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Planning for the sustainability of freight and logistics: Strategic guiding principles for regional policy

Sam McLeod[*]
sam.mcleod@uwa.edu.au
School of Social Sciences, the University of Western Australia, Australia

Michael Browne
michael.browne@handels.gu.se
Department of Business Administration, the University of Gothenburg, Sweden

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Policy-makers face challenges managing the movement of goods while responding to increasingly urgent sustainability problems. Freight policy is fragmented over many regulatory fields, often with ambiguous or contested objectives. Empirical freight transport research can be difficult to translate directly into policy settings, and policy measures often have substantial unintended consequences, especially over long time periods. These foundational challenges can make effective policy implementation difficult.

Through a review of the literature, and drawing on diverse applied research and practice experiences, we categorise intertemporal problems in designing regional freight policy, and identify principles for informing practical policy synthesis. These principles provide a framework for decision-makers who formulate policy, and for researchers who critically evaluate it. Adoption and refinement of these principles will improve the translation of research into policy through time, recognising the inherently complex and uncertain nature of planning for the movement of goods.

[*] Corresponding Author

1 Introduction

Influencing freight and logistics activity to meet intertemporal sustainability objectives is an immense challenge for governments, especially as mounting global challenges necessitate accelerating change. Public-sector decision-makers who grapple with immediate and complex regional transport and economic development issues are faced with a pressing need for insight and resources to devise good policy. There is a need to understand freight transportation, firm behaviours, and political dynamics to inform policy in a way that increasingly demands integrating different expertise and knowledge (Holguín-Veras et al., 2017; Lindholm and Blinge, 2014; Thompson and Taniguchi, 2008). Governments can lack such capabilities and expertise, particularly at the local level (Ballantyne et al., 2013; Cui et al., 2015; Lindholm and Blinge, 2014). While the emergence of logistics and supply chain fields has crystallised much knowledge about freight strategy - particularly within the private sector (Hesse and Rodrigue, 2004; Lindholm and Browne, 2013) – there remains a clear need for research and policy development principles to support public sector freight policy-making.

A large volume of contemporary transport research is published with limited connection to specific challenges of policy-making (Marsden and Reardon, 2017). Freight transport geography, which is heavily characterised by quantitative empirical research and bounded forms of statistical analysis, is arguably yet to fully embrace modes of more post-positivist thinking and mixed-methods analysis common to more strongly political and theoretical research traditions (Hall et al., 2016). This threatens the relevance of research which is ostensibly funded to inform the development of policy. Despite an ever-expanding corpus of positivist empirical and technical literature describing and evaluating freight transportation patterns, there is a paucity of literature synthesising general principles needed to translate research at the strategic policy level.

It is now also broadly recognised that improving freight sustainability requires an acceleration of proactive and much more transformative policy to facilitate more rapid change (Malekpour et al., 2015; McLeod and Curtis, 2020). Making freight more sustainable is a fundamentally intertemporal challenge in which policy-makers must consider increasingly critical long-run and intergenerational issues of climate change and resource depletion within the contested politics of the present day (Dooms et al., 2013; Legacy, 2016; Pike et al., 2006). Accordingly, this integrative review paper distils clear principles for freight policy and transportation planning, considering broader strategic development and sustainability objectives in the context of long-run sustainability outcomes. By taking a broad view of the nature of freight in cities and regions, this paper aims to integrate prevailing themes in economic and planning theory, and outline principles to guide policy-makers seeking to manage freight to maximise outcomes to meet public interest sustainability objectives.

While the global challenges of transport sustainability have prompted a substantial focus on local freight planning issues, and recent geopolitical events have resulted in re-consideration of established patterns of globalisation and offshoring, this paper seeks to examine freight and logistics policy at the level of economic regions. In this paper, we adopt the term "region" as commonly used in the literature (e.g. Malecki, 2004; Pike et al., 2006) to describe a geographic area with a specific economic makeup, which may comprise a city and its hinterland, or multiple cities centred around related industries and clustered production networks. At this level, flows of freight can be considered in view of the interaction between local production (e.g. extraction and processing of basic resources, manufacturing, etc.) and consumption (e.g. consumer goods) within broader trade and wider supply chains (see Browne and McLeod, 2023, p. 17; McLeod et al., 2019).

This article is presented in five parts. An overview of the review approach is outlined in Section 2. The article then explores the specific challenges of developing freight strategy and policy among public decision-makers, including politicians and planners in Section 3. Following this, we propose four strategic principles for freight policy (Section 4). The article concludes in Section 5, reflecting

on the need to ensure empirical freight research considers the critical interface in translating research findings into policy and practice.

