Location Factors and Their Performance Measures for a Sustainable Urban Freight Consolidation Centre (UFCC)

Afzal Mohammad Khaled and Zahurul Alam

Abstract

The sustainability of urban freight transportation is a burning issue due to its huge impact on the environment, economy and society. In order to improve the sustainability of urban freight transportation, many EU countries have established urban freight consolidation centres (UFCCs). However, a large number of UFCCs have failed to succeed. The location of the UFCC was one of the factors shown to determine success. Previous researchers have tried to identify the UFCC location decision and success factors independently. The location factors of UFCCs did not incorporate all the location-related success factors. Besides the performance measures of those factors, attempts to rate alternative locations were also not standardized. This descriptive research reviewed both location factors and success factors to build a pool of factors that will be crucial for evaluating and selecting UFCC locations that will be sustainable. The research also identified performance measures that should be used to measure the degree of existence of those factors. The most desirable location for establishing a sustainable UFCC can be identified from the best aggregate performance indices that can in turn be calculated using the framework proposed in this research.

Keywords: *location factors; performance measures; success factors; sustainability; UFCC*

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1. Introduction

Urban areas require effective and efficient transport systems to make them attractive places for living, shopping, working and spending leisure time. However, transport operations contribute significantly to the problems of congestion, pollution, safety and noise that can make urban areas unattractive (Allen, Thorne & Browne, 2007). Goods transportation consumes 40% of total urban oil consumption and produces 20-30% of total vehicle kilometres and 16-50% of air pollution in urban cities (OECD, 2003; Dablanc, 2007; Marcucci & Danielis, 2008). Nearly 1.2 million people die every year in road injuries and it is the leading cause of death among young people and the ninth highest cause of death among all people. Surface freight transportation causes 40 times and 200 times more fatal accidents compared to ship or rail transportation respectively (Lawson, 2007). Its contribution to congestion, noise and harmful emissions is also much larger than other modes of freight transportation. Hence, there is a popular perception that freight vehicles are detrimental to the urban environment (Regan & Golob, 2005; OECD, 2003; Woudsma, 2001). As a result, the sustainability of urban freight transportation has become a burning question. Many types of initiatives (e.g. entry restrictions, tax breaks, collective delivery and others) have been operationalized to try to make urban freight transportation sustainable (Allen *et al.*, 2003; Allen *et al.*, 2007; Ambrosini & Routhier, 2004; Browne & Allen, 1999; Ogden & Young, 1984; Quak, 2008; Taniguchi, Thompson & Amada, 2003). According to scholars, the most effective strategies will be those which can contribute simultaneously to tackling economic, environmental and social problems. The Urban Freight Consolidation Centre (UFCC) is one such effective strategy for building sustainable urban freight transportation. It can contribute economically by reducing vehicle-km, vehicles' dwelling time on roads, number of stoppages and peak time

operations. It can increase average truck loads, while also offering 24-hour 7-day services. The UFCC can assist the environment by reducing emissions and fuel consumption. It can also contribute to society by reducing pollution-related sickness, road accidents and loss of land. The UFCC in the city of London reduced the distance travelled and CO_2 emission by 20% and 54% respectively (Browne, Allen & Leonardi, 2011). At the Tenjin UFCC of Fukuoka, Japan, there was a decrease in total distance travelled of 28%, while the need for trucks was reduced by 61%, the total traffic by 0.8%, delivery vehicle parking time at the city centre by 6.8%, total NOx emissions by 0.4% and fuel consumption by 0.3% (Nemoto, 1997). The Broadmead UFCC in Bristol, UK, receives freights anytime and can ensure 100% on-time delivery (Van Duin, Quak & Manuzuri, 2010). The UFCC at Kassel in Germany has resulted in a 60% reduction in vehicle-km within the inner city, 13% reduction of drops per retailer and 100% or above increase in vehicle capacity (Browne *et al.*, 2005; Van Duin, Quak & Manuzuri, 2010). The UFCC at La Rochelle in France reduced vehicle-km made by conventional trucks in the city centre by 61% (Patier & Browne, 2010). The ability to contribute to all three kinds of sustainability measure related to freight transport made UFCCs very popular. However, the UFCC itself represents a serious sustainability issue. Browne *et al.* (2005) conducted a survey on UFCC initiatives taken between 1970 and 2005 and found 67 clearly evident UFCC initiatives in this time period, of which only 27 were still operating by 2005. Most of those feasibility, research, pilot/trail or fully operational initiatives originated in EU countries. Researchers identified several factors as being vital for sustainable UFCCs (Kohler, 2003; Allen *et al.*, 2007; Browne *et al.*, 2005 *inter alia*). Some of those success factors were related to both location and operations of UFCC. Another line of research identified various location factors for UFCCs (Ogden & Young, 1984; Young, Ritchie & Ogden, 1980; Kayikci, 2010; Zhang *et al.*, 2011). However, in those research studies, some location-related factors identified as being important for sustainability were not considered important for the location decision. Hence, current UFCC location choice factors do not

