service provider	N/A	N/A	√
	logistics insurance	N/A	N/A	√
	simple commercial banking facilities	N/A	N/A	√
	post office facilities	N/A	N/A	√
Industrial	container maintenance, fumigation and cleanup	N/A	√	√
	areas for light assembling / customizing / quality control *(if not included in warehousing)*	N/A	N/A	√
Amenities	petrol station including washing facilities	N/A	√	√
	restaurants / cafes	N/A	√	√
	motel / hotel	N/A	N/A	√
	parking lots (other than for trucks)	√	√	√
	fresh-up amenities	√	√	√
Area for Technology Activities related to Logistics				
IT / Engineering	IT facilities	N/A	N/A	√
	engineering facilities	N/A	N/A	√
Library & Exhibition	information clearinghouse / library for logistics / business / IT and trade related publications	N/A	N/A	√
	exhibition facilities	N/A	N/A	√

Land Connectivity Requirements

In our model, two categories of connectivity have been introduced; Physical connectivity, (enabled through transport infrastructure), and Information connectivity, (enabled through Information and Communication Technology) (Toh et al., 2008). Whilst connectivity requirements are defined as the physical transport linkage between the logistics nuclei and trade gateways, IT-connectivity aims to link all stakeholders in a Logistics City. This, in terms of a physical freight transport network, the layer "Land Connectivity Consideration" is subdivided into three different sections: (i) Connectivity to Gateways, (ii) Intra-Connectivity, and (iii) IT Connectivity.

Table 2 "Land Characteristics Requirement"

Land Characteristic Requirements	
Ownership and Land Acquisition	
Current and Expansion Area	site ownership
	ease of land acquisition if not owned by the government *(time / compulsory acquisition)*
	land price

Zoning	
Current and Expansion Areas	**adequateness of current zoning**
	time and cost of necessary rezoning
Surrounding Areas	**interference with surrounding zoning and land usage**
Additional Land Conditions	
Current and Expansion Areas	**contamination of site**
	time and cost of decontamination
	soil conditions
	square and flat area
	technical licensing requirements and orders
	environmental compliance
	land encumbrances
	gas and water supply / investment cost if not already connected
	electricity supply / investment cost if not already connected
	drainage and sewerage / investment cost if not already connected
	IT infrastructure / investment cost if not already connected

Clearly, efficient movement of goods to and from different regional and international markets requires streamlined physical connectivity, linking to gateways and logistics nuclei via primary and secondary transport infrastructure. Gateways, through which goods move from one territory to another via transportation corridors, are commonly seaport, airports or inland gateways based on rail, road or inland waterway modes. What was the "hinterland" transport corridor for the gateway becomes the primary connectivity transport corridor for other logistics nuclei of a Logistics City, and whilst observations have shown that a Logistics City should provide multimodal transport assets, the final transport modes clearly depend on the geographical and natural factors.

Physical connectivity relates to an enabling component referred to as a freight network, which contains multiples of logistics nuclei as well as associated gateways in a flexible geographical boundary connected by transport infrastructure. The network approach goes beyond what is seen as "typical" single infrastructure planning and it is readily recognised that these systems are significant in themselves and therefore planning for an integrated freight network is a far more complex undertaking. However in terms of the Logistics Cities and its spatial requirements the network approach must be in place to allow an efficient and sustainable freight handling and other logistics supporting activities.

Transport infrastructural excellence on its own does not ensure efficient connectivity. Whilst physical transport infrastructure is clearly a necessity, especially with the creation of a network approach, the physical transport flow has to be complemented by efficient information flow which can only be provided by an appropriately designed information and communication infrastructure. Together, these can lead to a more optimised utilisation of physical transport infrastructure, storage capacity and therefore an increase in productivity of the network. Here the notion of 'ICT infrastructure' is used as a general term to encompass all information technology assets, such as broadband and servers availability, as well as the necessary software that will enable efficient information exchange across the range of stakeholders. These three categories of the "Land Characteristics Requirement" layer are summarised in Table 3.

Table 3 "Land Characteristics Requirement"

Land Connectivity Requirements	
Connectivity to other Gateways	
Seaport	**Freeway and arterial highway connectivity to seaport**
	principal rail connectivity to seaport
	inland waterway connectivity to seaport
Airport	**Freeway and arterial highway connectivity to airport**
	principal rail connectivity to airport
Other Regional Inland Gateways	**Freeway and arterial highway connectivity to other regional or interstate inland gateways**
	principal rail connectivity to other regional or interstate inland gateways
	inland waterway connectivity to other regional or interstate inland gateways
Intra-Connectivity	
Primary and Secondary Intra-Connectivity	**Primary road network that allows efficient inter-connectivity between any of the progressions**
	secondary road network that allows efficient inter-connectivity between any of the progressions
	primary rail network that allows efficient inter-connectivity between any of the progressions
IT-Connectivity	
Physical and virtual IT Infrastructure	**physical IT-Infrastructure**
	virtual information platform

Land Accessibility Requirements

The fourth layer is linked to city constructs and their accessibility by the logistics activities of a Logistics City. This layer is subdivided into three different sections: (i) Accessibility to Markets, (ii) Accessibility to CBD-Constructs and Social Amenities, and (iii) Accessibilities to Knowledge Creation.