2 Review approach

This theoretical, practice-focused paper is based on a narrative literature review, drawing on a wide-ranging sample of literature, interpreted through the authors' diverse practice and research project experience. This paper was developed over a period of about four years, based on a continual reading of the literature concurrent with the authors' professional work in research, consulting and government. Literature was identified through scholarly databases (including Google Scholar, Scopus, and Web of Science) to develop a reference set of academic articles across themes in freight policy.

Searches were iterative, informed by findings as the literature as it was reviewed. Forwards and backward snowballing was used extensively, as were supplementary searches on specific concepts and topics as they were identified (Van Wee and Banister, 2016). This search strategy was adopted to identify diverging freight planning perspectives between disciplines, theories, research approaches, and geographic contexts. Searches specifically aimed to collate sources across the diverse range of disciplines and fields which research freight policy issues, especially considering the firm, local, regional, and national definitions of "competitiveness" and "strategy" (for instance, see Closs and Bolumole, 2015; McLeod et al., 2019). The searches aimed to achieve coverage of significant academic contributions to the international freight policy literature (particularly between the different scholarly disciplines which consider different aspects of sustainable freight policy) without necessarily being exhaustive.

Finally, the entire set of literature collated was then categorised into groupings of fields/topics as per Table 1. We have established a taxonomy of groupings and subgroupings based on our identification of the various fields of study which contribute to scholarship on freight geography and policy-making. This complete list of sources, broken down by subgroups, is available as a supplementary file (see the Appendix), to support further review and further bibliometric analysis. In all, a reference set of 265 sources was assembled, of which more than 100 are cited within this paper.

Table 1. Taxonomy of literature reviewed

Grouping	Example fields of study	Subgrouping	Sources collated	% of total set
Economic development and regional competitiveness	Economic policy	General theory	28	10.6%
		Transport and supply chain aspects	24	9.1%
		Subtotal	***52***	***19.6%***
Strategic planning and firm competitiveness	Business and management	General theory	16	6.0%
		Transport and supply chain aspects	13	4.9%
		Subtotal	***29***	***10.9%***
Freight and logistics research	Transport geography, operations research, analysis of market demand	Freight sustainability and supply chain optimisation	43	16.2%
		Freight transport demand	10	3.8%
		Terminals, ports, and intermodal consolidation	12	4.5%
		Subtotal	***65***	***24.5%***
Public sector planning	Planning, stakeholder theory, decision support, analysis of regulation	General theory	17	6.4%
		Externality pricing	8	3.0%
		Freight stakeholders and participation	21	7.9%
		Institutions, path dependence, and uncertainty	18	6.8%
		Land use and transport planning	39	14.7%
		Modelling and policy appraisal	9	3.4%
		Subtotal	***112***	***42.3%***
Methodological papers			7	2.6%
Grand total			**265**	**100%**

Through reviewing this literature, we identified the specific problem of freight research translation into policy and practice translation discussed in Section 1. While there is some literature regarding best practices in urban freight management (see Allen et al., 2007; Dablanc et al., 2013; Holguín-Veras et al., 2015), we could identify no contemporary equivalent source concerning regional freight policy in the available literature. Similarly, while multi-level and inter-agency governance is an established concept in freight policy studies (e.g. Kin et al., 2017; Lindholm and Browne, 2013), the challenge of inter-temporal coordination (i.e. considering the complexity of intergenerational impacts and path dependence resulting from present decisions) has been much less explored. Accordingly, we have structured the review findings to arrive at four guiding principles identified through both the contents of the sources we reviewed, and reflecting our experiences working on freight policy issues across two continents.

3 The challenges of developing freight policy

The literature outlines several fundamental challenges for the development of freight policy, which we group into five themes in the following subsections. At a high level, effective freight policy must recognise and consider both economic forces and sustainability constraints to meet public interest objectives – grappling with present challenges while seeking to achieve long-run objectives. Freight policy is often considered an essential aspect of planning for economic development. Strategic planning theory has been widely adopted by governments seeking to shape and achieve economic development objectives (Ballantyne et al., 2013; Malekpour et al., 2015; Tom Liou, 2000). Defined simply, *strategy* is the set of choices made to develop an advantageous position from which key objectives can be achieved, especially over the long term (Browne and McLeod, 2020; Porter, 2004). Strategy is often principally focused on the creation and retention of sources of competitive advantage - a condition which may be used to achieve superior performance of a firm, territory, region, or national economy (Begg, 2016; Budd and Hirmis, 2004; Closs and Bolumole, 2015; Porter, 1990). Freight policy which does not respond to economic development objectives is not likely to be effective or sustainable.

