How Could the Integration of Land Use and Transport in Planning Practice Contribute Achieving Sustainable Urban Form - By a Case Study Analysis of Kings' Cross and Olympic Legacy in London

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Abstract: This dissertation seeks to analyse how the integrated land-use and transport planning could contribute archiving sustainable urban form. It has been evidenced that there is a close interrelationship existing between land use and transport. Moreover, it is essential to evaluate the effectiveness of planning practice for archiving a more sustainable future from an integrated perspective of land use and transport. London Kings' Cross and Olympic Legacy have been selected as two studying cases, as London can be regarded as an excellent research platform with the well-developed planning system. In general, this study will analyse and explain the contribution of integrated land-use and transport planning for sustainable urban form in three levels. Firstly, the theoretical relationship between sustainable urban form and its influencing factors will be summarised. Then, the primary planning principles will be summed up through the analysis of integrated planning strategies. Finally, the effectiveness of planning practice will be assessed through the case-specific planning policies. The conclusion in various levels will improve the connection between theoretical research and planning practice for achieving sustainable urban form through integrated land-use and transport planning.

Keywords: Sustainable urban form, Integrated land-use transport planning, London King's Cross, London Olympic Legacy

1. Introduction

1.1 Theoretical background and purpose of study

In the 21st century, urban sustainability is regarded as a crucial issue for the development of human society. It is evidenced that the integrated efforts of land-use and transport planning usually have significantly positive impacts on sustainability in an urban context, which is also regarded as the achievement of the sustainable urban form (Mason, 1994). The definition of sustainable development and its relationship to the urban context is a priority to understand the concept of sustainable urban form (SUF). Since the conference of World Commission on Environment and Development (Brundtland, 1987), the universally accepted definition of sustainable development is described as an event which is capable of meeting today's needs without compromising the ability of future generations to meet their own needs. Previous research has revealed that shifts in behaviour and attitudes could significantly affect the acceptance of urban sustainability. Implicitly, manipulating land uses which support potential reductions in transport emissions should be one of the most effective methods of achieving sustainable urban development.

1.2 Research question

The principal aim of this paper seeks to answer the question of how could urban planners and policy-makers promote sustainable development in planning practice from the viewpoint of integrated land-use and transport planning(ILUTP). The interrelationship between sustainable urban form (SUF) and integrated land-use transport planning (ILUTP) will be established to explain how land-use and transport planning could collaboratively contribute to SUF in planning practice.

1.3 Overview of study process and significance of the study

Firstly, main influencing factors in achieving SUF will be critically analysed to explain why the relationship between land use and transport planning is vital in achieving SUF. Secondly, a literature review about the theories of the land-use transport interaction will be discussed to explain the interrelationship between land-use and transport planning system. Strategic planning policies will then be reviewed to classify main planning principles for achieving SUF. According to the analysis of strategic planning policies, case-specific policies of two study cases will be comparatively analysed. Finally, the contribution of ILUTP to achieve SUF will be assessed.

The primary contribution of this research may be to further explore the correlation between land-use planning system and transport planning system for make SUF successful. On the other side, the comparative analysis of case-specific planning policies in two study cases will help to define similar and different focuses on integrated principles in achieving SUF.

2. Literature review and criticism

2.1 Theories about sustainable urban form

It is hard to identify which urban form is most sustainable for development in cities. Williams et al. (2000) argued that certain types of urban forms could be more sustainable in some respects, involving

reduced travel demand and green energy usage, but detrimental in others, perhaps in causing social inequalities. In fact, the concept of sustainability covers a variety of aspects. It is necessary to analyse the connections between urban form and various sustainable features at different geographical scales.

Figure 2.1(a) Egan wheel: Key components of sustainable communities. Source: Mazni et al, (2010)

From the perspective of planning sustainable community, Egan (2004) reviewed a serious of key components in sustainable place making, which involves transport, ecosystem, economy, social equity, housing, governance, public services, and the built environment (Figure 2.1a). However, addressing key sustainable components appropriately in urban development can be challenging due to the complexity of the large cities.

Clearly, sustainability is not just dependent on physical form alone. However, expectations about the magnitude of an urban form's influence on sustainability are significant. Manipulating land uses could be regarded as an effective method of achieving sustainability especially for the sustainable transport systems in urban areas (Williams et al. 2000). Presently, there are two basic types of urban development patterns:

- **Compact city pattern**

The compact city pattern implies intensive land use patterns and a predominantly monocentric urban structure. The high density, the high spatial accessibility, and the high share of non-car travel modes could be expected in the compact city. From the perspective of energy efficiency, the compact city form is recognised as having the most efficient land use and transport systems by the Green Paper on the Urban Environment, which claims European policies on SUF (Brundtland, 1987).

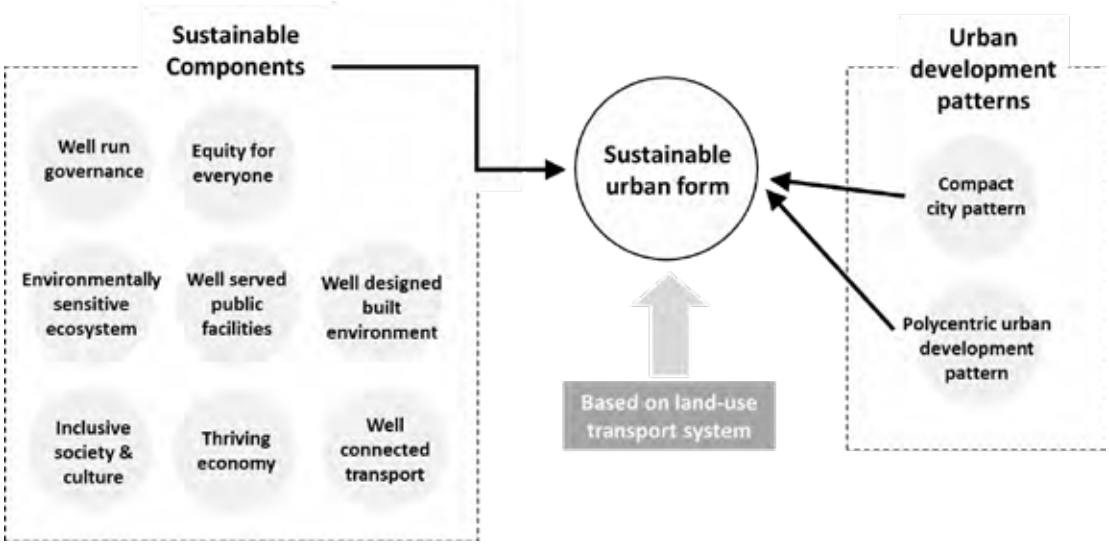
- **Polycentric urban development pattern**

The polycentric urban development pattern pursues a relatively high density around a central core that is surrounded by local employment and business centres. Development is restricted to the central zones adjacent to the sub-centres while a vital role for the central inner city is retained. As a result, high accessibility of primary facilities by non-car mode can be ensured, and more open spaces within the metropolitan area can be preserved (Wegener and Fürst, 2004).

Though a variety of urban development patterns have been proposed as theoretically sustainable urban forms based on sustainable land-use patterns and transport systems, there is not a clear consensus about which type of urban development pattern is preferable for achieving SUF. The different development histories of metropolitan areas, such as London or New York, make the urban development pattern significantly diverse. SUF cannot be designed as a specific type of form affected by the pre-existing historical urban development patterns. For different cities, urban planner and policy-makers will determine different pathways of sustainable development. But there is still a common agreement for urban planners and policy-makers.