Equally important to the connectivity of Logistics Cities is the accessibility to local markets within and around Logistics Cities. Infrastructural systems that provide accessibility to these local markets must be ready to cope with a wide range of goods, since some markets will, for example, require rapid, smooth and hygienic transport. In this respect, one bottleneck will disrupt the entire supply chain quality, therefore the size and quality of the possible local markets must be considered when locating logistics activities, hence logistics nuclei of a Logistics City.

In order to maintain appropriate workforce levels and for attracting Head Office functions, a Logistics City must be socially attractive, having accessible and sophisticated public infrastructure. The need for social amenities and CBD-constructs increases strongly within each step of progression and reaches is peak at the level of the Logistics City. Facilities for urban sustainability such as health care, education and childcare are required as well as parks and sporting areas. These accessibility requirements and the Logistics City have a symbiotic relationship that can be seen as self-sustaining and impart a positive impact on the region. Further, Knowledge generation is an important enabler for a Logistics City for sustainable growth, but while essential knowledge can be acquired through on-the-job experience within the logistics area; there is a growing understanding that appropriate knowledge can be generated by industry research, universities or other research platforms. Specific topics of collaboration related to knowledge generation between the public and private sectors must be clearly addressed, since a logistics supply chain inherits multiple stakeholders and therefore the establishment of specific knowledge generation centres must take place within a Logistics City. The spatial requirements of a Logistics City and all its progressions related to the notion of accessibility are shown in Table 4.

Table 4 "Land Accessibility Requirement"

Land Accessibility Requirements		Freight Terminal	Freight Hub	Logistics Village	Logistics City
Accessibility to Local Markets					
Retail / Wholesale	**highway accessibility to local retail/wholesale markets to enable appropriate quantity and trade of goods**				
	local road accessibility to local retail/wholesale markets to enable appropriate quantity and trade of goods				
Manu-facturing	**highway accessibility to local manufacturing markets to enable appropriate quantity and trade of goods**				
	local road accessibility to local manufacturing markets to enable appropriate quantity and trade of goods				
Accessibility to CBD-Constructs					
Leisure	**restaurants and hotels**	√	√	√	√
	recreation and entertainment *(including places for assembly)*	N/A	N/A	N/A	√
	shopping centres	N/A	N/A	N/A	√
Commerce	**government business support services**	N/A	√	√	√
	merchant banking	N/A	N/A	N/A	√
	legal services	N/A	N/A	N/A	√
	marketing and public relations services	N/A	N/A	N/A	√
	merchant insurance	N/A	N/A	N/A	√
	Headquarters	N/A	N/A	N/A	√
Accessibility to Social Amenities					
Public Transport	**public bus transport**	√	√	√	√
	public tram transport	√	√	√	√
	public train transport	N/A	√	√	√
Childcare & Education	**vocational training**	√	√	√	√
	childcare and kindergarten	N/A	N/A	√	√
	primary and secondary education	N/A	N/A	√	√
	tertiary education	N/A	N/A	√	√
Industrial	**residential area *(workforce related)***	N/A	N/A	√	√
	health *(hospital, clinic)*	N/A	N/A	N/A	√
	emergency services *(police, fire brigade)*	√	√	√	√
Accessibility to Knowledge Creation					
Research Platforms	**university research**	N/A	N/A	N/A	√
	research institutes	N/A	N/A	N/A	√
	other research platforms	N/A	N/A	N/A	√

CONCLUSIONS AND FURTHER RESEARCH

As indicated, all four layers of spatial requirement and their related properties can be used for gap identification in existing logistics concentrated areas where such an analysis can generate an indicative layout plan of the area under investigation. In addition, for Greenfield developments, the framework can be used as a design checklist at the macro level, allowing each of the layers to be investigated separately to generate sufficient data related to essential spatial requirements. While decision makers using this framework can set their own priorities in terms of their separate internal criteria, making decisions in terms of spatial data requires a holistic view of the development. Further research related to the spatial requirement framework is planned in order to test these spatial characteristics and attributes linked to an existing Logistics City as a single case, allowing amendments to the framework to strengthen its applicability.

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