3.1 Institutional fragmentation

The full scope of policy which influences the movement of freight is vast and institutionally fragmented. *Freight policy* encapsulates road and rail network management, regional transport planning, local traffic regulations, terminal planning and management, land use planning, economic (regulation, subsidy and pricing) policies, vehicle regulation, design rules, environmental standards, public transport planning, and energy policy (Allen et al., 2010; Hesse, 1995; McLeod et al., 2019; Muñuzuri et al., 2005; Ogden, 1992, 1984). Many such policies have been described as "strategic determinants" of economic competitiveness and regional productivity (Closs and Bolumole, 2015; Kresl, 1995; Porter, 1990). However, several of these policy settings (such as land use plans or building codes) may not be consciously contemplated as freight policy, especially where the policy-making institution has seemingly unrelated core aims. They may overlook or neglect the practical drivers underlying private-sector freight operators' decisions (Caris et al., 2008; Wilbur Smith and Assoc. and S. R. Kale Consulting, 2010). Policy settings also tend to be vertically fragmented across international, national, regional, and local levels of government (Browne and McLeod, 2023).

The implications of potential policy settings are often unclear. Measures are prone to significant unintended consequences, which are often distributed unequally among industry actors and stakeholders (Gatta and Marcucci, 2016; Holguín-Veras et al., 2017). Policies must also identify and address public interests, which are often hotly contested and difficult to reconcile (Giuliano et al., 2013; Lindholm and Behrends, 2012; McLeod and Curtis, 2020). For practitioners caught in responding to immediate local challenges, it can be challenging to identify the complexity of those problems, and the nature of their own bounded rationality (Acciaro, 2015; Forester, 1984). There is

often a lack of specific data available to support modelling of freight issues (McLeod and Curtis, 2020). Hence, the wide range of policy settings, with uncertain future effects, distributed among a broad scope of regulatory actors, can make coordinating attempts to govern freight an intricate or sometimes intractable exercise.

3.2 The divergence of firm strategy and regional policy objectives

The immediate objectives of firms and policy-makers are often divergent. Policy-makers' public interest concerns should generally be much more long-term than firms' profit-making objectives - though politically-motivated government decisions to address short-term issues commonly compromise long-term policy objectives (Dewar, 2016). Uneven impacts of specific freight policies on different firms (for instance, new vehicle standards impacting only certain firms' fleets, or road network or parking policy changes impacting only certain locations) can make their introduction controversial, and often politically dangerous (Bjørgen et al., 2021; Stathopoulos et al., 2012). While it is possible to characterise the various interests of the stakeholders involved in logistics activity (Macharis, 2005; Macharis et al., 2014), it is crucial to recognise all stakeholders, firms, and government agencies share a level of interest in overall local or regional productivity. This shared interest in high-level economic competitiveness is a strong basis for deliberatively developing progressive freight policy.

Governments have an obligation to ensure that their regional economies develop to host high-value industries (Begg, 2016), competing on attributes beyond the extraction of low-cost, low-value commodities. Competing on cost alone commonly results in the regions accepting or discounting negative external costs – including pollution, congestion, and impacts on human health – in order to host industries which result in a net detriment to overall public welfare and wellbeing. Governments which attempt to facilitate logistics competitiveness by reducing private sector costs (such as generously subsidising freight infrastructure) end up engaging in "fiscal competition" for corporate welfare, which ultimately transfers public money to private firms at the expense of the public good (Swanstrom, 1987; Taylor, 1992; Wildasin, 2009). This is exemplified by recent competition among US cities competing to offer massive concessions to attract the facilities of multinational firms, such as Foxconn and Amazon, where the subsidies offered by governments appear to greatly outweigh any public benefits (Farren and Philpot, 2018). This can also commonly be seen where already well-connected regions fund public road infrastructure for vaguely defined "freight industry" benefits, including forecast marginal travel time savings (Metz, 2008).

3.3 Intertemporal long-run and short-run objectives

Governments tasked with planning for freight face problems of widely different temporal scopes, which may be challenging to view in totality. The concept of *Path Dependence* – the influence of previous conditions on future ones - is critical to understanding the intertemporal nature of freight policy. Decisions made at any spatial scale can result in path dependence, in which long-term outcomes have been "locked in" or "locked out" by the prior decision (Dooms et al., 2013; Woodlief, 2016). Path dependence is also a significant concept in regional economics – recognising that local geography and history significantly influence future economic activity and consequent development (Malekpour et al., 2015; Martin, 2009). For instance, the city-state government of Singapore aggressively invested in the development of air freight capabilities, initially to support local export-oriented manufacturing, which then transitioned to support service-sector tourism, commercial, and health and education industries (Bowen and Leinbach, 2009). This level of investment was far more proactive and "over-capitalised" than traditional microeconomic cost-benefit analysis would support, but gained Singapore significant capacity and first-mover positioning advantages which then sustained rapid growth (Phang, 2003).