From the perspective of transport, SUF could be regarded as a type of urban development pattern which significantly promotes a sustainable travel system regarding the considerable reduction in energy consumption and an increase of the journey efficiency and road safety. In any case, a highly sustainable land-use pattern and transport system can be regarded as the cornerstone for SUF (Figure 2.1b), which is why research on SUF should focus on the interactive relationship between land use and transport.

Figure 2.1(b) The composition aspects of SUF, from the perspective of sustainable components and urban development patterns. Source: Made by author



Meanwhile, there is some practical analysis of SUF including the compact city pattern, urban villages pattern, mixed-use neighbourhood pattern, and the adaptable city pattern. Burton (2000) and Williams (1999) concluded that urban compactness achieved through higher residential density and mix of land use could promote greater public transport usage and social communications in town centres. Newton (1997) discussed some different urban forms beyond the distinction between compact and dispersed city form. He recommended the concept of the urban village located near public transport infrastructure as an ideal form for small-scale towns focusing on reduced travel distance and low-carbon emission.

Masnavi (1998) emphasised the variables of density and mix of uses as key influencing factors in achieving sustainable neighbourhoods, which significantly affect travel behaviour and attitudes of residents regarding travel mode choices, social interaction, and their perceptions of environmental quality. Besides, urban adaptability, which means the ability of different urban forms to adapt over time to the increase of travel need and land-use density is also discussed in the SUF debate. It is evidenced that particular shapes and sizes of urban grid, such as regular grid, adapt well to the urban change in density and travel patterns. (Scoffham and Vale, 1996).

In combination, considerable amounts of research have been conducted revealing the most effective development patterns for a more SUF. The research elements based on land use characteristic have positive impacts on sustainable travel patterns and travel behaviour (Table 2.1a).

Table 2.1(a) Aspects of sustainable development and their impacts

Elements of sustainable development pattern	Possible impacts
High density; *Mix of land uses*	Improve public transport usage with good accessibility to transport facilities; Improve social communications through design of active street space
Small neighbourhood size; *Neighbourhood location around town centres*	Decrease travel distance with commensurate lowering of carbon emission
High density; *Mix of land uses*	Improve travel mode choice, but only if the transport options are provided; Increase social interaction
Regular urban grid which promotes the increase of density; *Small-size block which is easily redeveloped into walking block*	Increase density, easily adapt to changing travel patterns

Besides, Newman and Kenworthy (1999) argued that the compact city development pattern could only have limited impact on sustainable travel behaviour if the travel strategies restricted car usage and improved travel mode choices. It is asserted that proximity to travel destinations did not have a significant influence on travel mode choices without considering travel purpose. Van and Senior (2000) argued that mixed-use and high-quality neighbourhood design with more accessible walking and cycling routes could encourage sustainable mode choices and reduce car dependency for daily shopping needs.

Based on the analysis of planning policy on transport, the relationship between urban form and travel patterns is criticised at the regional scale. Headicar (2003) concluded that the travel patterns are not just related to the size of neighbourhoods. It is suggested that residential density should be strategically considered, for example, in connecting to town centres or employment centres. Stead et al. (2000) speculated that if the location strategies for settlements catered to increased travel demand for work and shopping by offering more sustainable mode choices, then a greater reduction in car use and energy consumption will be achieved at the urban scale.

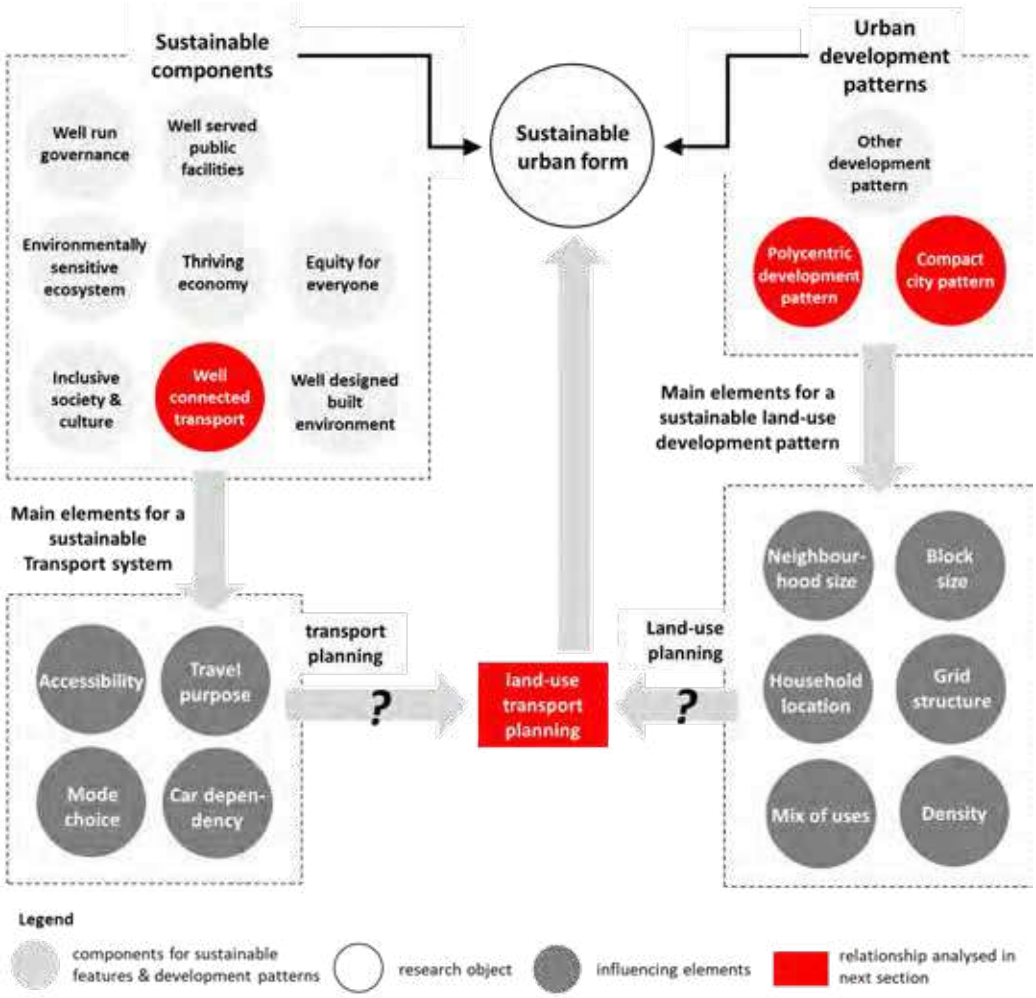
Overall, the main elements of a sustainable transport system have been illustrated (Table 2.1b), among which higher density development, good spatial accessibility to public transport, mixed land use, more travel mode choices, and proactive household location are key, and these elements could have evident influences on sustainable travel patterns and behaviour in achieving more SUF.

Table 2.1(b) Aspects of sustainable transport system and their impacts

Elements of a sustainable transport system	Possible impacts
Reduce car usage; *Create more travel mode choices;* *Focus on travel purpose and distance of work and shopping*	More sustainable mode choices may result, such as walking, cycling and public transport
Increase the mix of land use; *Improve neighbourhood design for cycling and walking*	More sustainable mode choices for travel generated by shopping; Reduce car uses for daily shopping
Large neighbourhood size with good connection with transport infrastructures; *High residential density*	Promote the transport accessibility and attractiveness of public transport
Household locations; *Accessibility of public transport;* *Create more travel mode choices*	Reduce car uses which then reduces energy consumption

In fact, all research discussed previously co-determine the sustainability of urban development patterns and transport patterns (Williams et al. 2000). The interrelationship between transport planning system and land-use planning system need be explored further through the integrated planning view of land use and transport system (Figure 2.1c).

