Moving in sync

Designing and implementing transport policy packages

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Publication date
2021

Document Version
Final published version

Citation (APA)
Yang, W. (2021). *Moving in sync: Designing and implementing transport policy packages*. [Dissertation (TU Delft), Delft University of Technology].

MOVING IN SYNC

DESIGNING AND IMPLEMENTING TRANSPORT POLICY PACKAGES

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Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology
by the authority of the Rector Magnificus, Prof.dr.ir. T.H.J.J. van der Hagen
chair of the Board for Doctorates
to be defended publicly on
Thursday 8 April 2021 at 12:30 o'clock

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This research was funded by the China Scholarship Council

Print: Ridderprint | www.ridderprint.nl

ISBN 978-94-6384-208-2

An electronic version of this dissertation is available at
http://repository.tudelft.nl/.

To my mother and wife

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SUMMARY

Congestion in and pollution by traffic are amongst the most severe and urgent problems faced by both developed and developing countries these days. It is regarded as a "wicked" problem, which implies it is both hard to define the inherent problem and to find adequate measures to deal with. The complexity of transport systems makes it impossible for policy makers to fully grasp the effectiveness of each measure or intervention in detail.

In policy maker‘s policy toolkits, there are traditionally two categories of transport measures that transport infrastructures supply (TIS) or transport demand management (TDM). However, these transport measures in reality are usually designed and implemented uncooperatively, some of which hardly receive political or public acceptance and others possibly cause unexpected negative side effects.

Policy packaging is regarded as a prominent approach to solve these problems of single measures, because it can improve the acceptance of single policy measures, eliminate their negative effects after implementation, and produce larger synergy effects. However, in spite of these advantages, policy packaging complicates the whole policy making and implementation process, involving complex values, actors, and measures, and challenges policy maker‘s consciousness and capacities. This is why there is rare successful policy packaging in reality.

Existing literature, in Chapter 1, investigates the policy packaging from two perspectives. Some studies regards the policy packaging as a static, designed outcome of a combination of carefully chosen measures, focusing on establishing normative building blocks for policy packaging, ideal packaging processes, and optimizing the combination of different measures combination. The other regards the policy packaging as a dynamic, pragmatic process of various measure integration, concentrating on the empirical design and implementation process of policy packaging, based on policy making and organization/institutional. There is, however, a lack of systematic research combining two perspectives: investigation into the whole policy packaging process from formation to implementation, combining desk research and empirical case analysis.

Therefore, this thesis aims to answer *“How can transport policy packaging be developed and implemented in the real world?”*. To find the result, three sub-questions, covering the whole policy packaging process from design to implementation in sequence, are answered in sequence.

Q1: What are the general characters of well-integrated transport policy packaging? How can they be empirically measured and used as a comparative approach between various cases?

First, in the perspective of policy packaging composition, existing research lacks an efficient approach to analyze characteristics of policy packaging and compare the effectiveness between various cases, which, to a large degree, limits the guiding functions on the policy packaging implementation. Therefore, this thesis in Chapter 2 develops an

effective method to capture both overall and specific characteristics of policy packaging, and to compare different packaging. Without analysing complex policy processes, document analysis can be used as a proxy for the way in which policy packaging is developing. Among the dimensions of this approach, the density reveals how policy documents interrelate different (types of) measures; the categories indicate the direction and possible strategy of packaging, by presenting the development of and links between different groups of measures; the interaction shows the connecting networks of measures and directly demonstrates the integration of packaging; the temporal factor enables us to understand how policy packaging keeps changing over time, which is a vital point of view to analyzing the dynamic characteristics of packaging. This approach then is trialed in the study of two Chinese cities: Shenzhen and Dalian. The tentative outcomes are that: packaging integration should be one major goal pursued by governments; efforts should be made to enhance the connections between existing measures rather than to issue more but isolated ones; the shift of policy goals or strategies influences the components and integration of packaging.

Q2: Will well-integrated transport policy packaging effectively reduce traffic congestion? As for the cities in different levels of economic development, what are the proper strategies to provide transport infrastructures and take transport policy packaging?

Second, this thesis in Chapter 3 checks the validity of the previous conclusion that a well-integrated transport policy packaging in the term of composition, can effectively release traffic congestion in different context conditions. To be specific, we empirically examine causally relevance of transport policy packaging, including transport supply and transport demand management measures, to the policy outcomes, relying on a fuzzy set qualitative comparative analysis (fsQCA) of 22 Chinese cities from 2011 to 2016. The conclusion is that, in general, limited economic development or high levels of infrastructures are the two main explanations for cities experiencing low levels of congestion; moreover, there is no specific kind of transport infrastructure supply, nor is there a unique TDM package to reduce traffic congestion. Although the results are not enough "significant" to provide an "encouraging" conclusion, it still reveals the actual complexity of traffic congestion and also reminds us to detect deeper explanations in the policy packaging process. A well-integrated policy packaging requires not only a well-designed document design at the start, but also a successful implementation to achieve it.

Q3: "What key factors determine transport policy packaging process and how? What are the proper responsive strategies?"

A well-integrated transport policy package, from the perspective of design alone, cannot ensure an expected effectiveness; thus, we carry out two empirical studies to unfold the "mysterious", "hiding" policy packaging process in China and Europe respectively.

Chapter 4, at the beginning, makes a step towards filling this gap by laying bare the whole transport policy packaging process in one typical Chinese city and explain why seemingly well-designed transport policy packaging eventually fails to achieve its expected results. Based on the data from policy documents and semi-structure interviews, several major problems threatening the implementation of packaging are detected, including a lack of political commitment, overlooking implementation at district-level, resource competition between measures, and the absence of integrative monitoring.

Moreover, Chapter 4 demonstrates that to identify key roles played and actions taken by different actors is a meaningful and helpful approach for analyzing complex policy packaging processes and detecting potential problems. Although the conclusion from one case study maybe not representative, the study identifies some major but easily overlooked problems through its deep analysis of a real packaging process.

To eliminate the limitation above, Chapter 5 further examines the robustness of the conclusions above, in four European cases with significant context conditions throughout the Europe as well as China: congestion charging package in Stockholm, 20mph speed limit package in Edinburgh, North-south metro line package in Amsterdam, and slow traffic package in Lisbon. The similar methodology is adopted. The main conclusion of this study is that powerful political support, sufficient financial support and institutional support are vital factors in the success of policy packaging. As these context factors can hardly be changed in a short period, so a successful policy package has to be designed into an applicable combination of measures under the considering of the influence of these factors, and also to be flexible and sensitive to the change of context conditions and take different responsive strategies.