The notion of path-dependence is critical in underlining the importance of considering the medium to long-term (10+ years) future implications of current decisions, particularly where bounded

forms of analysis may restrict the realisation of broader intertemporal objectives. Too often, infrastructure managers and policy-makers react responsively to short-term issues, fleeting opportunities, or pressing minor details with a limited view of the broader consequences of the decision through time (Browne and McLeod, 2020; Quak et al., 2016). Decisions may create physical, institutional, or economic barriers to future policies or practices (Dooms et al., 2013; Liebowitz and Margolis, 1995; Notteboom et al., 2013). A common example of such problems is the inadvertent erosion of freight movement corridors through inappropriate adjacent development resulting from poor land use planning (Hall, 2007).

The intertemporal and intergenerational consequences of decisions are a central challenge of policy-making to define and achieve freight sustainability objectives. This problem demands the application of broad expertise to prevent the bounded view of one discipline or profession from compromising future objectives (Savy and Burnham, 2013; Scheurer et al., 2019). This is a core reason for public-sector involvement in understanding freight activity - including to identify negative externalities and market failures, and implement regulatory responses to remedy them.

3.4 Unintended policy effects

The unintended consequences of freight policy decisions can significantly compromise public policy objectives. Improving road freight transport tends to induce demand (for both freight and passenger traffic) and perpetuate the spatial sprawl of logistics, locking in long-term ongoing resource use (Holl, 2016; McLeod and Curtis, 2020). Policy-makers who attempt to facilitate competition through preferentially investing in road network development risk causing adverse induced traffic and logistics-related land consumption (McKinnon et al., 2015). Road freight trips are induced because businesses adjust their supply chains to utilise the level of supply available (Rodrigue, 2016; Rodrigue et al., 2001). Firms also select more distal locations when road transport costs are lower (Dablanc, 2014). Similarly, induced demands for passenger transport can rapidly consume capacity investments in roads intended for freight (Holl, 2016). These problems illustrate the importance of considering passenger and freight transport system interactions as an essential component of strategic freight planning. Many unintended consequences of policy decisions can be reasonably foreseen by conceptualising the mechanisms through which freight movements are generated (Holguín-Veras et al., 2011; McLeod et al., 2019), and through deliberative planning across different professional disciplines and across agencies and organisations.

Road transport demand does not perfectly scale with economic activity, especially as economies mature towards advanced high-value industries. Research over recent decades has illustrated potential decoupling in economic activity and the magnitude of freight transportation generated, particularly as economies become increasingly oriented towards services (Alises et al., 2014; McKinnon, 2007a; Tapio, 2005). Road freight decoupling has been slated as a policy objective, and mirrors a change from "predict and provide" planning to demand management in the passenger transport planning field (Goulden et al., 2014; Vigar, 2002). Decoupling can be encouraged through policy arrangements - including those which seek to manage and reduce demand, and those which incentivise more sustainable mode and vehicle choices (Verny, 2007).

3.5 Monopoly conditions

Some forms of freight may tend towards inherently non-competitive states. Critical freight assets – particularly those which handle large volumes of material – may be natural monopolies, especially at the city or regional scale (Jacobs, 1985, p. 227; Ogden, 1992; Visser and Hassall, 2010). Railway lines, ports, airports, roads, and any other asset which has high barriers to replication may represent a natural monopoly. Public-sector led logistics schemes can also inadvertently result in new monopolies, such as through the creation of a limited number of consolidation hubs (Allen et al., 2012, p. 487). The privatisation of monopolistic freight assets often leads to perverse outcomes whereby the private operator seeks to extract rents from the asset in a manner contrary to its

efficient operation (Sandberg and Abrahamsson, 2011, p. 64). For instance, a review of a freight corridor to a port by one author of this paper identified a pipeline proponent buying up private properties along the corridor. These property acquisitions would preclude any other pipeline - requiring future projects to use more expensive rail or road transport modes. While in the strategic interest of the first proponent, such privatisation runs against the broader economic public interest for diverse user access to the corridor. Poorly-managed or accidental infrastructure privatisation can threaten regional competitiveness, and must be a key concern of planners. Policy-makers thus have an obligation to identify such competitive actions by firms which may be to the detriment of regional competitiveness.