Figure 2.1(c) The potential interrelationship between SUF, land-use planning system and transport planning system. Source: Made by author

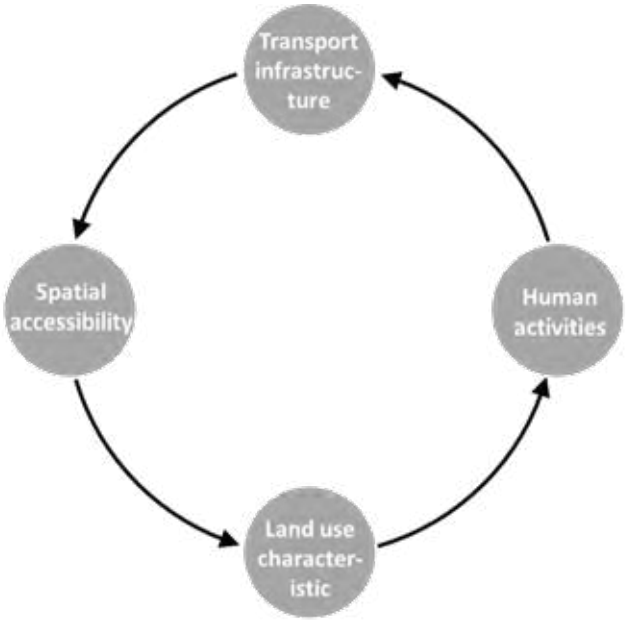


2.2 Theories about the land-use and transport interaction

Theories concerning the interaction between land-use and transport planning system involve technical, behavioural, and strategic dimensions. For example, land use has impacts on travel behaviour. Meanwhile, transport could influence the location behaviour of firms and households. But issues of coordination between land-use and transport planning in different urban contexts are still less well known (Wegener and Fürst, 2004).

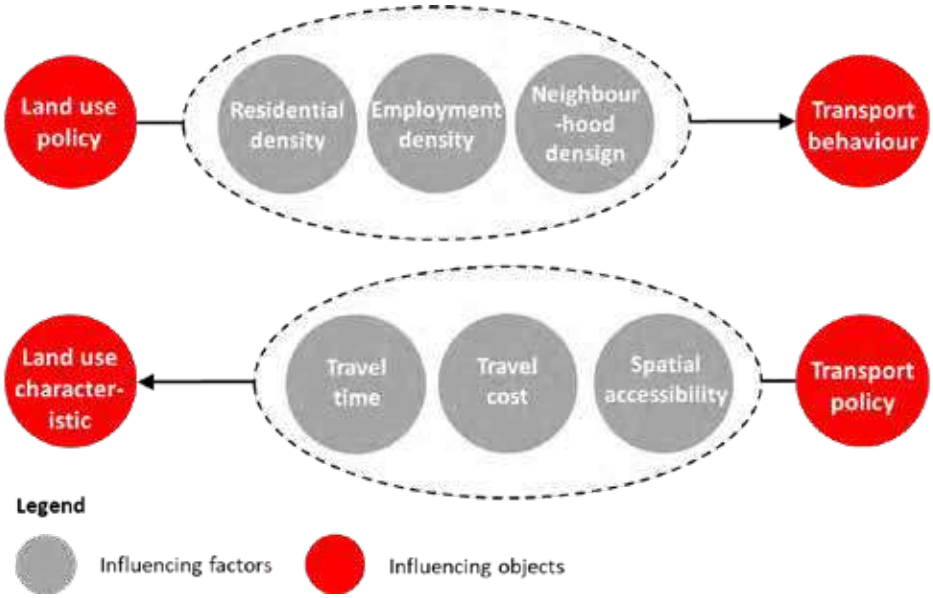
According to the EU research project, 'Transland' which evaluates strategic policies and their impacts on future urban developments in the field of integrated transport and land-use planning, theoretical and conceptual work on the integration of land use and transport has been reviewed. Theories on the two-way interaction are put forward to address the locational and mobility responses, involving households, travellers and firms, to changes in the land use and transport system. It is proposed that land-use and transport planning should be seen as an integrated mechanism, producing the land-use transport feedback cycle (Figure 2.2a). The mechanism in this 'cycle' is based on a set of relationships including the distribution of land uses, human activities, transport infrastructure, and spatial accessibility.

Figure 2.2(a) The land-use/ transport feedback cycle to illustrate the land use/ transport mechanism. Source: Made by author, Wegener and Fürst, (2004).



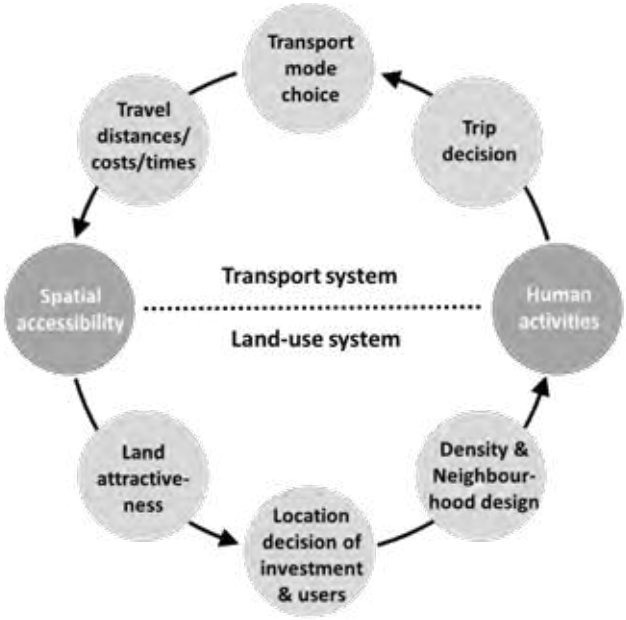
The results of the land-use and transport interaction are expressed concerning expected impacts on urban density, employment density, neighbourhood and open space design, development locations, accessibility, and travel cost/ time (Figure 2.2b). There are two influencing directions in this interactive mechanism, which is the impact of land use policies on transport behaviour and the impacts of transport policies on land use outcomes. It is summarised that the impacts of land use policy on transport behaviour could be reflected through the traffic variables such as trip length, mode choice, and travel cost. Besides, the impacts of transport policy on land use characteristics could be mainly measured by the location decisions reflected in different land-use categories.

Figure 2.2(b) Expected influencing factors within land use/ transport mechanism. Source: Made by author, Wegener and Fürst, (2004).



In general, the current research has explored a two-way interactive paradigm of urban development, which consists of four main elements including the land use system, human activities, the transport system and spatial accessibility. Land-use planning policy is regarded as an important factor to generate travel demands, while transport planning policy has an inevitable influence on the changes in land use because of diverse location decisions of investments in future development. Moreover, changes in land use characteristics will further generate more travel demands and inevitably have impacts on current transport behaviour. Thus, the dynamic relationship between the land use system and the transport system have been established (Figure 2.2c). Based on this interactive relationship, the interrelationship between SUF and the specific influencing factors can be established.

Figure 2.2(c) Dynamic relationship between the land use system and the transport system. Source: Made by author, based on an article by Wegener and Fürst, (2004).



2.3 Strategic policy Review

To guide the susyainable planning practice, a variety of strategic policies have been stated, which adopt the integration of land-use and transport planning, such as Planning Policy Guidance 13[1] (PPG 13), National Planning Policy Framework (NPPF), Sustainability of Land Use & Transport in Outer Neighbourhoods[2] (SOLUTIONS), and Smart Codes[3].