To sum up, in Chapter 6, important implications can be drawn after a series of investigations above. First, a well-designed transport policy packaging can increase the possibility of success through enhancing the intensity and interaction of measures inside a package and forming a clear direction or tendency for its next development. For example, a package of slow traffic improvement should set the measures which increase slow traffic facilities and services as the primary components, and other measures such as connecting slow traffic to public transport and decreasing attractiveness of private car usage as ancillaries, all of which are integrated into one master plan or a series of integrated action plans. These characteristics are generic for policy packages in other fields. Second, the effect of transport policy packaging is always restrained by various externals conditions, such as economic level, transport supply, and its implementation; therefore, it must be accepted that a seemingly well-designed policy package alone can hardly ensures an expected performance, although the pursuit of "ideal" integration is still meaningful for guiding the design process in principle. One main reason is that the barriers in implementation are unintentionally or intentionally overlooked during the design. Policy packaging, requiring extra knowledge or skills, consuming more resources, and confronting more conflict among key actors, can hardly considerate and predict all the barriers after the implementation. Moreover, the primary task in the design process is to formulate a seemingly well-designed policy package, rather than to arise extra complexity and uncertainty from implementation. Last but not least, political, financial, and institutional/ organizational supports largely determine the policy packaging process. The efforts on pursuing an "ideal" or "best" package are only meaningful until the package can be fully implemented under the influence of these context factors in reality. Thus a "better" policy package should achieve a balance between design and implementation: integrating not only proper policy measures, but also other key elements, such as consciousness, resources, actors, and institutions during the design, and keeping flexible to the change of context conditions during the implementation. Above all, this thesis provides insights into the design and implementation of policy packaging, helping policy makers in general to understand the advantages and barriers of policy packaging and

responsive strategies.

As for the thesis contributions to the methodology, two approaches have been proposed and proved effective in analyzing the design and implementation process respectively: the analysis of policy packaging characteristics captures both overall and specific characteristics of policy packaging, and to compare different packaging, relying on document analysis, which can be used to examine or predict the effectiveness of a package during the design; the role identification can simplify a large number of complex actors from multi-level and multi-fields into several clear roles which promote a policy packaging process, which can quickly detect problems in a packaging process by checking whether key roles are absent.

SAMENVATTING

Over de gehele wereld loopt stedelijk verkeer vast en genereert een hoeveelheid uitstoot die lokale en globale problemen creëert. Deze problematiek wordt gezien als een "wicked" probleem, wat inhoudt dat het zowel moeilijk is om het inherente probleem eenduidig te definiëren als om passende maatregelen te vinden. De complexiteit van vervoerssystemen maakt het voor beleidsmakers onmogelijk om de effectiviteit van elke maatregel of interventie in detail te begrijpen.

In de set van beleidsinstrumenten van beleidsmakers in mobiliteit zijn er traditioneel twee categorieën: transportinfrastructuuraanbod (*transport infrastructure supply of TIS*) of transportvraagmanagement (*transport demand management of TDM*). Beleids¬maatregelen in deze categorieën worden vaak los van elkaar ontworpen en geïmplementeerd, waarbij politieke of publieke acceptatie en onverwachte negatieve bijwerkingen vaak de effectiviteit beperken.

Beleidsintegratie (of *policy packages*) wordt gezien als een beloftevolle benadering om het probleem van enkelvoudige maatregelen op te lossen, omdat het de acceptatie van enkelvoudige beleidsmaatregelen kan verbeteren, de negatieve effecten ervan na implementatie kan wegnemen en grotere synergie-effecten kan opleveren. Ondanks deze voordelen compliceert het integreren van beleid het hele proces van beleidsvorming en implementatie, met complexe waarden, actoren en maatregelen, en stelt het de capaciteiten van de beleidsmaker op de proef. Dit is de reden waarom het lastig is om succesvolle voorbeelden van beleidsintegratie of het gebied van mobiliteit aan te wijzen.

De bestaande literatuur, behandeld in hoofdstuk 1, beziet de integratie van beleid vanuit twee perspectieven. Sommige studies beschouwen de beleidsintegratie als een statisch ontwerp van een combinatie van zorgvuldig geselecteerde maatregelen, waarbij de nadruk ligt op het vaststellen van normatieve bouwstenen voor beleidsintegratie, ideale processen van integratie en het optimaliseren van de combinatie van verschillende maatregelencombinaties. Een beperktere set van studies beschouwt de beleidsintegratie als een dynamisch, pragmatisch proces van koppeling van verschillende maatregelen. Deze studies hebben vaak een wat meer empirische focus en bezien ook vaak het implementatieproces, en de institutionele context. Er is echter een gebrek aan systematisch onderzoek dat twee perspectieven combineert: onderzoek naar het hele proces van beleidsintegratie van ontwerp tot implementatie, een combinatie van deskresearch en empirische case-analyse.

Daarom wil dit proefschrift de volgende vraag beantwoorden: *"Hoe kan de beleidsintegratie in mobiliteit het best worden vorm gegeven en geïmplementeerd?"* Deze vraag is opgesplitst in drie deelvragen die het gehele proces van ontwerp van geïntegreerd beleid tot en met implementatie beslaan.

Vraag 1: Wat zijn de algemene kenmerken van goede beleidsintegratie voor mobiliteit? Hoe kunnen ze empirisch worden gemeten en de basis vormen voor een vergelijkende analyse?

Ten eerste, in het perspectief van de ontwerp van beleidsintegratie ontbreekt het aan bestaand onderzoek aan een geschikte benadering om kenmerken van beleidsintegratie te analyseren en de effectiviteit in verschillende cases te vergelijken. Dat is wel nodig voor een goede analyse van beleidsintegratie. Daarom ontwikkelt dit proefschrift in Hoofdstuk 2 een methode door sleutelkenmerken van beleidsintegratie te selecteren daarop verschillende vormen van integratie te vergelijken. De methode stelt de, verderop in dit proefschrift geanalyseerde, complexe beleidsprocessen nog terzijde en gebruikt documentanalyse als een proxy voor de manier waarop beleidsintegratie wordt gerealiseerd. De methode gebruikt vijf stappen voor het realiseren van dat beeld: selectie, verzameling, categorisering en interactieanalyse en temporele analyse van de beleidsdocumenten. Allereerst worden alle beleidsdocumenten geselecteerd die melding maken van een voorgedefinieerde lijst van mobiliteitsbeleidsinterventies, opgesteld vanuit de wetenschappelijke literatuur. Die beleidsdocumenten worden voor een langere periode verzameld. Die lijst van documenten wordt gecategoriseerd en dat geeft een beeld van de regionale beleidsfocus, bijvoorbeeld of de regio meer auto gericht of meer openbaar vervoer gericht beleid voert. Vervolgens wordt geanalyseerd hoe vaak de verschillende documenten naar andere beleidsterreinen verwijzen, wat een proxy geeft van de beleidsintegratie op het niveau van de nota's. Tenslotte wordt die interactieanalyse in een tijdsperspectief geplaatst, zodat begrip ontstaat over het belang van beleidsintegratie door de jaren; de temporele factor stelt ons in staat te begrijpen hoe beleidsfocus en beleidsintegratie in de loop van de tijd veranderden, om zo ook een beeld te hebben van de dynamiek van beleidsintegratie. Dit rijke beeld van beleidsintegratie in de documenten wordt vervolgens geconfronteerd met de prestaties van de regio of belangrijke prestatieindicatoren op het gebied van mobiliteit, zoals congestie. Deze aanpak is vervolgens uitgetest in de studie van twee Chinese steden: Shenzhen en Dalian. De resultaten uit deze empirisch beperkte studie zijn dat integratie van mobiliteitsbeleid beloftevol is en dat de ontwikkelde methode met relatief beperkte toegang tot een regio toch een onderscheidend beeld kan geven van het niveau en de ontwikkeling van beleidsintegratie.

Vraag 2: Wat is het effect van beleidsintegratie in het mobiliteitsbeleid de congestie? Wat zijn, in de steden met verschillende economische ontwikkelingsniveaus, de passende strategieën om vervoersinfrastructuur te bieden, de vraag te sturen, en mobiliteitsbeleid te integreren?