As economies mature, planning for freight infrastructure may be viewed beyond simplistic notions of bounded optimisation and cost reduction to consider more complex long-run development implications. Freight policy must move from optimising the near present to guiding the transformation of uncertain futures. Through this, it becomes a deliberative and essentially political exercise in facilitating industry evolution and succession, the elimination of negative externalities, and creative destruction in line with public interests.

4 Guiding principles for policy-making

Freight policy is constructed in fragmented and dynamic processes. Given these challenges and recognising the complexity of freight patterns, there is a need to establish guiding principles to guide the inherently incremental, muddling process of moment-by-moment public policy decision-making (Forester, 1984; Lindblom, 1979). The heavy emphasis on positivist thinking, technical rationalism, and quantitative methods in freight research and policy synthesis described by Hall, Hesse, and Rodrigue (2016) presents a singular, mostly numerical picture of the nature of freight flows. This may result in a limited view of problems and the policy responses available to mitigate them, and an inability to consider how regional freight policy may work to guide more sustainable outcomes over longer-term, less bounded time horizons. For instance, interpreting freight efficiency concerns as reflecting deficiencies in existing infrastructure is likely to engender a focus on supply-side engineering solutions (which may further lock in unsustainable supply chain configurations) at the expense of initiatives to work with carriers to better understand and influence the patterns of freight transport demands.

Reflecting this need to support policy-making for the long-term (see Section 1), and the policy-making challenges identified in the literature (see Section 3), there is a need to view freight policy through top-level strategic guiding principles suited to informing all freight policy-making. Accordingly, this section charts four guiding principles for regional freight policy and associated research. These have been identified through this wide-ranging thematic review, and informed by the authors' experiences undertaking research and policy development for regional freight policy. These guiding principles are outlined in Table 2 and detailed in each of the following subsections.

The guiding principles have been ordered in approximate level of influence, from very long-term economic structure decisions, ranging down to principles that may directly influence immediate operational decision-making. Each guiding principle may support the implementation of the others. For example, incentives for reducing externalities in individual operating decisions (Principle 4, Section 4.4) can encourage firms to compete on attributes other than raw cost (Principle 3, Section 4.3) - which can rely on diverse infrastructure and supply chain development options being available (Principle 2, Section 4.2). Table 2 also includes a negative framing of each principle to illustrate the policies or decisions which are to be discouraged if that principle is to be applied.

Table 2. Overview of guiding principles

Guiding principle	Negative framing of principle	Intended outcome on freight patterns	Time scale/influence level	Related theoretical concepts
1. Plan for long-run succession of industries (Section 4.1)	Do not privilege old non-renewable industries over new sustainable development	Prioritise industries which transport higher value-density products and/or minimise transport impacts	Macroscopic (long-run strategic economic policy impacting on regional economic structure)	Freight decoupling (3.4); industry succession and creative destruction (3.2); economic diversification
2. Protect options for future decisions (Section 4.2)	Do not "lock out" future opportunities to improve sustainability	Maximise the set of future options for public policy and firms' supply chain design	Macro/mesoscopic (enabling divergent future regional infrastructure choices and uses)	Institutional fragmentation (3.1), path dependence (3.3), bounded rationality (3.1)
3. Develop competitiveness on attributes other than cost and speed alone (Section 4.3)	Do not target generalised user cost reductions	Incentivise firms to compete on attributes other than marginal transport cost; incentivise transport reduction	Mesoscopic (setting regional policy influencing firm location and supply chain design choices)	Induced demand and supply chain dynamism (3.4), fiscal competition (3.2)
4. Explicitly Value Negative Externalities (Section 4.4)	Do not discount or downplay impacts caused by freight	Incentivise the sustainability of supply chains and individual transactions which generate trips	Microscopic (incentives on transactional/ operational decisions)	Deliberative planning methods; pricing (4.4)

4.1 Principle 1: Plan for long-run succession of industries

Healthy economies evolve to improve productivity over time. In the long run, industries also tend to evolve towards higher efficiency and greener methods of production. The long-run aim of economic development is thus to facilitate the transition of the economy towards competitively advantaged industries which create high value with minimal negative impacts (Begg, 2016; Kresl, 1995). Excellent amenity, high standards of living, and the resulting quality of life are essential characteristics of places which attract and retain highly specialised mobile firms and knowledge workers necessary for advanced industries (Begg, 2016; Malecki, 2004). Policy-makers should therefore seek to maximise regional competitiveness through the prioritisation of industries or sectors.