necessarily relate to sustainability. This research study will review papers to identify the factors important for locating a sustainable UFCC. In addition, the performance measures of the factors required for the empirical evaluation of the alternative locations were identified. The research will help to make an evaluation framework for evaluating and prioritizing UFCC candidate locations.

2. Conceptual Framework

2.1. Urban Freight Consolidation Centre

The UFCC is a logistic facility that serves a specific central business district (e.g. city centre) or a shopping centre or a large construction site with regular consolidated deliveries provided by multiple transporters. The UFCC can also offer other additional services such as temporary storage, collection points and home deliveries.

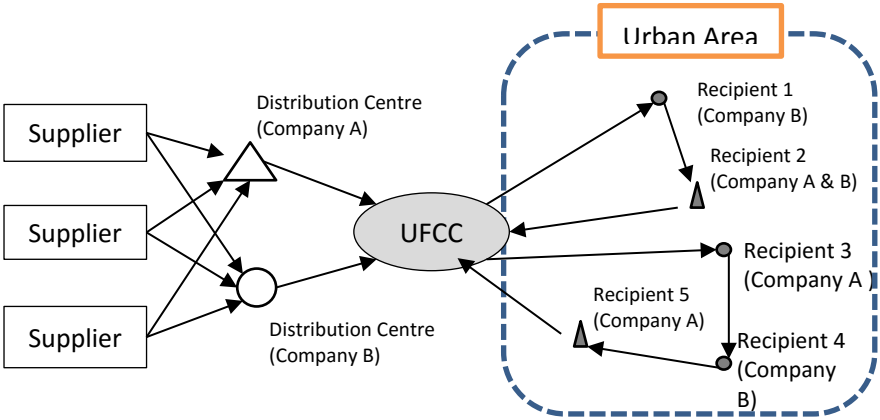

Figure 1: *Operations of the UFCC;* **source:** *Author*

In contrast to a typical company distribution centre, a UFCC is managed by an independent company and consolidates and delivers freights of multiple distribution companies based on the final drop

point (Allen *et al.*, 2007). Being located outside of the service area, the UFCC normally enjoys some exemptions from local vehicle access restrictions with respect to time and area. Since the UFCC delivers to end customers such as retailers or even consumers, its scale of operation is much smaller than for an integrated freight terminal or regional hub. The average distance of the UFCC from its service area is generally less than 10 km.

Previous research studies related to UFCCs can be categorized into concept enlargement studies, impact analysis studies, case studies and location and demand measurement studies. The concept enlargement studies explain the definitions, classification, implementation and evaluation of the methodologies of the UFCC (Allen *et al.*, 2007; Ambrosini & Routhier, 2004; Benjelloun & Crainic, 2008; Browne *et al.*, 2005; OECD, 2003; Ogden, 1992; Weisbrod *et al.*, 2002; Woudsma, 2001). Impact analysis studies evaluated the UFCC's contribution to environmental, social and economic improvement (Kawamura & Lu, 2008; McDermott, 1975; Taniguchi & Van der Heiden, 2000). Case studies identified critical factors for the success or failure of previous UFCC initiatives (Kohler, 2003; Van Duin *et al.*, 2010; Van Roijen & Quak, 2010; Quak & Tavasszy, 2011; Chwesiuk, Kijewska & Iwan, 2010; Finnegan *et al.*, 2005). Studies related to location and demand for UFCC focused on representative factors to be considered when locating a UFCC (Young *et al.*, 1980; Ogden & Young, 1984; Yang & Lee, 1997; Yang *et al.*, 2008; Zhang *et al.*, 2011), the potential customers of the UFCC (Regan & Golob, 2005) and urban freight transport cost structures that favour UFCCs over private distribution centres (DCs) (Marcucci & Danielis, 2008).