Ten tweede toetst dit proefschrift in Hoofdstuk 3 de validiteit van de eerdere conclusie dat een goed geïntegreerd mobiliteitsbeleid in termen van samenstelling, verkeerscongestie effectief kan verminderen in verschillende contextomstandigheden. Om specifiek te zijn, onderzoeken we empirisch de causale relevantie van beleidsintegratie in mobiliteitsbeleid, met inbegrip van maatregelen voor het beheer van transportaanbod en transportvraag, voor de beleidsresultaten, op basis van een *fuzzy set qualitative comparative analysis (fsQCA)* van 22 Chinese steden van 2011 tot 2016. De conclusie is dat, in het algemeen, een beperkte economische ontwikkeling of een hoog niveau van infrastructuur de twee belangrijkste verklaringen zijn voor steden met weinig congestie; Bovendien is er geen specifiek aanbod van transportinfrastructuur, noch is er een uniek pakket van mobiliteitsmaatregelen verkeerscongestie te verminderen. Hoewel de resultaten niet voldoende "significant"zijn om een definitieve conclusie te trekken, geeft het een eerste blik op de feitelijke complexiteit rondom beleidsintegratie als instrument om

congestie te verminderen en vraagt om diepere analyse en verklaringen te vinden ten aanzien van het succes van beleidsintegratie. Een goede beleidsintegratie moet tenslotte meer zijn dan beleidsdocumenten die naar elkaar verwijzen, maar vraagt ook om effectieve implementatie “op straat”.

Vraag 3: “Welke sleutelfactoren bepalen het succes van beleidsintegratie van mobiliteitsbeleid en op welke wijze? Wat zijn passende strategieën voor beleidsintegratie? "

Een pakket van maatregelen op het gebied van mobiliteit dat op het oog goed op elkaar aansluit, garandeert de verwachte doeltreffendheid niet; daarom voerden we twee empirische studies uit om het "verborgen"proces van beleidsintegratie in respectievelijk China en Europa te ontvouwen.

Hoofdstuk 4 zet een eerste stap om deze leemte te vullen door het hele proces van integratie van mobiliteitsbeleid in een typische Chinese stad bloot te leggen en uit te leggen waarom schijnbaar goed ontworpen pakketten van mobiliteitsbeleid uiteindelijk niet de verwachte resultaten opleveren. Op basis van de gegevens uit beleidsdocumenten en semi-structuurinterviews worden verschillende grote problemen ontdekt die de implementatie van het geïntegreerde mobiliteitsbeleid bedreigen, waaronder een gebrek aan politiek engagement, het over het hoofd zien van implementatie op districtsniveau, concurrentie tussen de middelen en tussen maatregelen en het ontbreken van integratieve monitoring. Bovendien laat hoofdstuk 4 zien dat het identificeren van de belangrijkste rollen die door verschillende actoren worden gespeeld en de acties die worden ondernomen door verschillende actoren een zinvolle en nuttige benadering is voor het analyseren van complexe processen van beleidsintegratie en het detecteren van potentiële problemen. Hoewel de conclusie van één casestudy misschien niet representatief is, identificeert de studie enkele grote, maar gemakkelijk over het hoofd geziene problemen gerelateerd een beleidsintegratie.

Om de bovenstaande beperking aan te pakken, onderzoekt hoofdstuk 5 de robuustheid van de bovenstaande conclusies, in vier Europese gevallen met significante andere context dan in China: een pakket met congestieheffingen in Stockholm, een pakket met maximumsnelheid van 30 kph in Edinburgh, een pakket rond de Noord-Zuid-metrolijn in Amsterdam, en een pakket rond langzaamverkeer in Lissabon. Een vergelijkbare methodologie wordt toegepast als in de Chinese casus. De belangrijkste conclusie van dit onderzoek is dat krachtige politieke steun, voldoende financiële middelen en institutionele steun essentiële factoren zijn voor het succes van beleidsintegratie. Aangezien deze contextfactoren vaak dynamisch zijn en ook niet altijd controleerbaar, moet een succesvolle implementatie van een pakket van mobiliteitsbeleid worden vormgegeven met in de basis een passende combinatie van maatregelen, en daarnaast ook flexibel zijn voor de verandering van context en verschillende responsieve strategieën mogelijk maken.

Samenvattend, in hoofdstuk 6 worden de belangrijkste conclusies samengevat van de reeks hierboven beschreven onderzoeken. Ten eerste kan een goed ontworpen pakket van mobiliteitsmaatregelen de kans op succes vergroten door de intensiteit en interactie van maatregelen in een pakket te versterken en een duidelijke richting of tendens te kiezen voor de richting van de doelen waarin de maatregelen elkaar versterken. Een pakket ter versterking van langzaam verkeer kan dus investeren in voorzieningen en diensten voor langzaam verkeer, als primaire component, en andere maatregelen toevoegen, zoals het aansluiten van langzaam verkeer op het openbaar vervoer en het verminderen

van de aantrekkelijkheid van het gebruik van privé-auto's. Dit tesamen kan dan worden geïntegreerd in één masterplan of een reeks gekoppelde actieplannen. Deze kenmerken zijn generiek voor beleidspakketten op andere terreinen. Ten tweede wordt het effect van integratie van mobiliteitsbeleid altijd beperkt door verschillende externe omstandigheden, zoals economisch ontwikkeling en de kwaliteit van transportaanbod; daarom moet worden aanvaard dat een ogenschijnlijk goed ontworpen beleidspakket sec de verwachte prestatie niet kan garanderen, hoewel het streven naar 'ideale' integratie nog steeds zinvol kan zijn om het ontwerpproces richting te geven. Een belangrijke reden voor minder presterende beleidsintegratie is dat de problematiek van implementatie tijdens het ontwerp onbedoeld of opzettelijk over het hoofd worden gezien. Beleidsintegratie vraagt veelal om extra kennis of vaardigheden, kan een groter beroep doen op beperkt beschikbare middelen en conflicten oproepen tussen belangrijke stakeholders. Dit en andere belemmeringen, zijn voorafgaand aan het proces van implementatie vaak lastig te voorspellen. Bovendien wordt in de vroege ontwerpfase van denken over beleidsintegratie in een regio toch vaak de combinatie van maatregelen an sich als de de primaire taak gezien. De extra complexiteit en onzekerheid van de implementatie wordt daarbij veelal gemeden. Tenslotte bepalen politieke, financiële en institutionele / organisatorische ondersteuning in hoge mate het proces van beleidsintegratie. De inspanningen om een ïdeaalöf "beste"pakket na te streven, zijn alleen zinvol totdat het pakket kan worden geïmplementeerd in werkelijkheid, in een context die die implementatie faciliteert. Een 'beter' beleidspakket moet dus een balans vinden tussen ontwerp en uitvoering: niet alleen de juiste beleidsmaatregelen integreren, maar ook andere sleutelelementen, zoals bewustzijn, middelen, actoren en instellingen tijdens het ontwerp, en flexibel blijven bij de verandering van contextcondities tijdens de implementatie. Bovenal biedt dit proefschrift inzicht in de relatie tussen het ontwerp en de implementatie van beleidsintegratie, waardoor beleidsmakers in het algemeen de voordelen en barrières van beleidsintegratie en responsieve strategieën beter zouden kunnen begrijpen en gebruiken. Wat betreft de thesisbijdragen aan de methodologie, zijn twee benaderingen voorgesteld en effectief gebleken bij het analyseren van respectievelijk het ontwerp- en implementatieproces: de analyse van de kenmerken van beleidsintegratie legt zowel algemene als specifieke kenmerken van beleidsintegratie vast, en het vergelijken van verschillende pakketten, bouwend op degelijke documentanalyse, die kan worden gebruikt om de effectiviteit van een pakket tijdens het ontwerp te onderzoeken of te voorspellen; de rolidentificatie kan een groot aantal complexe actoren van multi-level en multivelden vereenvoudigen tot verschillende duidelijke rollen die het proces van beleidsintegratie kunnen verbeteren en dat problemen kan detecteren door te controleren of sleutelrollen niet ingevuld zijn.