Some forms of competitive advantage are fundamentally incompatible (Tom Liou, 2000, p. 1631), and governments may therefore play a major role in facilitating specifically desirable economic activity (Porter, 1998, 1990), and the relocation or retirement of noxious forms of industry. For instance, established ports are often at coastal sites with highly desirable geographic features, with the surrounding land being hotly competed for by uses (such as residential, tourism, and commercial development) which seek out that natural amenity (Hall, 2007). Regions which seek to create transport advantages for noxious commodities may therefore end up doing so at the expense of amenity and health, and at the detriment of potentially higher-value forms of economic activity. Regions which orient planning solely around raw basic material export, or some other single freight-intensive sector, will not enjoy long-term economic resilience (Pike et al., 2006). The implication is that policy-makers must facilitate the transition away from amenity-destroying historical industries – facilitating Schumpeterian "Creative Destruction" – accelerating succession towards industries which meet broader public interests.

Regional economic policy inevitably involves contentious and painful economic readjustment and potential conflicts between interests at the local, regional, and national levels; the role of government is to manage such transitions to achieve long-run public interest objectives (Kresl, 1995). Policy-makers have an obligation to identify and terminate economic activity which creates

value solely through the external destruction of finite resources, and the erosion of intergenerational equity (Greaves and Stanley, 2016). While this may appear to be an impossible ask, structural factors (such as technological innovations towards sustainability) may inherently align with these changes. The erosion of old competitive advantages, the decline of noxious industries and underperforming firms, and the frictions of creative destruction are often associated with political turbulence (Budd and Hirmis, 2004, p. 1020). The challenge for decision-makers is thus to be seen to manage the transition effectively. Their role is to identify the risks, challenges, and negative emotions of these changes and facilitate planning processes that mobilise changing structural forces for public benefit (Reed et al., 1987). Many such decisions are eventually made by default if governments do not act (Kresl, 1995). This underlines the need for integration of freight policy which recognises the multi-scale and intertemporal nature of public interests, and how efficient, market-oriented policy measures must be implemented through the accumulation of decisions through time (Allen et al., 2010).

4.2 Principle 2: Protect options for future decisions

Strategic planning must protect the options for use and access to existing infrastructure. Both infrastructure and logistics land can be threatened by inappropriate competition from other uses. Many monopolistic assets (particularly freight corridors and terminals) are critical for the ongoing competitiveness of the regional hinterlands they support, and governments must ensure that impediments to access are prevented (Visser and Hassall, 2010). Future options can be destroyed through: anti-competitive practices of private ownership of supply chain infrastructure; consumption of infrastructure capacity by unintended users (particularly low-value passenger transport as discussed in Section 3.4); and long-term deterioration of freight corridors by inappropriate adjacent development (Hall, 2007, and Section 3 of this paper). These factors must be considered by integrating land use and transport planning across national, regional, and local planning levels, particularly to prevent any local development that might inhibit regionally-significant infrastructure and associated logistics activity. Traditional planning controls may be applied to protect diverse freight modes, such as land-use planning oriented to facilitate the use of intermodal freight (Cui et al., 2015; McLeod and Curtis, 2020; Pellegram, 2001). For example, the City of London has proposed safeguarding existing river wharves and railheads to both maintain logistics capacity, and enable prioritisation of freight transport by rail and by water via the River Thames (Transport for London, 2019, pp. 131–142).

Protecting future options enables future market innovation, and the deferral of the replacement of existing assets that already embed resources and consume land. Clearly defining how options will be preserved also provides a degree of policy certainty for firms, supporting investment confidence. Options can be protected primarily by avoiding the privatisation of land and assets that may enable innovation in supply chain design. Infrastructure which falls out of use, such as railways, should also generally be preserved to enable future reuse. Corridors to ports and airports should be specifically protected to enable the future development of infrastructure within them, particularly considering the potential for alternative modes and future infrastructure. This principle is becoming commonplace in the planning of seaports (Taneja et al., 2012).

Providing the opportunity for multi-modal and multi-user infrastructure in freight corridors to ports can also enable co-location, bulk handling, and the consolidation of supply chains within close proximity to the port. Co-location of supply chain elements is a critical strategy in reducing the total quantum of freight movements and consolidating value-adding economic activity within a region (McLeod et al., 2019). Many actions to preserve long-term options – such as building railway infrastructure to cater for future double-staking when it is not currently used - may seem non-rational if viewed only through the lens of short-term optimisation, and assuming normative trends. Taking a long-term options protection view can also run counter to common decision-making heuristics, such as the economic discounting of future benefits common to economic appraisal (Hickman and Dean, 2017). Therefore, these strategic decisions often require the

legitimacy of deliberative and consultative processes, which can support the private sector's confidence in the logic and durability of freight policy.