2.1. Location Factors for a Logistics Facility

A UFCC serves in a similar way to traditional DCs. Consequently, the factors considered for logistics facility location (whether a factory or a DC) are also important for the location decision of a sustainable UFCC. Table 1 below presents the main location selection factors

proposed in the literature for DC location problems. There are also some research studies that have tried explicitly to identify the relevant UFCC location factors (Young *et al.*, 1980; Ogden & Young, 1984; Kayikci, 2010; Zhang *et al.*, 2011). Table 2 below presents a summary of those factors identified in the literature.

Factors	**Category**
Population (size and density)	Demand
Purchasing power (income)	
Competitors (size and aggressiveness)	Competitors
Transportation (availability and cost of access to market/supplier, congestion level)	Transportation
Community (attitude, utilities, living standards, law and order)	Community
Land (cost of land, rent, size, visibility)	Land
Labour (availability, productivity, wage rate, unionization)	Labour
State and local regulation (tax, tax incentives, wage payments, environment pollution)	Regulations

Table 1: *Summary of Location Factors for Manufacturing and DCs***; source:** *Adapted from Yang and Lee (1997); Yang et al. (2008)*

Factors	**Category**
Market size, corporation size and closeness to other sister facilities	Demand
Proximity (to roads, seaports, railways, highways, airports)	Transportation
Cost of operating the vehicle fleet	
Availability of land and utilities and land cost	Land
Social impact, access restriction, environmental restriction	Regulation
Availability of labour	Labour availability

Table 2: *Summary of Location Factors for Freight Facilities/City logistics Centres;* **source:** *Adapted from Ogden and Young (1984); Young et al. (1980); Kayikci (2010); Zhang et al. (2011).*

As will be shown, most of these logistics facility location factors are also included in the UFCC location decision factors. Only two main categories, the competitor and community related factors, are excluded. Since the UFCC will try to consolidate freights across competitors, it is understandable that competitor related factors may not be important for the UFCC location decision. However, with the exception of law and order, other possible community-related factors were totally ignored in the UFCC location decision.

2.2.Sustainability of Urban Freight Transportation

Sustainability in transportation means the ability to meet today's transportation needs without compromising the ability of future generations to meet their transportation needs (Richardson, 2005). The triple bottom lines of sustainability are economic, environmental and social sustainability. A successful UFCC can become a sustainable UFCC if it pays attentions to these bottom lines. If the success factors of UFCCs as identified by multiple case studies are considered (see Table 3 below), it can be seen that community and administrative factors were also found to be playing important roles. Among the total of 17 types of factors, many are related to community and administrative circumstances. In addition, the emphasis on individual factors within categories also differs in some cases. For example, in the case of the location category, the emphasized factors are mostly land prices, utility costs and the availability and visibility of the land, whereas the main location related factor that causes the success of a UFCC is distance. The reason may be that government support for most of the UFCCs' land and infrastructure development has reduced the importance of land price factors. Consequently, the factors and their relative importance identified for a suitable UFCC location by these studies are not closely related to sustainability.

Significant existence of transport problems (Transport issues)	Early involvement of all actors (Participation issues)
Enhancement of economic efficiency of delivery (Efficiency issues)	Availability of funds
Existence of restrictions over traffic movement (Access issues)	Political and administrative back-up
Environmentally friendly vehicles (EFV)	Local enforcement of relevant transportation and environmental laws
Demand for consolidated deliveries	Experienced private management
Demand for value added services	Competent mediators
Strategic site location	Substantial control over all the actors
Common interest for social welfare (Objective issues)	Scientific support
Cooperative attitudes among potential participants (Attitude and strategic issues)	

Table 3: *Summary of Success Factors for a Sustainable UFCC;* **source:** *Adapted from Kohler (2003); Allen et al. (2007); Browne et al. (2005); Quak and Tavasszy (2011); Van Roijen and Quak H (2010); Van Duin et al. (2010).*

2.3. Objectives

There were three objectives of this study. The first objective was to identify the factors that must be considered for selecting locations suitable for UFCCs from the viewpoint of sustainability. The second objective was to develop a location choice model that will denote the nature of the factors favourable for establishing a successful UFCC. The third objective was to identify performance measures for the selected factors so that candidate locations can be compared in terms of the selected factors and, therefore, the best location can be chosen.