[1] 'PPG 13' aims to deliver the UK government' s objectives for transport development and encourages the integration of planning and transport. (National planning policy framework, 2012).

[2] 'SOLUTIONS' is a research conducted by Engineering and Physical Research Council, which aims to develop a guidance to support the implementation of sustainable land use and transport. (Suburbansolutions.ac.uk, 2017).

[3] 'Smart Codes' is a guidance for smart growth, including multimodal transport, infill development, affordable housing, and other practices in planning regulations (American Planning Association., 2017).

This paper has summarised the major planning objectives from these policies, basically involving the formation of urban form, the promotion of transit-oriented development, the classification of walking and cycling transport system, the improvement of spatial accessibility and safety, the application of traffic and parking management to reduce the usage of private cars (Table 2.3). In addition, the key planning factor has been categorised, which could be regarded as a set of the main influencing factors for making the sustainable development possible.

Table 2.3 Strategic policies for the integrated approach to land-use and transport planning

Framework	Planning objectives	Key factor
PPG 13 & NPPF	Manage the major generators of travel demand in district centres and make them near to the transport interchanges	Developments site locations
	Promote more sustainable mode choices for people and moving freight	Public transport, Walk and cycle
	Promote accessibility to work, shopping, leisure and other services by public transport, walking and cycling	Accessibility of facilities, Work-housing balance
	Reduce the need to travel in urban areas, especially for the reducing of car uses	Travel demand management
	Create safe and secure layouts which minimise conflicts between traffic and cyclists or pedestrians	Walk and cycle, Neighbourhood design
SOLUTIONS	Regulate land use and transport, particularly for the conservation area and the allocation of dwellings and employment	Work-housing balance
	Invest the development of land and transport, for example improving the capacity of existing transport networks and establishing more travel links	Strategic transport network
	Price the use of land and transport, such as the extra travel taxation in central region like the congestion charging zone.	Travel demand management

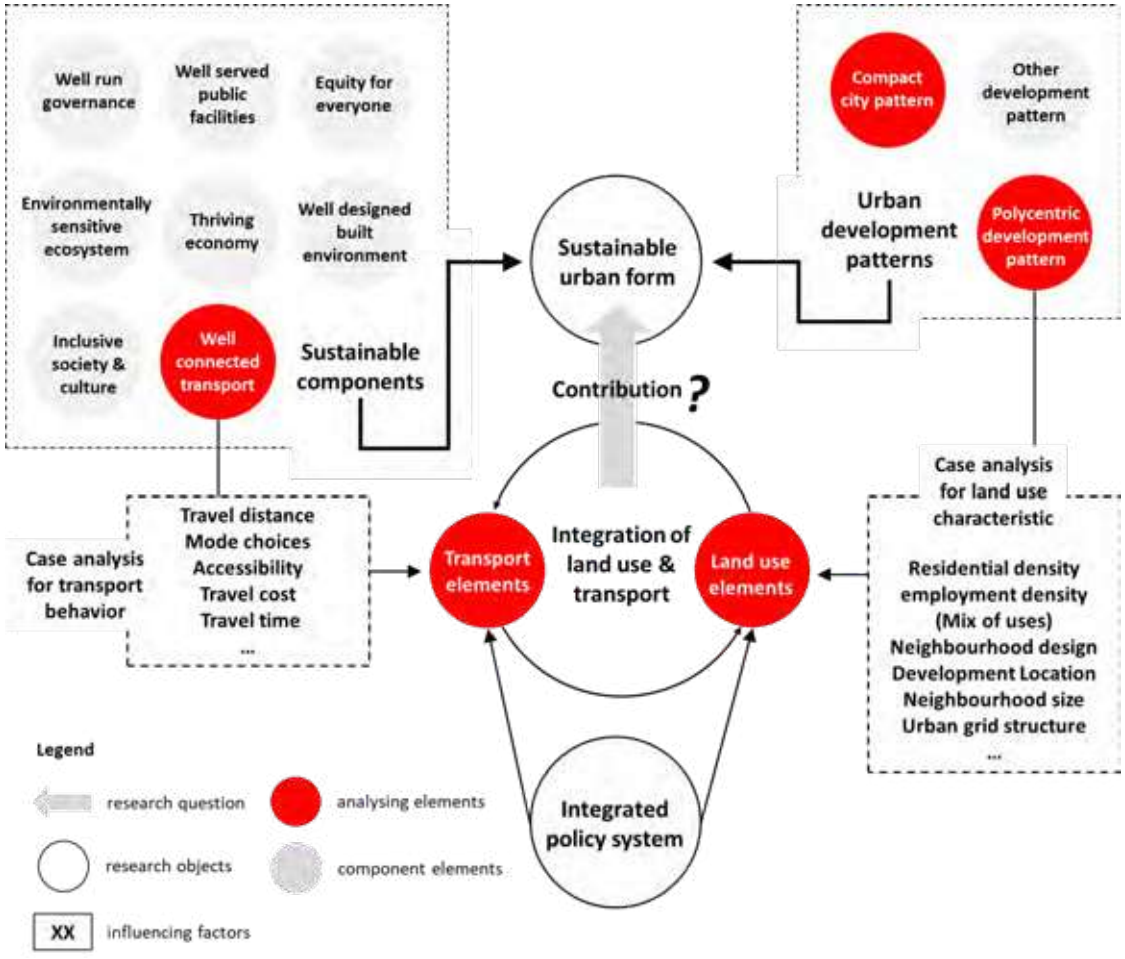
Smart Codes	Accommodate the mixed-use blocks and buildings to stimulate community development and promote the wellbeing of residents	Mix of use, Neighbourhood design
	Provide the appropriate flexibility of live/work units used for commercial and residential development	Work-housing balance
	Develop a high-density, high-intensity and mixed-use employment district centre	Development density Mix of use
	Encourage the development of affordable housing in more accessible areas and increase the community density	Development density, Development site locations
	Protect the transfer right of development for different purposes, such as green spaces preservation, historical district preservation.	Mix of use
	Cluster the residential development and creating the physical active community	Neighbourhood design

2.4 Theoretical framework - interrelationship between sustainable urban form and integrated land-use transport planning

A theoretical framework is established, which shows the expected interrelationship between SUF and its influencing factors (Figure 2.4). More importantly, the interactive mechanism between these factors has been revealed by the land use and transport system relationship. Banister and Givoni (2010) argued that an integrated view of land-use and transport planning could guide them in the direction of more effective measures to achieve SUF. Based on the perspective of an integrated land-use and transport planning system, a sustainable development pattern could be possibility assessed.

Land-use system considered in spatial planning will define particular types of urban forms (i.e. compact, polycentric) which can promote more social interaction, activities and sustainable transport behaviour. Transport system considered in spatial planning could contribute to reducing unnecessary long-distance travel, car use and to guiding more sustainable travel behaviour. More importantly, once more sustainable travel behaviour has been achieved, this will have positive impacts on later land-use investment and development to strengthen its pre-existing sustainable land-use characteristics. Finally, SUF will be accomplished through this dynamic-interactive relationship, especially regarding the aspect of sustainable transport.

Figure 2.4 Interrelationship between sustainable urban form and integrated land-use transport planning. Source: Made by author



3. Methodology for the research process

3.1 Research approach

The approach of this research will mainly focus on the exploratory, qualitative research on the integration of land-use and transport planning to promote the evolution of more SUF through primary principles of planning policy and planning practice instructed by them. The research can be regarded as a collaborative effort to criticise planning guidance on how local planning authorities can contribute in making urban development more sustainable through the integration of land-use and transport planning.