1

INTRODUCTION

1

1.1. EMPIRICAL PRACTICES OF TRANSPORT POLICY PACKAGING

Modern societies are facing the challenges of fast-growing urban mobility, especially congestion and air pollution (Hassan and Lee, 2015). As cities develop and mobility grows, this often comes at the expense of economic efficiency and environmental protection. For example, in the U.S. alone, congestion costs are more than 310 billion in 2016 (Schneider, 2018); in a study in 83 urban areas around the world in 2011, traffic induced air pollution has been shown to contribute to more than 2,200 premature deaths per annum (Levy et al., 2010). Globally, this situation is getting more severe. And the problems do not seem to be overcome with traditional approaches of straightforward goal setting and implementation of related policy instruments or measures. There is a variety of various perspectives on a broad set of interrelated problems, which always challenges the effectiveness of policies. Therefore, transport issues are also regarded as 'messy' or 'wicked' problems (Rittel and Webber, 1973) that combines complexity, uncertainty, and divergence (Head, 2008) like in other fields, such as education (Jordan et al., 2014), fiscal (Turnbull, 2010) and general administration (Roberts, 2000).

There are two widely adopted types of interventions for governments to deal with transport issues and achieve transport sustainability: providing transport infrastructures supply (TIS) and adopting transport demand management (TDM) policies (May et al., 2010). TIS (e.g. construction of various-level roads and metro rail systems) alone has been proven to lack effectiveness, following worldwide empirical experiences (Nugmanova et al., 2019; Wen et al., 2019).

TDM focuses on changing travel behaviors in order to make the most use of existing transport infrastructures or optimize current transport systems through various policies or measures, governments around the world increasingly emphasize its important role in urban transport policy, because its promising advantages of relatively low cost and high impact optimisation of the use of existing transport infrastructures. However, the practical implications of TDM are still not entirely clear and even unsatisfactory, such as negative side effects (Wang et al., 2014), and low acceptance (Gärling and Schuitema, 2007), especially in real-world application with different contexts and combined applications (Tønnesen, 2015) . In sum, it has been clearly accepted that neither TIS nor isolated TDM measures can solve transport problems of the most of world's cities.

A great deal of literature mentions a possible answer to this problem adopting a more integrated policy perspective (Geerlings and Stead, 2003; Goldman and Gorham, 2006; Silva and Ribeiro, 2009). Transport policy packaging (TPP), the term we adopt in this research in Figure 1.1, goes beyond the combination of various TDM measures and their respective focus on different aspects of "wicked" traffic problems (Givoni et al., 2010; Soria-Lara and Banister, 2018). In addition, it looks at configurations to understand how they deal with contextual heterogeneity, such as existing demand patterns, transport infrastructures, institutions and geography. The idea is, when we understand wicked problems as many interdependent mechanisms, it would make sense also to understand the interventions in their interdependency. Different governments have piloted and taken various packages of TDM measures. Some cities have achieved satisfactory outcomes, for example, Stockholm mainly adopts congestion fees with public transport improvement, Singapore combines land use policies (e.g. TOD) with high car-use fees, and Seattle carries out Commute Trip Reduction Program by flexible work schedule and

subsidies for public transportation. However, there are also other cities confronted with unpredictable problems, such as inappropriate design and incomplete implementation of policy packages. Increasingly more policy makers have realized that transport policy packaging is far more than a collection of 'popular' or 'seemingly effective' measures and requires many efforts on its design which fit the specific contextual situations of each city and fully consider the possible barriers in implementation. Therefore, it calls for better understanding and focused research and knowledge of transport policy packaging in design and implementation. To that, this thesis wants to contribute.

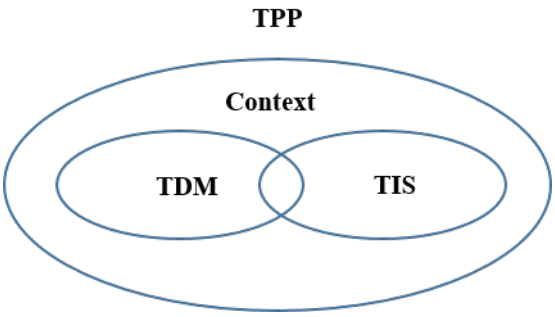

Figure 1.1: Conceptual relations of TDM, TIS, contextual situation and TPP

1.2. Theoretical research on policy packaging

1.2.1. Transport infrastructure supply

In the urban context, transport infrastructure supply consists of the provision of urban roads, public transport (bus ways and urban rail systems) and slow traffic lanes (lanes for bicycles and pedestrians). Although it is widely accepted that the investment in infrastructure supply could benefit urban economic and social development (Chi, 2015; Duranton and Turner, 2011; Hong et al., 2011), it has become clear that transport infrastructure supply alone has its problems as a tool to battle traffic congestion and the cities with high economic growth are more possible to confront transport issues. The effects of transport infrastructure supply on congestion are not undisputed and the empirical results even sometimes conflict. However, it is commonly agreed that one main reason for this is city heterogeneity (Baum-Snow and Kahn, 2005; Beaudoin et al., 2015; Winston and Langer, 2006). Moreover, it is necessary to consider the vital role of various transport policies in transport systems.

1.2.2. Transport demand management

The attention for transport demand management or TDM took hold in the 1970s; it has a broad set of definitions, depending on the different background knowledge authors have. The shared perspective underlying TDM is that it focuses on transport demand management rather than supply and includes various kinds of specific measures (Meyer, 1999; Bamberg and Schmidt, 2001). Some typical demand management measures, such as road toll, congestion fee, and public transport subsidies, are well known

as economic instruments to stimulate specific travel behaviors; in the meanwhile, the measures which improve the facilities and services of public transport and slow traffic to attract people to take public transportation are also regarded as one essential part of TDM measures tool-kits, albeit with infrastructure related elements. A clear classification of a large number of TDM measures based on different characteristics is necessary for the next step of research, although there are also various classification (Currie and Delbosc, 2011; Stewart et al., 1997; Thorpe et al., 2000). In this study, TDM is classified, on one hand based on target transport modes, in pedestrian, cycling, public transport, and car measures, or on the other hand based on characteristics of approaches, like campaigning, economic, regulation, service and facility measures (Yang et al., 2018). The latter classification can be further looked at in terms of the administrative style: command and control or more incentive based approaches; the former denotes the government's preferences of traffic modes: car-oriented or public transport oriented.

Some TDM measures have been proven effective in increasing transport performance. For example, congestion fees implemented in London, Stockholm and Singapore successfully relieved traffic congestion in specific areas (Vonk Noordegraaf et al., 2014). However, other TDM measures can cause negative side-effects. For instance, the subsidy for cleaner energy vehicles encourages people to purchase more cars, although its original goal was to reduce vehicle emission of polluting gases (Herring and Roy, 2007). Moreover, the road pricing and bus subsidies, although widely adopted worldwide, hardly maintain effective in different cities.