4.3 Principle 3: Develop competitiveness on attributes other than cost and speed alone

The costs of transporting freight have been, over a long time period, significantly reduced (Glaeser and Kohlhase, 2003). However, while some reductions have been achieved by improved technology and operational optimisations, costs savings can also be made through: public subsidies (such as government spending on infrastructure – see section 3.2); the use of lower-cost fossil fuel sources; the exploitation of workers; and by indirect costs (such as pollution and safety risks) being imposed on external parties - and thus not borne by the customer (Mostert and Limbourg, 2016). The vast majority of global freight transportation, by all motorised modes, is still largely powered by fossil fuel sources with high-intensity greenhouse gas emissions (ITF, 2015; Kamakaté and Schipper, 2009; McKinnon, 2007b; McKinnon et al., 2015). Accordingly, policy measures which incentivise greater freight transportation activity (by reducing costs borne by carriers and their customers) are very likely to have negative sustainability implications. Therefore, except in very poor regions, reducing generalised costs of transport (including measures to generally increase road network capacity and increase vehicle speeds) is not likely to be an effective policy for supporting economic development, because new capacity is consumed by induced demand, eroding benefits and increasing emissions (Levinson and King 2019). Governments' infrastructure spending may yield little long-term competitive advantage, because regions may end up effectively in a bidding war to capture private-sector activity, competing away any overall economic development benefits (see section 3.2).

A focus on generalised costs, such as by public sector road-building, ignores this demonstrated capacity for firms to innovate to compensate for transport costs, and the potential for induced freight logistics demands to consume new supply, negating benefits. Firms in locations with high transport costs tend to adapt supply chains and differentiate product offerings accordingly (Gulyani, 2001). Where regional accessibility improves through new infrastructure, industries tend to relocate to consume low-cost peri-urban land (Dablanc, 2014). This "logistics sprawl" locks in future consumption of land and the resources to run extended supply chains. Therefore, infrastructure project planning should elucidate industry benefits in terms of opportunities for value differentiation and innovation, rather than in simplistic reductions of transport time or time variability associated with congestion.

Passenger and freight transportation policies are often developed separately (Cui et al., 2015), which further risks unintended induced demand consuming new infrastructure capacity. Decision-makers must consider both passenger and freight's modal shares, especially recognising that many flows of goods - particularly at the consumer ends of supply chains - are directly substitutable for passenger trips (Browne and McLeod, 2020). Governments must abandon "predict and provide" planning or the targeting of generalised costs and adopt policies that recognise the private sector's capacity to innovate within regulatory and physical constraints. For instance, a policy decision to tolerate a degree of peak period congestion provides an indirect incentive for logistics operators to consider measures to improve the efficiency of their operation. In such conditions, operators may schedule trips for times when more capacity is available, or provide a discount for customers who provide facilities to allow for unattended deliveries outside of usual business hours - without a specific policy or regulation being established. However, policy or regulation can be used to encourage operators to adopt a specific response to the recurrent peak congestion, if desired. Similarly, land use zoning controls against further development on the land side surrounding existing seaports may incentivise private-sector involvement in the establishment of dry ports, thus resulting in more efficient consolidation of large freight flows, and the protection of other land uses on the coast near the existing seaport (Cullinane et al., 2012).

4.4 Principle 4: Explicitly value negative externalities

Freight can be made more sustainable when the customer bears the full cost of the impacts of their activity (Mostert and Limbourg, 2016). While many externalities of freight can, in theory, be priced and integrated into policy assessment (Macharis et al., 2010; Van Wee, 2012), the full environmental, health and wellbeing impacts of some externalities (such as the implications of global warming and resource depletion) are uncertain. Since strategic policy-making must cope with such inherent uncertainty, it invariably involves value-based discretion, even where it is supported by significant empirical analysis. Externalities – even if nominally taxed – may also be fundamentally unfair to the people who suffer from their impacts. Thus, levying externalities through regulation or taxation alone may be ineffective at fully addressing sustainability impacts, especially if the funds collected are not used to remedy the actual impacts of the externality (Bithas, 2011; Piecyk et al., 2010), or if nearby jurisdictions do not levy an equivalent price, incentivising firm or industry relocation.

The political dynamics of levying indirect costs can also counter long-run, intergenerational sustainability outcomes, since only stakeholders in existence at the present day can directly influence policy-making (Scheurer et al., 2019; Spash, 1997). The pricing of externalities should thus be explicitly value-laden, broadly applied, and proactively increased to the level needed to truly offset any adverse impacts on third parties, including future generations. In turn, all costs should become internalised and thus paid in full by shippers and their customers. For example, many European cities have instituted charges, taxes, or restrictions on vehicles based on mass, size, or compliance with European emissions standards. In turn, this charge may prompt operators to: replace older, less efficient vehicles; substitute vehicles for cargo cycles; or make operational improvements, such as consolidation or measures to reduce the rate of failed deliveries.