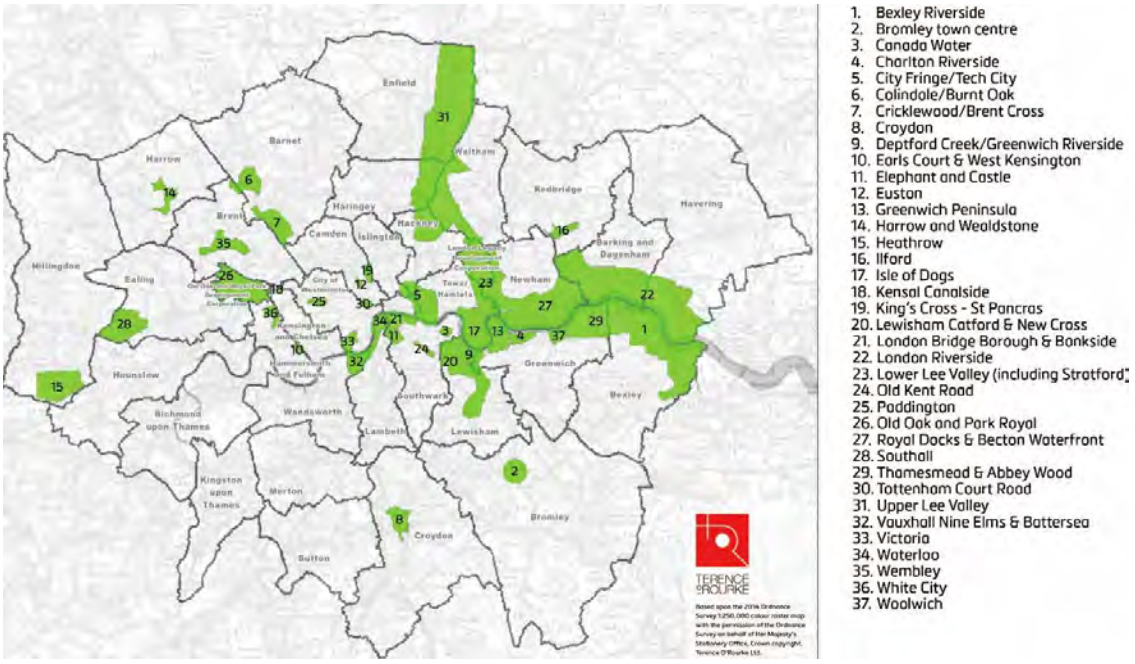
3.1 Research scope

According to the model of urban development pattern, the compact city model and polycentric urban development pattern is commonly recognised as more sustainable growth pattern, which is also mainstream urban development model in most western countries. Cities under the effects of high development density and high-efficiency public transport system such as London, Paris, Barcelona have great potential to be more sustainable through the integrated land-use transport planning. More

importantly, the research should concentrate on a highly-developed city currently experiencing pressures of urban growth.

London is an excellent platform for the analysing the practice of integrated land-use and transport planning because of the large-scale urban intensification and numerous regeneration events. Thousands of new homes and jobs are proposed to create in London's 38 opportunity areas. The delivery of SUF through urban development practices in these opportunity areas will significantly affect the urban sustainability in London (Figure 3.1).

Figure 3.1 The location map of London's 38 Opportunity Areas. Source: Londonfirst.co.uk, (2017)



4. Case study analysis

4.1 Background for Kings' Cross and Olympic Legacy area

The regeneration of King's Cross can be recognised as a transport-led development project, while the urban regeneration in London Legacy district was significantly promoted by the 2012 Olympics and its redevelopment. Though the two cases have different development histories and historical backgrounds (Table 4.1), they have strong similarities in their development objectives.

Table 4.1 Overview of the case study areas

Area	Kings' Cross Opportunity Area (KCOA)	London Legacy Development Corporation area (LLDC)
Developing vision	a vibrant, inclusive, and sustainable redevelopment project with the	a mixed-use development driven by the 2012 Olympics, London's eastern

	significant potential to utilise its excellent transport accessibility	gateway and intersected by the Channel Tunnel Rail Link
Total area	24 hectares (excluding the area of railway stations)	73 hectares (Phase 1, known as 'Stratford City')
Principle Development objective	High spatial accessibility, mixed use (including commercial, retail, education, residential, green spaces), high density (especially compared to traditional residential areas), improvement of transport interchanges, local community involvement.	

In brief, regeneration of Kings' Cross and Olympic Legacy is mainly driven by the massive investment in transport infrastructure and land use development, which contributes to integrated land-use and transport planning more significant (Figure 4.1a, Figure 4.1b). These cases both reflect the strong character of the compact city pattern or polycentric urban development patterns, such as high density of housing and employment, a mix of uses, and high spatial accessibility for public transport. Land use characteristics and transport behaviour in local areas will be substantially changed by these regeneration projects. The two cases have relatively high value for assessing the contribution of integrated land-use and transport planning to develop a more SUF.

Figure 4.1(a) Location and the boundary of Kings' Cross Opportunity Area. Source: Made by author

Figure 4.1(b) Location and the boundary of London Legacy Development Corporation Area. Source: Made by author

4.2 Case-specific policy analysis in Kings' Cross Opportunity Area

Currently, Kings' Cross presents one of the most significant regeneration opportunities in Europe. It is also the largest plot of brownfield land in central London. As a gateway from Europe to London and the UK, St Pancras International and Kings' Cross railway station play vital roles in the urban-regional transportation system.

4.2.1 Spatial accessibility and connectivity in urban-regional scale

Delivering efficient urban-regional transport connection is an integral part of the regeneration objectives (Kings Cross Opportunity Area planning & development brief, 2003). The location of Kings' Cross and two transport interchanges offer significant advantages for the improvement of spatial accessibility and mobility (Figure 4.2.1). The physical boundaries of the regeneration site should be broken down to provide a full connection with the rest of London. It is argued that the area's transport accessibility underpins the potential for high-density development, which is also fully integrated with public transport network (Kings Cross Opportunity Area planning & development brief, 2003).

Figure 4.2.1 The spatial connection of KCOA with central London. Source: *Kings' Cross Central: Urban Design Statement document*

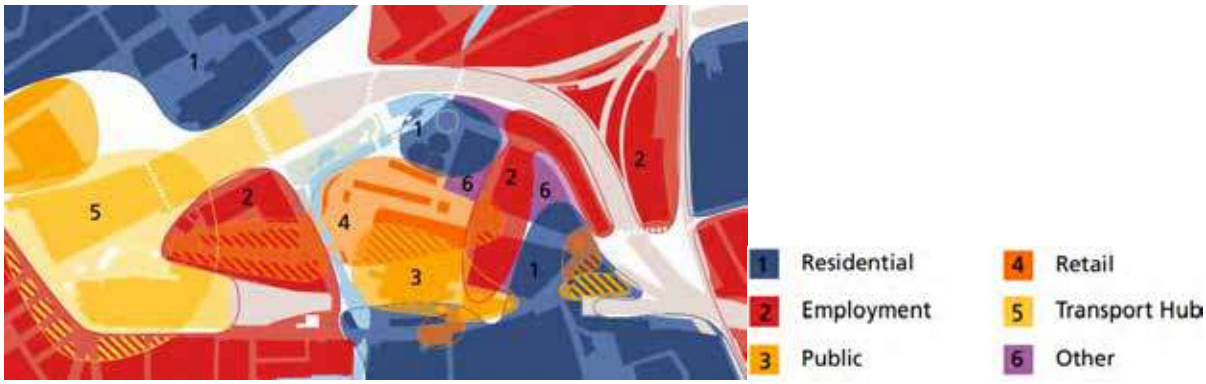
In a word, the planning policy related to spatial accessibility usually focuses on the improvement of transport connectivity within the urban-regional area. For KCOA, two transport interchanges, Kings'

Cross Station and St Pancras International Station including CTRL terminus, are key catalysts to guide the direction of redevelopment. This transportation hub comprised of two railway stations, CTRL terminus and Kings' Cross St Pancras underground station become one of the most crucial transport gateways for central London. Under this developing condition, the form of high-density development will also be considerably promoted by the integrated rail transport system. On the other side, locating at the fringe of Central activities zone (CAZ) and smaller size of regeneration site (around 24 hectares) enhance the demand for developing density and intensity, because of the significant increase in land values.