As a consequence, single TDM measures have proven to have limited power in changing the urban mobility for the better. In that respect, the integrated packaging of various TDM measures, possibly together with TIS measures, becomes much more promising.

1.2.3. Transport policy packaging

Policy packaging

To deal with the disadvantages of isolated policies mentioned above, policy packaging has attracted attention in both professional practice and academia, because it is expected to improve the effectiveness of policies, and reduce both political and public obstacles (Givoni, 2014). Similar terms such as "policy integration", "policy packaging", "policy mixes" and "policy portfolios" have been widely investigated in the fields such as sustainable energy transition, industrial innovation, finance and transport management (Givoni et al., 2013; Rogge and Reichardt, 2016). To explicitly distinguish how these concepts are used in different research fields, we performed a research in the online database Web of Science for all the concepts above, limited to the papers published since 1966 referring to terms related to policy integration[1]. Among the result of 2089 papers, the five main research fields and the corresponding preferences of conceptual terms are shown in Figure 1.2. We find that environmental and urban studies prefer to use "policy integration", emphasizing the integration of various elements in the dynamic environmental system. Economic studies usually take "policy mix" and "policy integration", and in contrast, "policy portfolio" are widely adopted in the energy field. Nearly half

[1] The search queries in the Web of Science are "TS=("Policy mix") OR TS=("Policy mixes") OR TS=("Policy package") OR TS=("Policy packages") OR TS=("Policy packaging") OR TS=("Policy integration") OR TS=("Policy portfolio") OR TS=("Policy portfolios")"

of articles in transport research uses the term “policy package”. Besides of the leading term in literature in transport research the growing importance in citations, one additional reason for using “policy packaging” is that it is ever more regarded as a practical combination of various transport instruments, rather than a systematic integration of goals, institutions, and measures (Givoni and Banister, 2013; Yang et al., 2018). Therefore, this study will focus on “policy packaging”, and contribute to further develop the understanding on the topic. Current research on policy packaging can be classified into two perspectives: theoretical and empirical studies. On one hand, many researchers focus on establishing a normative conception of the policy packaging process (Justen et al., 2014b), selecting proper numbers and types of instruments (Givoni, 2014) and figuring out appropriate building blocks for policy packaging. Rogge and Reichardt (2016) propose an extended framework for policy packaging in sustainable energy transitions (in figure 1.3). This framework comprehensively covers the essential building blocks and elements of policy packaging from design to implementation, which is also applicable in the policy packaging of transport as well as other research fields. On the other hand, however, we find that only a few studies empirically examine the effectiveness of policy packaging after implementation and less research aimed at detecting the difficulties in the implementation and investigate the influence of contextual factors on the whole policy packaging process (Sørensen et al., 2014; Reichardt et al., 2017).Here, we make a further step on analyzing literature particularly in transport policy packaging.

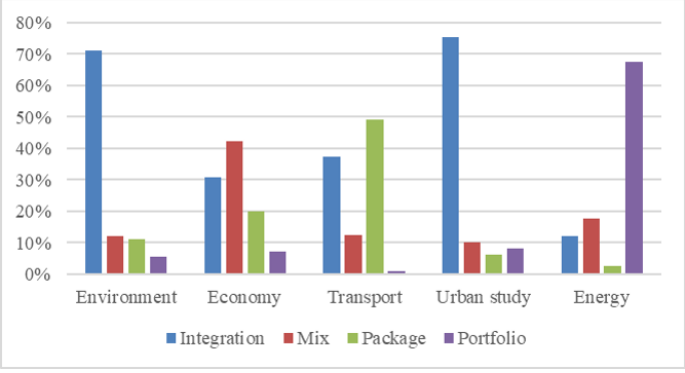

Figure 1.2: Terms of definitions in different research fields

POLICY PACKAGING IN TRANSPORT

This study undertakes a review of research on transport policy packaging. Specifically, 116 articles are searched from the online database Web of Science published since 1996[2] . As Figure 1.4 shows, the research on transport policy packaging keeps rapidly increasing since 2006, crossing 100 after 2017, although more studies are required in the future in the account of the relatively small total number.

[2]The search queries in the Web of Science are “(Policy mix OR Policy mixes OR Policy package OR Policy packages OR Policy packaging OR Policy integration OR Policy portfolio OR Policy portfolios OR Policy patching OR Policy interaction OR Policy interactions OR Policy coordination) AND (transport OR transportation OR mobility OR public transport OR travel OR road OR TDM OR congestion OR transit OR brt)”

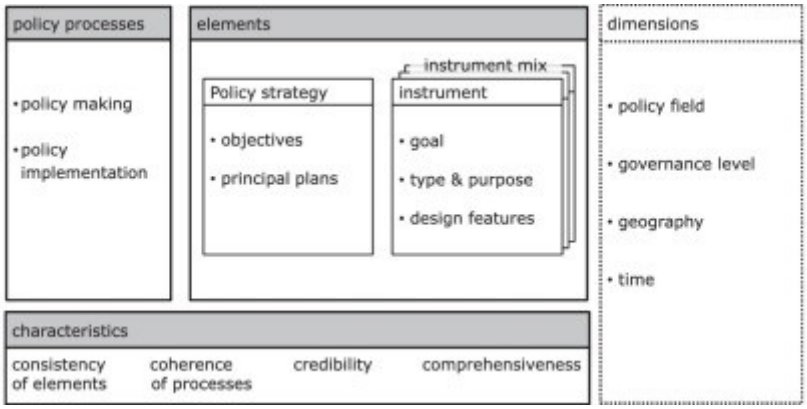

Figure 1.3: An extended framework of policy packaging. Source: Rogge and Reichardt (2016)

This study, based on the literature review, summarizes that current research on transport policy packaging mainly answers three questions. First, what should the policy package be like? Researchers focus on establishing a normative conception of the policy packaging process (Justen et al., 2014b), providing general rules for selecting proper numbers and types of instruments (Givoni, 2014) and establishing appropriate building blocks for policy packaging (Rogge and Reichardt, 2016). These studies provide meaningful guidelines from theoretical ground to the practical design. Second, how can an effective policy package be designed? Existing studies have tested the effectiveness of various design processes. Some of them examine various combinations of transport policies through various methods, such as scenario simulation and statistical analysis (Feng et al., 2017; Viguie and Hallegatte, 2012), or develop an applicable system for policy makers to help generate packaging (Taeihagh et al., 2014). Others show how difficult the design of an effective policy packaging proves to be in different cities, and start to examine the influence of contextual factors (Dineen et al., 2018; Styczynski and Hughes, 2019).Lastly, how can policy package be successfully implemented? The expected effectiveness cannot be achieved without policy packaging's successful implementation. There are enormous uncertainties and contextual factors that will increase difficulties in implementation, such as, the political acceptance (Schout and Jordan, 2007), the public acceptance (Hysing and Isaksson, 2015), new organizational design (e.g. leading group) (Geerlings and van der Sluis van Meijeren, 2008; Shin et al., 2011), additional financial and technological support (Hull, 2009), the cooperation of multiple administrative levels (Olowoporoku et al., 2010) and the involvement of multiple level governance (Tønnesen, 2015).