3. Methodology

To make a UFCC location sustainable, it is important to incorporate all spatially related success factors into its location choice model. Here, the reviewed success factors of UFCC were analysed under a framework of location factors for logistics facilities. In this manner, it is possible to merge the success factors and the location factors together in order to build a representative framework for selecting a suitable as well as sustainable location for a UFCC. Since each candidate location will be scored for each factor, specific performance measures must be identified for all of them. Research studies related to the evaluation of urban freight transport facilities were used to identify a possible pool of performance measures. For the identification of sustainable location factors and their performance measures, success factors in five categories were first analysed to clarify the ways those factors are related to the success of the UFCC. A comprehensive model was then constructed for at a glance identification of UFCC location choice factors and their performance measurement tools. Sources of information for this process included literature reviews, empirical success and failure case studies, relevant websites and books.

4. Findings

4.1. Sustainable UFCC Location Choice Factors

4.1.1. Transportation Factors

The possibility of accepting UFCC is very high in the areas where transport problems such as congestion, parking place scarcity, pollution, safety hazards, narrow streets, large crowds and access restrictions are acute (Kohler, 2003). The severity of transportation problems in a specific locality can be measured by delay times, travel times, level of service, passenger car and freight vehicle volumes, loading and unloading times, noise level, carbon level, number and severity of crashes, cost of access restrictions and others. However, the social benefits of such restrictions should be well communicated to avoid misinterpretation (Kohler, 2003; Van Roijen & Quak, 2010, Van Duin *et al.*, 2010). However, if the UFCC can offer better efficiency than an ongoing delivery system, then such restrictive regulations become unimportant. There are several kinds of regulations from which UFCC can benefit such as, for example, entry restrictions, entry pricing, loading and unloading (parking) pricing and environmental zones. The number and severity of such restrictions can be used when choosing between alternative location candidates.

Relevant costs incurred by delivery through UFCC should be less than the relevant delivery costs incurred without UFCC from the perspectives of both users and city administrators to encourage them to participate in this initiative. The performance measures in this context could be the efficiency of the UFCC and could be measured in terms of percentage of deliveries made on time, time savings per delivery, open hours per day per week, reductions in vehicle-km, number of trucks per destination per year, utilization of vehicle capacity, shorter journey times, night time deliveries, changes in parking time and frequency, changes in fuel consumed or changes in operating costs (Van Duin *et al.*, 2010; Browne *et al.*, 2005).

Environmentally-friendly vehicles (EFVs) reduce pollution and, thus, are often allowed to enter into restricted zones at restricted times. Use of EFVs through a UFCC allows wider time windows and access to areas where regular delivery vans cannot enter. These enhanced services can induce freight forwarders to use UFCC services. EFVs also fit the environmental improvement objectives of the UFCC. However, one of the problems associated with the failure of the La Rochelle UFCC initiative was the lower capacity of electric vehicles (EVs), which resulted in more vehicle trips and urban congestion. Moreover, EVs at the UFCC in Leiden slowed down all the traffic (Van Roijen & Quak, 2010). Here the problem identified was the failure to select the right kind of EFV. Consequently, for sustainable UFCC location decisions, the impacts of EFVs will be covered by the proximity to the service area attributes of site location factors.

4.1.2. Demand Factors

The success of a UFCC depends to a considerable extent on the demand for it. Many UFCC initiatives have failed due to overestimation of the level of demand (Browne *et al.*, 2005). The transport companies and/or retailers interested in UFCC services may have had their interest stimulated by delivery services; value added services and/or return load opportunities (Kohler, 2003; Browne *et al.*, 2005). The volume of deliveries depends on population densities in the catchment areas (Kawamura *et al.*, 2008), size of population, business mix etc (Kohler, 2003). Ambrosini and Routhier (2004) and Regan and Golob (2005) estimated that about 20% of the carriers are willing to use a city consolidation centre. Again, not all goods can be feasibly delivered through a UFCC. Goods that requires special treatment, such as those that are perishable, time sensitive, hazardous and high value goods, are not easy to consolidate and, therefore, are not feasible for handling through a UFCC (Browne *et al.*, 2005). Similarly, only less than truckload (LTL) deliveries should be taken as demand since full truckload (FTL) deliveries are more efficient than breaking bulk at a UFCC (Van Roijen & Quak, 2010).