4.2.2 Social and economic activities in regeneration area

Financial links can be promoted by allocating newly available jobs widely. For social interactions, the focus is on community involvement, which primarily includes making better access to employment and training, improving local people's qualification through education and creating attractive communication environments. High-density mixed use is an effective way to enhance the competitiveness of business, maximise affordable housing provision to meet changing needs and contribute to the vitality of the whole project. Depending on this mixed pattern of land uses with optimised density (Figure 4.2.2), the land-use capability of offices, retail, leisure, education can be increased. The hugely demand of housing and diverse services in central London will be met.

Figure 4.2.2 Strategic land use framework in KCOA. Source: *Kings' Cross Central: Urban Design Statement document*



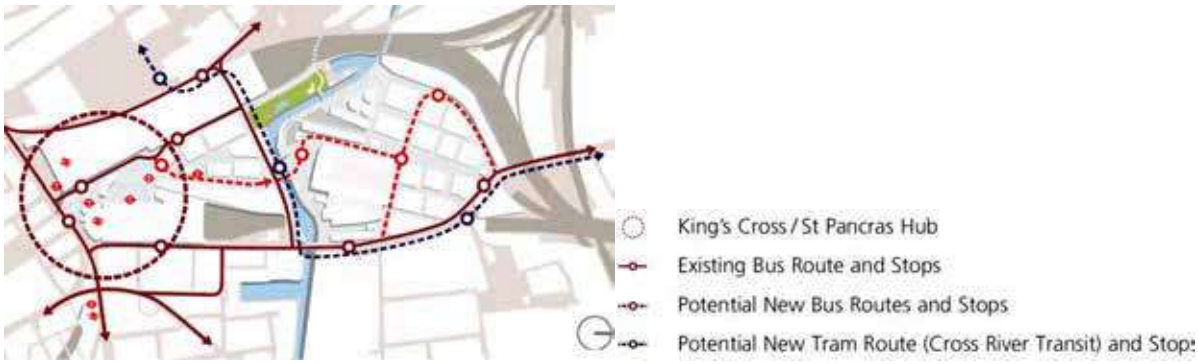
To conclude, the planning policy related to the social-economic activities generally emphasis on the enhancement of local vitality by high density and mixed-use development. The policy requires the commercial development should achieve plot ratios of at least 3:1 wherever there are good transport accessibility and capacity. Moreover, that ratios nearer to 5:1 is recommended to be achieved in highly accessible areas (Queenelizabetholympicpark.co.uk., 2017). To make optimum mixed use of the site, a flexible framework of land use plan is proposed that allows the mix of uses in the north part to be chosen to respond to a changing social-economic climate.

4.2.3 Transport availability for sustainable travel modes

Encouraging more sustainable travel modes by improving the attractiveness of public transport, walking and cycling will have significant impacts on reducing car dependency. To increase the attractiveness of sustainable travel modes in KCOA, new reliable bus routes linking the site with surrounding

communities and Camden town centre should be considered (Figure 4.2.3). The provision of bus priority measures wherever needed to maximise the reliability of existing and new services for jobs, shopping, leisure and other activities. Besides, high-quality pedestrian and cycle links to public transport nodes should be well-designed. For car parking and storages, the provision for car parking is expected at deficient levels. For example, the developer should demonstrate on minimising the traffic generation in the site. The proportion of car-free housing is required to reach at least 75%.

Figure 4.2.3 Public transport system plan in KCOA. Source: *Kings' Cross Central: Urban Design Statement document*



In summary, the planning policy related to promoting the availability of sustainable travel modes builds on the well transit-connection of public transport, walking and cycling. A network of tertiary vehicular routes can minimise most of the car traffic in the centre of the site except for the essential vehicle services such as fire access and deliveries, which will make public realm more quiet and safer for pedestrians . In Kings' Cross, private and public car parking is combined to make the best use of shared facilities, which can also provide for different demands at different times of the day and week (Queenelizabetholympicpark.co.uk., 2017). Also, more cycle parking can improve the attractiveness of cycling travel instead of travel by private car.

4.3 Case-specific policy analysis in London Legacy Development Corporation Area

Different from the regeneration of Kings' Cross, the redevelopment of London Legacy emphasises on a larger-scale site, which covers the area in four London boroughs. After the 2012 London Olympic, the London Legacy Development Corporation was established to promote and deliver physical, social, economic and environmental regeneration of the Olympic Park and its surrounding areas by securing sustainable development and ensuring the smooth transformation of these Olympic venues in the long term (Queenelizabetholympicpark.co.uk., 2017).

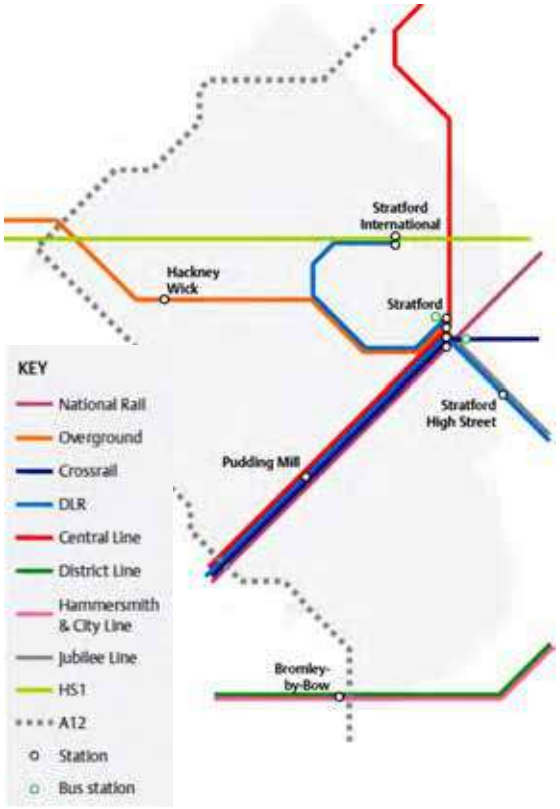
4.3.1 Spatial accessibility and mobility in urban-regional scale

Improving the strategic transport connection and transport infrastructure is considered as the priority to develop business growth, jobs and lifelong learning in Stratford area. The Legacy Corporation area occupies a key strategic location at the meeting point of the London-Stansted-Cambridge-Peterborough Growth Corridor and the Thames Gateway Growth Corridor (Anon, 2017). Strategically, this area is connected to the major business and growth hub of central London, including Canary Wharf and the

Royal Docks (Figure 4.3.1a). The potential of being another London Metropolitan centre improves spatial accessibility more important for the redevelopment after the 2012 Olympics.

Figure 4.3.1(a) Location of LLDC area in London. Source: *A walk around Queen Elizabeth Olympic Park*

Figure 4.3.1(b) Public transport and connectivity in LLDC area. Source: *LLDC Local Plan 2015 to 2031*



In general, the improvement of public transport infrastructures and services at all levels is the cornerstone for delivering the social-economic growth in Stratford area, including the development of international, national, regional and local transport connectivity. The efficient and well-designed stations, including the development of Stratford Station for Stratford City and the 2012 Games, the new stop of Channel Tunnel Rail Link at Stratford International Station, the capacity enhancements of Jubilee Line, Overground and DLR, strengthen the spatial accessibility and mobility of LLDC area (Figure 4.3.1b). Based on that, Stratford becomes one of the best-connected places in London, which attracts substantial investment for the further land redevelopment.