As for the choice of methodology (shown in Table 1.1), both of theoretical and empirical studies on transport policy packaging are conducted using a wide range of approaches during last two decades. Among the empirical studies, over 60% of researchers take qualitative methods (e.g. interview and document analysis), with the remainder focusing more quantitative methods, usually such as simulation analysis and statistical analysis. Moreover, more than 70% of studies are carried out based on one or several

particular cases. Among the location of the cases, most of them (70%) are from Europe; by contrast, many developing countries in other continents have not been well investigated. Considering the level of cases, near 70% of studies focus on the city or municipal levels and 21% will choose national level to analyse more general characteristics of transport policy packaging; by contrast, the policy packaging in more micro levels, such as counties or districts under the city level or in more macro levels, such as regions or unions has not been paid substantial attention.

Considering the elements and the dimensions of policy packaging, based on the framework proposed by Rogge and Reichardt (2016), we find that about two-third of studies focus on making more effective and efficient policy packages from the design perspective, around one-third studies refer to the implementation. However, only 26% of studies undertakes empirical investigation of policy packaging implementation from different perspectives and in different case studies. Moreover, the research on particular dimensions of transport policy packaging is rather limited. As for the five main field dimensions in transport policy research, over half of studies focus on general traffic issues, such as congestion. Besides, environmental issues caused by traffic are another major research topic. By contrast, land use planning, new energy of transportation, and traveller's health do not receive substantial attention.

In sum, current research on transport policy packaging has three limitations at least. First, although many studies have proposed several "best designs" for policy packaging in particular cases or specific situations mostly through ex-ante and a little through ex-post examinations, existing research still fails to generate a general set of characteristics of policy packaging which can be comparable and applicable in various situations. Moreover, although current studies have proposed several contextual factors on policy packaging implementation and performances, its reliability and validity should be examined in different contextual situations. Lastly, there is a lack of systematic and integrated reflection of the whole policy packaging process from theories to practices, from design to implementation.

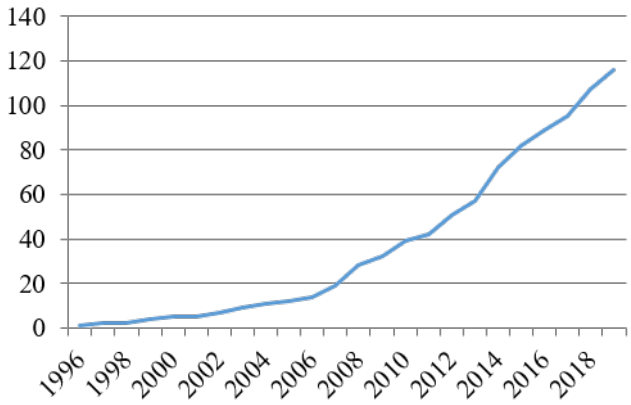

Figure 1.4: Cumulative number of articles in transport policy packaging

1.3. RESEARCH QUESTIONS

To fill the gaps above in the literature, this study aims to answer Q: "How can transport policy packaging be developed and implemented in the real world?" and following three sub-questions related to the whole packaging process (design, implementation, and outcome) are addressed sequentially for a deeper understanding of it.

Q1: What are the general characters of well-integrated transport policy packaging? How can they be empirically measured and used as a comparative approach between various cases?

Existing studies usually explore the components and factors of policy packaging only in principle or seek the best packaging from a static combination of several policies. There are few studies investigating the dynamic process of policy packaging in practical transport management. Besides, there is limited methodology for analysing its characteristics in real-world application, comparing different police packages, and assessing its outcomes from a dynamic perspective.

Q2: Will well-integrated transport policy packaging effectively reduce traffic congestion? As for the cities in different levels of economic development, what are the proper strategies to provide transport infrastructures and take transport policy packaging?

There are few studies that check the effects of TDM packaging on relieving traffic-related problems and examine whether the proposed TDM packaging is effective across different real-world urban transport systems, with different contexts, such as transport supply and economic power.

Q3: "What key factors determine transport policy packaging process and how? What are the proper responsive strategies?"

In contrast to its prominence, the policy packaging in reality does not often perform successfully as expected. Policy makers usually do not consciously understand the difference of policy packaging from traditional single policies and lack skills and experiences to solve issues of policy packaging. There is also a lack of research in explaining why one policy packaging succeeds or fails, the reason of which can provide lessons for policy packaging in reality.

1.4. THESIS STRUCTURE

This thesis includes six chapters shown in Figure 1.5. Chapter 1 provides an introduction of the thesis, including research background, questions, and structure. Chapter 2 provides a methodology for analyzing transport policy packaging in four dimensions (i.e., density, classification, interaction, and time) and examines this methodology through comparative case studies based on policy document analysis in two Chinese cities. Chapter 3 empirically assesses the impact of transport policy packaging, in various scenarios of transport infrastructure supply, on congestion reduction. Chapter 4 examines the implementation process of Transport policy packaging from the perspective of actors and their distinct roles and interactions in one Chinese city. Chapter 5 examines the robustness of conclusions in Chapter 4, what and how key factors determine the empirical policy packaging process, through comparison analysis in four European cases. Chapter 6 presents the key conclusions, reflections of limitations, and suggestions for future research.

Table 1.1: Literature review

Content	Frequency	Rate	Content	Frequency	Rate
Type of research			**Type of methodology**		
Theoretical research	16	14%	Qualitative research	64	64%
Empirical research	100	86%	Quantitative research	36	36%
Case study			**Elements of policy packages**		
Single case	44	38%	Design	76	66%
Multiple case	37	32%	Implementation	40	37%
None case	35	30%	*Empirical study in implementation*	*30*	*26%*
Case location			**Dimensions of policy packages**		
Europe	69	71%	Governance integration	45	39%
Asia	14	14%	Geographical integration	16	14%
America	2	2%	Time integration	22	19%
Oceania	3	3%	Field integration	22	19%
Worldwide	9	9%	**Research fields**		
Research level			Environment	34	29%
Union (e.g. Europe)	4	4%	Land use planning	9	8%
nation	20	21%	New/clean energy	7	6%
region	2	2%	General transport issues	63	54%
city	67	69%	Health (e.g. travel security)	3	3%
county & district	1	1%			
university	3	3%			