Large retailers and chain stores are already very efficient in operation. So, their interest in seeking UFCC services can be very limited. The real demand for UFCCs should be calculated from the demand of independent and small retailers in constrained areas who are serviced by operators with small multi-drop deliveries (Browne *et al.*, (2005). Independent and small retailers are chosen since their operations are not optimized and they rarely get FTL deliveries (Van Roijen & Quak, 2010, Van Duin *et al.*, 2010)

Measuring demand for value added services is relatively qualitative in nature, since such services reduce the participant's investment in land and infrastructure and, consequently, land prices and infrastructure development costs should be used for measuring the demand variability among alternative candidates.

Return loads can generate revenue for UFCCs and reduce empty vehicle trips. Inter-store transfers, stock return, outbound from city delivery, waste and damaged materials for recycling, delivery of customer orders to pick-up point are all candidates for return loads (Browne *et al.*, 2005). The oldest successful UFCC of Tenjin, Japan is well known for collecting goods from the city centre to deliver elsewhere as return loads. Return loading of waste materials not only save storage space but also reduce trips made by rubbish collection trucks in the city centre. The volume of return loads can be estimated by considering the nature of manufacturing destinations in the catchment areas.

4.1.3. Site Factors

The site of a UFCC influences its accessibility, travel distance, coverage area, service level and other variables. A remote location reduces exposure to large vehicles and maximizes the uses of EFV for deliveries but increases the number of kilometres travelled. On the contrary, a close siting will obtain fewer social and environmental benefits. A strategically sited UFCC will also increase the number of

users. Distances from highways (intermodal points), distances from private DCs and distances from service areas are the three basic factors considered while siting sustainable UFCCs (Allen *et al.*, 2007; Van Roijen & Quak, 2010). The average one-way distance from a service area of all currently operational UFCCs is about 10 km. Such distance can now be covered without difficulty by modern EFVs.

4.1.4. Community Factors

A UFCC should be located in a community where the stakeholders related to freight transportation share common interests and believe in mutual cooperation and active participation. Here, the community includes traders in the same geographic area who offer a similar range of products (i.e. logistics companies and retailers), local government representatives, potential UCC operators, trade associations, police authorities and resident representatives (Browne *et al.*, 2005). The main interest for establishing UFCC should be related to social or environmental issues rather than economic advantage. In Kassel, Germany, the transport companies voluntarily cooperated to build a UFCC to improve their image for being environmentally-friendly (Van Duin *et al.*, 2010). If the receivers and retailers join to use a UFCC, then the freight forwarding agencies will also be forced to use UFCC services in a demand driven market (Kohler, 2003; Van Roijen & Quak, 2010). Common interests should be coupled with mutual cooperation and transparency among the participants. The UFCC of Leiden in the Netherlands failed because of reduced demand caused by the unwillingness of parcel companies to co-operate with their competitors. The involvement of retailers gives opportunities to set pick-up points and also to generate revenue by home deliveries (Kohler, 2003). The successes of the UFCCs at La Rochelle, France and Malaga, Spain were attributed to the involvement of the initiator, the municipality and important stakeholders at a very early stage (Van Duin *et al.*, 2010). Factors under community categories are mostly attitude-related factors and thus necessitate qualitative surveys.

4.1.5. Administrative Factors

Not all of the administrative factors mentioned for a sustainable UFCC are directly related to its location decisions. Among the seventeen factors mentioned above, the availability of funds, political and administrative support and law enforcement issues are directly related to the location choice. A UFCC requires funds for two kinds of expenses: initial setup costs and operating expenses. The sources of fund could be either from public donations or cost-sharing by participants. Most of the sustained UFCC initiatives have been supported by the continuous financial help from municipalities or from other public sources (Kohler, 2003). Public funds normally come from development projects and transport revenues (such as access fees, road pricing and parking fees). Hence, regional economic strength and transport revenue status can be diverse sources for public funds. The attitudes of politicians can be crucial for securing long-term continuous funding. Besides, they can also help for building awareness and legislation in favour of the UFCC (e.g. through vehicle restrictions, time windows and eco-zone provision). However, such legislation cannot do much for a UFCC if the implementation is insufficient. The UFCC at La Rochelle, France, faced a problem with participation resulting from the lack of implementation of vehicle entry restrictions (Van Roijen & Quak, 2010). An opinion survey of the stakeholders can reveal the attitudes of politicians and the level of enforcement of transportation and environmental laws.

5. Findings and the Sustainable Location Choice Model

In Table 4, below, the analyzed success factors relevant to the location decision are presented in accordance with the location factors. Factors are also categorized into sub-factors, according to the hierarchy of the problems and issues involved.