External costs create political forces which should be mobilised to support the imposition of higher prices. The pricing of those externalities may also result in the collection of funds that may be used to support initiatives to further prevent or mitigate the impacts of freight activity. The coalitions of interest which arise around negative externalities (and positive solutions to address them) are a significant resource for policy-makers seeking to manoeuvre against the existing industrial interests which create those negative externalities (Legacy, 2016). This is often acutely true in urban areas, where the interests of a concentrated group of local stakeholders impacted by freight – who may be principally concerned with their present-day welfare – may align with broader, intertemporal sustainability goals (see Browne and McLeod, 2020).

The use of participatory Multi-Criteria Analysis (MCA) methods and other frameworks and techniques for involving public stakeholders in freight planning processes has become widely profiled in the research literature (Gatta et al., 2019; Hickman and Dean, 2017; Macharis, 2005; Macharis et al., 2014). Similarly, research programs such as BESTUFS have demonstrated the potential for partnership and collaboration arrangements to translate, trial, and establish practical measures to implement freight policy (Allen et al., 2007). As many of these studies have identified, stakeholder engagement in freight policy-making often involves business and organised interest groups being well-represented, with comparatively limited involvement of the general public, or stakeholder groups that may be disproportionately impacted by the negative externalities of freight transport. Such participatory methods hold much promise in elevating long-run, intergenerational public interest concerns in planning for freight. Freight planning which focuses purely on technical analysis may miss many of these broader and complex socio-political functions of planning, such as the development of public support for strategies through deliberative engagement (Soria-Lara and Banister, 2017).

5 Conclusion

Freight policy fundamentally requires the application of a broad range of expertise and analytical processes. Planning for freight transcends several professional fields, including logistics, transport economics, civil engineering, planning, business, and other environmental and social domains of knowledge. This often results in drastic differences in focus, objectives, problem definitions, and proposed solutions. The competitive dynamics which drive freight patterns are often fundamentally ambiguous and difficult to understand (Mentzer, 2004) - not least because of the incentive freight actors have to limit their sharing of information (Hensher and Brewer, 2001; Lindawati et al., 2014; Wilbur Smith and Assoc., 2010).

Effective strategic planning for freight requires the integration of input and the proactive coordination of decisions by a wide set of interrelated actors. Regional freight policy must move away from traditional "predict and provide" toward more collaborative processes. The integration of different actors and processes towards common aims (and prioritising the most high-value sources of competitive advantage) is a critical requirement for freight policy that supports economic development (Begg, 2016; Closs and Bolumole, 2015). Economic development should be fundamentally concerned with taking a proactive approach to facilitating trade which best meets public objectives. Key to this is differentiating economic activity and associated freight flows, and making deliberate decisions to create the conditions in which innovative firm activity maximises productive value and minimises external costs.

The principles outlined in this paper are likely to deliver the most significant benefits if adopted at the highest possible level of strategic policy, used in executive decision-making, and perhaps most importantly, as the basis for deliberative planning. Much of the existing literature on freight policy remains focused on presenting highly specialised analytical processes and bounded optimisation, rather than assessing the complex political nature of problems faced by decision-makers within the broader policy-making process. There has been limited conceptual debate on the role or complexities of public interests in freight policy, or recent guidance for practitioners on how to consider the interrelated problems of freight geographies, economic development, sustainability, and the political process of forming public policy. These questions deserve further scrutiny, particularly where analyses are opened to consider intergenerational implications of economic policy decisions (Malekpour et al., 2015; Pike et al., 2006).

The development, application, and evaluation of principles, frameworks, and outcomes derived from translating empirical freight research is the critical frontier of freight planning research. How we translate research into tangible, large-scale change through policy is the critical challenge of freight planning today. Further research on political methods and practices to transition unsustainable industries towards competitive innovation and higher-value economic activity would also be of significant value. Questions of how public policy-makers should facilitate conditions that catalyse firms' innovation towards sustainability are critical and deserve more research focus. Similarly, further research on how diverse stakeholder groups and interests may be involved in freight policy-making and implementation is likely to support improved practice.

Ultimately, policy-makers must recognise that strategic planning and analytical rationality should be a support – not a substitute – for democratic political decision-making. Given the urgent need to transition towards more sustainable regional freight flows, and the immense public benefits that can be achieved through more sustainable freight transport, the public policy processes for facilitating these changes at scale remains a critical area for further research.

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Appendix - Supplementary File

The supplementary file for this article (the full set of literature reviewed, in the taxonomy as presented in Table 1) is available at: http://doi.org/10.17632/n9scz66vxh.