4.3.2 Social and economic activities in regeneration area

Developing a strong local economy and driving the transformation of east London as a new city centre is the vital objective for the regeneration in LLDC area. To reach this target, the economic profile of the area should be strengthened, which depends on providing additional floor spaces in a wide range of sizes, types and forms.

More particular, the local plan about employment clusters will foster a range of job opportunities, and it is also the key to the character and vibrancy of the regeneration site. With the spatial distribution of employment areas and social infrastructures in several hierarchies, the daily social activities can be centralised around the central development area. More social communications can be promoted within the new-designed public spaces. On the other side, a mix of housing types should be provided to create the sustainable neighbourhood and avoid problems that may result from over-concentration of certain size and types of accommodation. It is required that all community planning proposals should reflect identified housing size, building form and tenure requirements.

4.3.3 Transport availability for different travel modes

Managing development and its transport impacts to promote sustainable transport choices and prioritise pedestrians and cyclists is an essential policy to minimise reliance on the private car to ensure that the regeneration of the Legacy area is optimised and more sustainable. The plan aims to lead to dramatic changes in Londoners' behaviour and attitudes to their cars and contribute to decreasing car ownership per household in local communities. In doing so, several specific policies should be considered, such as implementing a locally connected street network that prioritises pedestrians and cyclists as the most important travel modes, followed by public transport and the private car (Figure 4.3.3) (Queenelizabetholympicpark.co.uk., 2017). The amount of new development across its areas, in particular as the town centres and employment clusters, should be related to the transport capacity of existing or planning improvements to transport infrastructures and services.

Figure 4.3.3 Transport prioritises. Source: *LLDC Local Plan 2015 to 2031*

Besides, facilitating local connectivity with the redevelopment of high-quality built environment can significantly strengthen the attractiveness of walking and cycling within the area. It is believed that the improvement of local connectivity is a critical issue for the liveability of this area. Currently, physician barriers such as motorways, railway lines and canals, increase the difficulty for people to move around the area. It is crucial to forming a network of linked walks connecting with adjacent neighbourhoods and town centres throughout the Olympic Park, which will adequately respond to the potential of social activities.

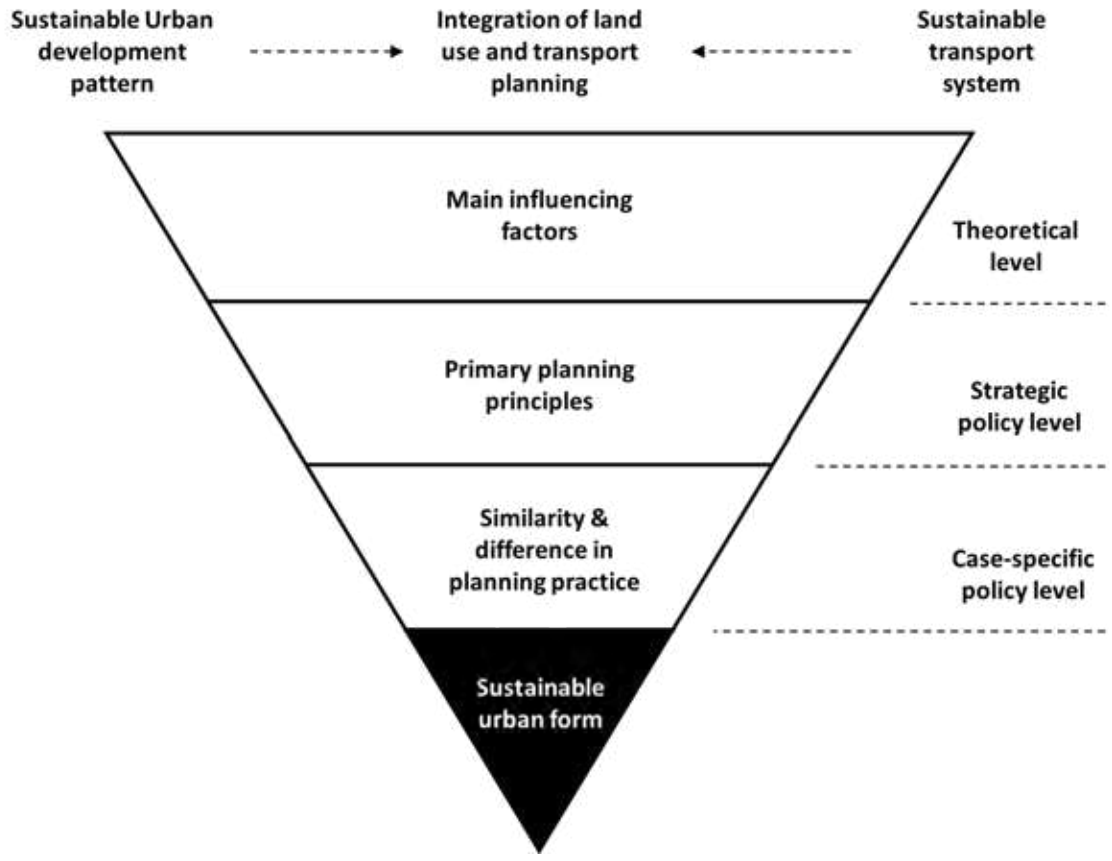
5. Conclusion and recommendation

5.1 Contribution of integrated land-use and transport planning for SUF

It has been evidenced that land use and transport planning are two principal systems in co-determining the sustainable effectiveness of spatial planning in practice. In general, the transport planning policy can be regarded as a kind of 'push' measures to limit the unsustainable travel behaviour, such as long-distance car travel and car dependency. While, the land use planning policy can be considered as a kind of 'pull' measures to indirectly guide more sustainable land-use characteristics, which greatly promote the social-economic vitality in town centres and communities.

This research concludes that the integrated land-use and transport planning consisting of sustainable urban development pattern (i.e. compact city model and polycentric urban development pattern) and sustainable transport system (the most crucial components for sustainable objectives) can significantly contribute to achieving SUF (Figure 5.1).

Figure 5.1 The framework about contribution of ILUTP for achieving SUF at three levels. Source: Made by author



Besides, the complexity of SUF and ILUTP has been revealed. The reason is probably that a various range of influencing factors are involved in the land-use planning and transport planning systems, and they have impacts on co-determining the sustainability of urban development. More complicated, it is difficult to assess the efficiency of each influencing factor on promoting SUF because of the significant

difference in urban areas. However, the contribution of ILUTP for achieving SUF can still be assessed in the western countries with the well-developed planning system, through the analysis of planning strategies and empirical studies. Based on this research, contributions of ILUTP for achieving SUF have been concluded in three respects, involving influencing factors summarised from the literature review, planning principles classified from planning strategies and different planning practice assessed through case-specific policies.

a) Main influencing factors for affecting SUF

Main influencing factors are summarised from land-use and transport planning policy which promote SUF through positively affecting transport behaviour and land-use characteristic in development areas.

The influencing factors related to changing transport behaviour have a 'push' impacts on achieving SUF in the short term, which mainly include the improvement of public transport infrastructures to change people's travel modes, traffic management and minimised parking provision to reduce the use of the car.