Category	Factors	Sub factors
Transportation Issues	Vehicle manoeuvring issues	Access restrictions Congestion and Parking issues
	Pollution issues	Air pollution Noise pollution
	Safety Issues	
	Efficiency improvement issues	Delivery reliability Cost reduction issues
Demand	Demand for consolidated deliveries	Number of retailers/end consumers Number of transport carriers
	Demand for value added services	Retailers' usages (stockholding facilities; quality control; pre-retailing of products such as removal of packaging, pricing and labelling; inter-store transfers, home delivery operations) Carriers' usages (storage facilities; waste collection services; community collection and delivery points; return loads such as stock returns; outbound city deliveries)
Site Issues	Proximity to intermodal points (highways, railways and sea ports) Proximity to the private DCs of participating transport companies Proximity to service areas	
Community Issues	Common objective issues Cooperative attitude issues Participation issues	
Administrative Issues	Funding issues	Initial funding Operational subsidies
	Political and administrative back-up	
	Law enforcement issues	

Table 4: *Classified of the Success Factors for the Sustainability of a UFCC;* **source:** *Author*

The resulting model (see Figure 2 below) can be used to evaluate a potential location for building a sustainable UFCC. The model includes factors to be considered, as well as issues relating to issues involved in establishing a sustainable UFCC.

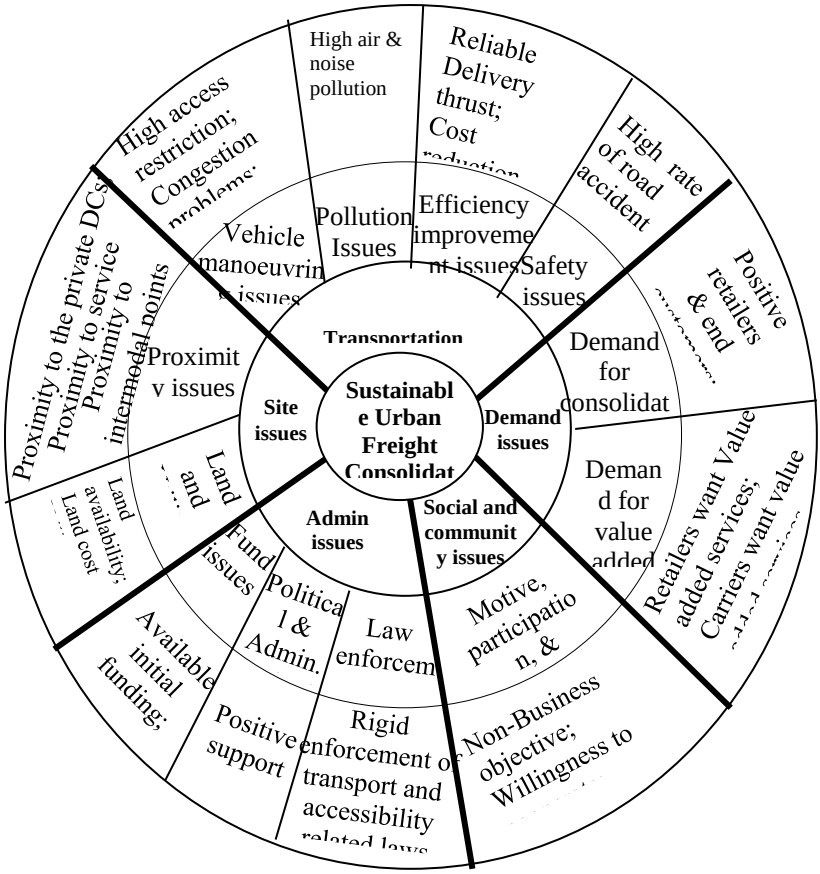

Figure 2: *Location Choice Model for Sustainable UFCC;* **source:** *Author*

However we need some performance measuring scale for measuring each of the factors so that we can use factor rating method to the location candidates. Table 5 presents a complete pooled picture of the categories of factors with their relative performance measures found in the reviews. Candidate's weighted aggregate performance indices

can now be calculated for prioritizing establishment of sustainable urban freight consolidation center.