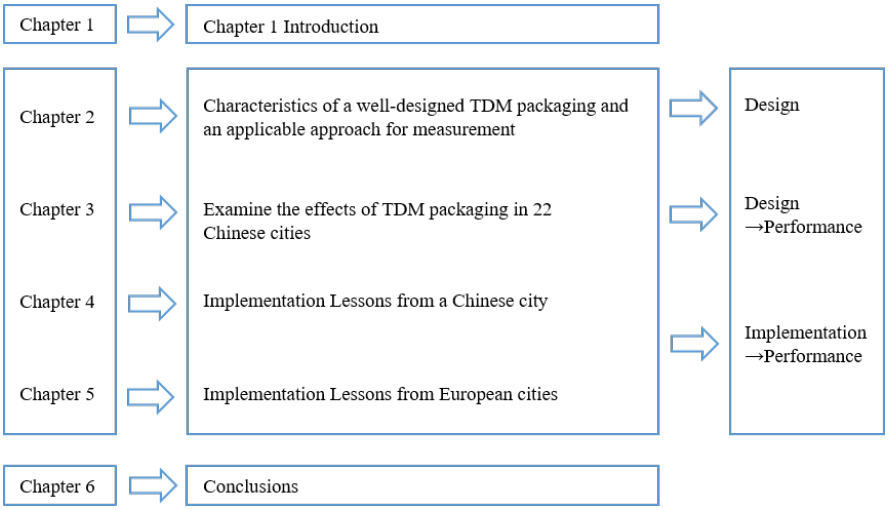

Figure 1.5: Structure of the thesis

2

MOBILITY RELATED POLICY INTEGRATION THROUGH PACKAGING IN CHINESE CITIES: A PROPOSED ANALYSIS OF ITS EFFECTS

Transport demand management (TDM) measures are widely regarded as essential tools to deal with traffic issues. Their effectiveness has been under scrutiny. Packaging of TDM measures has recently received much attention from researchers and governments, because it can achieve more complex policy goals and resolve the negative effects of single TDM measures. Many studies have examined the concept of policy packaging, the ideal packaging process and potential barriers at the theoretical level. However, the way TDM packaging as a concept works in a real-world context has received little attention. Besides, there is little methodology to analyze its characteristics from a dynamic and historical perspective. Therefore, this study provides a methodology for analyzing TDM packaging in four dimensions (i.e., density, classification, interaction and time). These dimensions respectively reveal how many and what kind of TDM measures have been implemented, how they interact in a package, and how these characteristics change over time. We examine this methodology through comparative case studies based on policy document analysis in two Chinese cities, Dalian and Shenzhen, both of which adopt a large number of TDM measures. The results show that this methodology successfully reveals the characteristics of case cities: both tend to put more TDM measures into the transport policy package to deal

The content of this chapter corresponds to a revised version of the article published as Yang et al. (2018). Transport demand management policy integration in Chinese cities: A proposed analysis of its effects. Energies, 11(5), 1126.

with traffic issues, but the package in Shenzhen is more integrative than that in Dalian. We also find that with the integration of packaging increasing, transport systems are becoming more sustainable, and Shenzhen performs better in this regard than Dalian. This methodology can be used to analyse policy packaging in broader areas and to exam its influence on transport systems in more case studies in future research.

2

2.1. INTRODUCTION

Modern societies are struggling with the effects of growing urban mobility, in terms of sustainability and congestion (Hassan and Lee, 2015). Governments throughout the world have applied a wide variety of policy measures to improve transport systems' performances, both in terms of their internal functioning, as well as their negative externalities. As transport related policy problems are regarded as 'messy' or 'wicked' (Rittel and Webber, 1973), inherent difficulties exist in defining the goals and problems and finding adequate measures; the variety of perspectives to a broad set of closely interrelated problems challenges the effectiveness of classic policy development. This complexity of transport systems makes it impossible for policy makers to fully grasp the effectiveness of each measure or intervention in detail.

A possible way forward to this challenge is to have a more integrated policy perspective (Geerlings and Stead, 2003). As Banister (2008)underline the pluralism of problems, a pluralism of coordinated solutions could be an answer, oftentimes combined with the inclusion of stakeholders that can represent the various perspectives on mobility processes. Yigitcanlar and Teriman (2015) stress the need for integrated planning and decision-making for sustainable urban development.

Since the 1970s, governments have aimed to facilitate the growing need for transport. However, it has become clear that keeping pace with the growing demand by supplying more roads to meet increasing travellers' demands is self-defying: more roads mean more congestion (Downs, 2004; Duranton and Turner, 2011). From this point of view, TDM is regarded as a new focus to deal with these problems to achieve equilibrium between supply and demand. There are many TDM measures successful in cities around the world. For example, a congestion fee in Sweden which reduced 20% traffic entering the core and improved the overall accessibility, and individualized travel planning which increased public transport use, and bicycling and walking in Japan, UK and the US (Black and Schreffler, 2010). Although many TDM measures are usually regarded as effective measures on changing travel behaviour and promoting effectiveness and accessibility of transport systems in principle, individual TDM policies have been proved less effective and may cause unexpected negative side effects after implementation. For example, the policy of car restriction based on tail numbers in Beijing offered some incentives to households to purchase more cars with distinctive tail numbers (Wang et al., 2014). Moreover, it is also accepted that only TDM policies without those policies from supply sides and even other sectors cannot solve traffic related problems, like congestion and pollution.

With the wide set of possible TDM measures and the need for integrated policy making, a more integrated approach to transport policy making could provide a way forward. Policy packing (or policy mix, or policy portfolio) could provide such an approach. Researchers and practitioners are currently examining concepts of policy packaging, the

ideal packaging processes and potential barriers at the theoretical level (Givoni et al., 2013; Howlett, 2015; Justen et al., 2014a). However, these studies usually explore the components and factors of policy packaging only in principle or seek the best packaging from a static combination of several policies. There are few studies investigating the dynamic process of policy packaging in practical transport management. Besides, there is limited methodology for analysing its characteristics in real-world application, comparing different police packages, and assessing its outcomes from a dynamic perspective.

Therefore, this study aims to design a methodology for analysing TDM packaging in the real world and to explore the impact of TDM packaging on the development of sustainable transportation, by using that methodology. The effectiveness of this methodology is examined in two Chinese cities: Dalian and Shenzhen; both cities are famous in of public-transport-oriented development by packaging various TDM measures in recent decades; however, the bus sharing rate, one important indicators of public transport performances shows Shenzhen passed Dalian in 2008 and has kept growing fast since that (Dalian Municipal Bureau of Statistics., 2009, 2017; Shenzhen Municipal Bureau of Statistics., 2009, 2017).

The article is structured as follows: Section 2 establishes the value of policy packaging in a TDM context and the methodological gap for empirical analysis of policy packaging; Section 3 describes the proposed methodology for analysing TDM packaging and details the data sources and information of two case cities; Section 4, by piloting this methodology in Dalian and Shenzhen, illustrates the characteristics of TDM packaging and relationships between their packaging and transport systems' performances; Section 5 answers research questions, evaluates this methodology and provide prospects for the future study.

2.2. Literature review

2.2.1. TDM

The concept of TDM, first developed in the United States in the 1970s, has become broad and rather blurred as it is now widely used and modified around the world by a set of professionals specializing in different disciplines with their own background knowledge. For example, engineers view transport demand management as the traffic flow control and technological challenges (Meyer, 1999), economists regard TDM from the pricing perspective (Bamberg and Schmidt, 2001), and policy makers may view it as a regulation within transport systems (Vonk Noordegraaf et al., 2014). The shared perspective is their obvious focus on regulating demand for mobility, rather that the supply, with large gray areas for example in demand-regulating supply, likes that of public transport services.

As there is a wide variety of TDM measures in transport management, a need exists for further categorization. The literature provides several. One important categorization is based on transport modes which one TDM measure targets and deal with, including walking, cycling, public transport, private car and taxi, etc. (Stewart et al., 1997). TDM measures are also distinguished by different approaches to changing travelling behaviours (Gärling and Schuitema, 2007; Santos et al., 2010). TDM measures usually can be classified into five categories of focus: facility measures (which change transport infrastructures to increase the attractiveness of alternative travel modes), regulation mea-

sures (which are directly regulating use), economic measures (raising the costs of private car-use respective to alternative travel modes), information and education measures (which aim at changing people's beliefs, norms, and values related to car use by providing latest and sufficient information or knowledge), and service measures (which focus on improving the quality of alternative transport services).