The influencing factors related to affecting land-use characteristic usually have a 'pull' impacts on achieving SUF in the longer term, which include strategic development location, accessibility of key facilities, size of development settlement, work-housing balance in local area, a mix of uses in town centre, high development density especially for residents and employments, design for walkable neighbourhood and open streets.

b) Primary planning principles for instructing SUF

To guide planning practice, three primary planning principles have been summarised, include the promotion of spatial accessibility, diverse activity and sustainable transport availability.

Principle-A: Spatial accessibility supported by the improvements of transport infrastructures and transport network connectivity to attract investments and connect the travel origins and destinations much easier;

Principle-B: Diverse activities in town centres and new communities supported by high-density development and mixed land use to create social and economic vitality;

Principle-C: Transport availability for mode choices supported by high-quality design and amenity of public spaces to promote more sustainable travel behaviour.

c) Case-specific planning policies for achieving SUF

The similarity of case-specific policies in planning practice has been assessed and summarised from the case-specific policies as well as the difference (Table 5.1). It is also explored from the case-specific planning policies that the location of regeneration projects may result in somewhat different outcomes in planning practice for achieving SUF.

Table 5.1 Similarity of case-specific planning policies in KCOA and LLDC area

Principles	Similarity of case-specific policies
Principle-A	• Deciding the form of regeneration as high-density and mixed-use development by establishment of integrated transport system at the beginning; • Easily getting more capital investments from related stakeholders to speed up the regeneration process; • Potentially generating vast numbers of inbound and outbound daily trips through the improved transport infrastructure and system;
Principle-B	• Greatly cutting down the travel distance between homes and workplaces by offering relative numbers of new homes and workplaces and keeping work-housing balance locally; • Compulsively providing sufficient proportion of affordable housing in development communities to promote the mix of accommodation, the mix of residents and the mixed use of public spaces;
Principle-C	• Directly reducing car uses through discouraging unnecessary car travels, such as daily light food shopping, leisure activities by working out more strict parking measures; • Indirectly reducing car uses through encouraging more sustainable mode choices by designing more walkable public spaces and street layouts, particularly in new communities;

The development location may affect the development pattern of the project and change the spatial character of the city. Kings' Cross is planned as a viral connection node, and new employment centre in central London as the transportation interchanges have already been here. The project can be treated as an expansion of central London, which significantly strengthens the spatial character of the compact city in central London. While London Legacy is planned as a new urban centre for the great London, which relies on the consistent improvement of transport accessibility since 2012 Olympics. The project can be recognised as a development for a new urban centre, which shapes the spatial character of Great London as a polycentric urban form. In general, the regeneration project in KCOA and LLDC area will both contribute to promoting London as a more sustainable city at regional-district scale.

5.2 Limitation of the research and recommendation for further analysis

The conclusions reflect primary concerns for urban planners and policy-makers toward more SUF from the perspective of ILUTP. The outcomes may not be specific enough to explain the achievement of SUF through influencing factors, primary principles, and case-specific policies, because of the limited time and lack of data. The measures of quantitative analysis focusing on the changes of travel modes, density, and the mix of uses will be greatly helpful to evaluate the correlation between SUF and ILUTP.

d) Shortcoming and failing within this research

One significant limitation is those previous conclusions about achieving SUF aim at assessing the effectiveness of integrated policies in urban regeneration projects. The outcomes of ILUTP have limited influence on the improvement of sustainability in surrounding areas. But the SUF should not just be accomplished through urban renewal projects under the instructions of integrated land-use transport planning, which may lead to creating a 'sustainable island' surrounded by the 'unsustainable sea'. A more ambitious target should be considered, emphasising on how to promote more SUF for the whole city through the integration of land use and transport planning.

e) Further questions arising from the research

It is also claimed that the influencing factors in social respect can also affect the sustainability of urban development, especially having considerable impacts on the sustainable transport system. Stead et al. (2000) once argued that socioeconomic conditions could explain more variation in travel patterns than do land use characteristics. It is believed that the influence of land use could not be as significant as it previously assumed. The socioeconomic component, such as household car ownership, household socioeconomic group and working residents proportion, need to be paid more attention instead of issues of land use or transport.

References

Anon, 2017, [online] Available at: https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-2016-pdf [Accessed 12 May. 2017].

American Planning Association., 2017, Policy and Advocacy. [online] Available at: https://www.planning.org/policy/ [Accessed 3 Jun. 2017].

Banister, D. and Givoni, M, 2010, *Integrated Transport: from policy to practice*. Abingdon, Oxon: Routledge.

Brundtland, G., 1987, Report of the World Commission on environment and development.

Burton, E., 2000, The Compact City: Just or Just Compact? A Preliminary Analysis. *Urban Studies*, 37(11), pp.1969-2006.

Egan, J., 2004, *Skills for sustainable communities*. London: Office of the Deputy Prime Minister.

Headicar, P., 2003, The contribution of land use planning to reducing traffic growth: The English experience. *European Journal of Transport and Infrastructure Research*, 3(2), pp.137-154.

Kings Cross Opportunity Area planning & development brief., 2003, London: King's Cross Team, Environment Department, London Borough of Camden.

Londonfirst.co.uk., 2017, Opportunity Knocks: Piecing together London's Opportunity Areas | London First. [online] Available at: http://londonfirst.co.uk/opportunity-knocks-piecing-together-londons-opportunity-areas%EF%BB%BF/ [Accessed 1 Jun. 2017].

Manzi, T., Lucas, K., Jones, T.L. and Allen, J. eds., 2010, *Social sustainability in urban areas: communities, connectivity and the urban fabric*. Routledge.

Masnavi, M. R., 1998, Urban Sustainability: Compact versus Dispersed in terms of Social Interaction and Patterns of Movement, a Thesis Submitted to the Mackintosh School of Architecture in the University of Glasgow, in Fulfilment of the Degree of Doctor of Philosophy.

Mason, M.J., 1994, *Which Kind of Urban Structures Are Most Sustainable*?

National planning policy framework., 2012, London: Department for Communities and Local Government.

Newman, P. and Kenworthy, J., 1999, Sustainability and cities: Overcoming Automobile Dependency, Island Press, Washington DC.

Newton, P. W., 1997, *Re-shaping Cities for a more sustainable future: Exploring the Nexus between Urban Form. Air Quality and Greenhouse Gas Emissions*, Research Monograph 6, Australian Housing and Urban Research Institute, Melbourne.

Queenelizabetholympicpark.co.uk., 2017, Local Plan | Queen Elizabeth Olympic Park. [online] Available at: http://www.queenelizabetholympicpark.co.uk/planning-authority/planning-policy/local-plan [Accessed 3 Jun. 2017].

Scoffham, E. and Vale, B., 1996, How compact is sustainable—how sustainable is compact. *The compact city: A sustainable urban form*, pp.66-73.

Stead, D., Williams, J. and Titheridge, H., 2000, Land use, transport and people: identifying the connections. Achieving sustainable urban form, pp.174-186.

Suburbansolutions.ac.uk., 2017, SOLUTIONS - Sustainability of Land Use and Transport in Outer Neighbourhoods. [online] Available at: http://www.suburbansolutions.ac.uk/findings.htm [Accessed 2 Apr. 2017].

Van, U.P. and Senior, M., 2000, The contribution of mixed land uses to sustainable travel in cities. *Achieving sustainable urban form*, pp.139-148.

Wegener, M. and Fuerst, F., 2004, Land-Use Transport Interaction: State of the Art. *SSRN Electronic Journal*.

Williams, K., 1999, Urban intensification policies in England: Problems and contradictions. *Land Use Policy*, 16(3), pp.178-199.

Williams, K., Jenks, M. and Burton, E., 2000, Achieving sustainable urban form. Taylor & Francis.