6. Recommendations

The theoretical benefits of a UFCC have lured many government and city agencies to trying to create one without prior feasibility studies and, therefore, decisions which could not be sustained. There are several other methods by which such benefits might be obtained when a UFCC is not feasible. Consequently, a complete feasibility study is required using the factors proposed in this research. Positive outcomes of the analysis with respect to all factors would be necessary to predict success for a UFCC. However, measuring each of the factors simultaneously may increase unnecessary costs. Factors should be studied one by one and ranked by importance. Factors have been classified here in five categories. In order to reduce the cost of a feasibility analysis, it is recommended that analysis of each category be conducted sequentially and should proceed only if the previously analysed categories were found to be positive for establishing a UFCC. The chronology for analysis should follow the framework presented in Table 5, i.e. transportation problems, sufficient demand issues, site issues, social acceptance issues and administrative issues. All successful UFCCs started on a pilot test basis and it is recommended that such a policy continue to be put into practice. A governing authority should demonstrate patience for several months in order to reach break-even point, if this is to be achieved, since it represents a complete shift of paradigm in urban distribution systems.

Category (Location reviews)	**Factors (Sustainability reviews)**	**Sub factors (Sustainability reviews)**	**Performance Measures for alternatives** (Kennedy *et al.*, 2005; Allen *et al*, 2007; Kohler, 2003; Kawamura *et al.*, 2008; Thompson & Hassall, 2006)
Transportation Problems	Vehicle manoeuvring issues	Access restrictions problems Congestion problems Parking problems Operating cost issue	Cost of entry, open hours per day per week, average delay times, travel times, loading and unloading times
	Pollution issues	Air pollution Noise pollution	Passenger and freight vehicles volumes Freight vehicles dwelling time in CBD. Carbon and noise levels
	Safety Issues		Number and severity of crashes, freight vehicles
	Efficiency improvement (Service) issues	Delivery reliability issues Cost reduction issues	Percentage of deliveries made on time, open hours/day/week Time saving per delivery, reduction in vehicle kilometres, increase in capacity utilization, shorter journey times, changes in parking time and frequencies, changes in fuel consumption, changes in operating costs
Sufficient Demand Issues	Demand for consolidated deliveries	Measuring from retailers'/end consumers' and carriers' perspective	Urban area size, population density, number of independent and small retailers Number of LTL deliveries, volume of goods carried
	Demand for value added services	Retailers' usages (stocking; QC; pre-retailing functions such as removal of packaging, pricing, labeling etc.; inter store transfer, home delivery	Urban area size, population density, number of independent and small retailers Number and volume of LTL deliveries, number of manufacturing units in the destination, land price, infrastructure

		operations) Carriers' usages (stocking; waste and return load collection; community collection and delivery points, outbound to city deliveries)	development costs
Site Issues	Proximity issues	Proximity to intermodal points (highways, railways and sea ports) or freight traffic centres, private DCs and service areas	Average distance from intermodal points and private DCs and average round trip lengths to service areas
	Land and utility issues	Land availability and cost, utility costs	
Social Acceptance Issues	Objective issues Mutual cooperation issues Participation issues		Percentage of participants with objectives on social and/or environmental improvements of service area Level of interest in cooperating with competitors for joint distribution Percentage of freight transporters and retails/end customers agreed to participate
Administrative Issues	Funding issues	Initial funding issues Operational subsidies issues	Development budget, general tax base, transportation levy Transport revenues (access fees, road tolls, parking fees)
	Political and administrative favourable attitudes		Average level of interest by politicians and administrators for backing up UFCC
	Law enforcement issues		Level of traffic law enforcements opinioned by stakeholders

Table 5: *Hierarchy of Location Selection Factors with Their Performance Measures for a Sustainable UFCC Location;* **source:** *Author*

7. Conclusion

A UFCC can be a great resource in terms of sustainable urban freight transportation. However, the UFCC itself may lack sustainability. An inappropriate location choice has made many UFCCs unsuccessful. In this research, the success factors of UFCCs have been categorized by a location decision framework relating to logistics facilities. The factors important for a sustainable UFCC are divided into five categories: transportation issues; demand issues; site issues; social acceptance issues and administrative issues. There are 11 factors and 23 sub-factors within those categories. Each factor or sub-factor can be measured by means of several performance measures. The most desirable location for establishing a UFCC will be the candidate location that earned highest aggregate indices of performance values weighted by the factors/sub-factors weights. This research has created a model for evaluating alternative candidate for UFCC location from the sustainability viewpoint. It also identified alternative performance measures for each of the factors affecting sustainable UFCC location. Establishing UFCC in a location identified by this framework would ensure the highest possibility of its subsequent success and sustainability.

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