Several studies have examined the effectiveness of various kinds of single TDM measures in ex- and post- ant transport practices (Eriksson et al., 2008; Kingham et al., 2001; Loukopoulos et al., 2005; Taylor et al., 1997), where single TDM measures prove disappointing in dealing with broader transport and environmental issues. The reasons manifest in four aspects. First, one individual TDM measure, especially financial measures are easily rejected or evaded by the public (Givoni, 2014). For example, congestion fees or road fees are often rejected, although these measures have proved effective later (Graham-Rowe et al., 2011). Secondly, one individual TDM measure hardly deals with its possible negative side-effects. For instance, the subsidy for cleaner energy vehicles is aimed at decreasing the greenhouse gas emission per vehicle, but at the same time it can increase the demand for private cars (Herring and Roy, 2007). Thirdly, an individual TDM measure itself generally lacks the power to realise the more ambitious policy goal-behavioural change (Mistro et al., 2007). The last but not least, the effectiveness of one individual TDM measure is easily influenced by external factors within or outside transport systems (Tønnesen, 2015). As a consequence, single TDM measures have proven to have limited power in changing the urban mobility for the better.

2.2.2. TDM PACKAGING

To solve problems of individual policy measures, policy packaging is widely considered by policy makers and researchers, because it could "improve the possibility of policy success" by providing "a wide range of policy options" which can be "implemented in coordination" (Givoni, 2014). Although the normative definition of policy packaging towards a policy mix (Lehmann, 2012; Rogge and Reichardt, 2016), or policy portfolios (Howlett et al., 2015; Doremus, 2003) is not a new concept and has been known for many years, the published research on it takes a relatively theoretical perspective, focused around three elements: policy strategy, instruments and the instrument mix process (Rogge and Reichardt, 2016). First, the literature around policy strategies goes beyond the objectives to be realized through specific policy instruments, and includes a long-term and actor perspective (Hekkert et al., 2007). The instruments usually are classified by two types: the primary measures and ancillary measures (Givoni, 2014). The primary measures are expected to achieve the direct effectiveness of the policy package following expected behaviour, while ancillary measures related to secondairy effects of unexpected behaviour and to make sure packages implementable. Here, packaging follows a normative dynamic process (Justen et al., 2014b), which can be classified into four categorizations (i.e. replacement, drift, conversion and laying) according to the consistency between goals and measures (Kern and Howlett, 2009).

In order to analyse the real-world application of the concept of policy packaging in transport systems, a review is needed of the methodologies used in current studies to evaluate their advantages and disadvantages. Some of them focus on developing a method to design an "ideal" policy packaging. They usually propose various potential

combinations of policy measures as a package and examine their effectiveness and acceptance based on the pre-evaluation from experts, policy makers or travellers through interviews and questionnaires (Tuominen et al., 2014). In addition, Taeihagh designs a network-centric method with computational approach for analysing the interactions of policy measures, to analyse and predict the development of packaging (Taeihagh, 2017). All these studies focus on the ex-ante analysis of policy packaging. The methods are good at benchmarking and following the criteria of policy packaging in former literature, but its effectiveness is easily influenced by the representability of the subjective opinions used, and also restrained by the limited dimensions and factors proposed in the early stage of the research.

In contrast, other studies measure policy packaging, which have been implemented, in different dimensions. A first dimension is the proportion of various measures in one policy package. For example, Filipe and Macário develop an assessment methodology to evaluate the proper percentage of various measures in one package for various BRT development contexts (Filipe and Macário, 2014). Besides, Tønnesen compares two transport policy packages in two Norwegian cities by analysing the different proportion of each kind of measure in the package (Tønnesen, 2015). A second dimension looks at the categorizations of measures. Davoudi and Sturzake map categorizations of existing policy packaging and examine its relation to with urban forms (Davoudi and Sturzaker, 2017). Finally, researchers like Rogge and Reichardt and Kern et al. emphasize time as another crucial dimension for analysis the development of policy packaging and the need to understand the timeline of policy measures based on a systematic review (Rogge and Reichardt, 2016; Kern et al., 2017). These studies provide fruitful perspectives for analysis of characteristics of existing policy packaging, but there still lacks an approach which can capture the main characteristics of policy packaging and compare the effectiveness by synergizing all available dimensions.

To conclude, in the context of sustainable transport development, policy packaging could be an effective tool for managing real-world mobility, but its effects are poorly understood in real-world contexts. In order to achieve this objective, three aspects should be improved. First, a dynamic perspective should be taken to investigate the whole lifecycle of TDM packaging. TDM packaging is a continuously dynamic process without a precise packaging boundary (Rogge and Reichardt, 2016). Consequently, there is a need to understand the effects within a broader period, looking at TDM packaging from a general and historical perspective. Second, an approach should allow for a straightforward comparison of TDM packaging on different characteristics. Existing research lacks a methodology for analysing policy packaging characteristics as well as evaluating the outcome of policy packaging, which, to a large degree, limits the guiding functions on the TDM packaging implementation. Third, we needed to evaluate the effectiveness of TDM measures packaging on the sustainable development of transport systems. Although confirming the causal relationship of packaging excluding other potential contextual factors such as political, geographical and cultural factors is mostly impossible in real world (Sørensen et al., 2014), empirical research from different backgrounds on exploring the correlation between TDM packaging and transport system performances is meaningful for its design and implementation.

2.3. METHODOLOGY

In order to unfold the whole process of policy packaging, a comprehensive approach is unavailable to analyse policy packaging. It is much more meaningful to examine how various policy measures develop over time, rather than to identify an "ideal" static policy package (Kern et al., 2017). That approach has to deal with a reality where policy packaging does not occur instantaneous. Policies are packaged with new policies introduced after learning about the effectiveness of implemented policies, understanding the interaction between policies, and the consequently layering of policies that can be done more or less interactively. Those interactions are reflected in the design space (the interaction of various design alternatives, stakeholder involvement, and other context-specific factors), and the layering is found in temporal factors (e.g. sequence of policy measures, and the process of policy implementation), both of which are important in analysing policies (May, 1981; Howlett, 2010; Taeihagh, 2017). Therefore, our study develops an integrative method, considering both of aspects. Moreover, one further step is made by applying this method, to explore the influence of TDM packaging on the performances of sustainable transport systems.

2.3.1. MEASURING POLICY PACKAGING

This study develops a method to measuring policy packaging, based on the combination of methodologies selected in literature review, including four dimensions, density, categorizations, interaction and time, each of which reveals one character of policy packaging, shown in Table 2.1. It not only covers the characters of single measures and the interaction among them, but also investigates their change in a dynamic process. The reasons why the methodology includes these characteristics are that: first, it includes the temporal factor, which enables us to investigate packaging from a dynamic and historical point of view. Secondly, the characteristics can provide a whole picture of packaging by describing it from different perspectives: the density reveals the numerical value of TDM packaging; the categorization reflects differences of groups of measures; the interaction indicates the relationships between two measures; the time presents the change of these characteristics. Lastly, considering of the data accessibility, these four characteristics all can be analysed based on contextual analysis.

Table 2.1: Dimensions of TDM packaging

Dimensions	Explanations
Density	the average occurrence of TDM measures
Categorization	the occurrence of each categorization of TDM measures
Interaction	the co-occurrence of two TDM measures
Time	changes of density, categorizations and interaction

DENSITY OF TDM MEASURES

A first relevant measure is the density of TDM measures, being the number of TDM measures taken. To establish this, policy documents are scanned for the occurrence of TDM

measures, as stated on a first long-list of possible TDM measure. This is no indication yet of the integration of policies. Measures may be implemented separately and not considered in their interdependencies. So, a first analysis looks only at the number of measures as a measure of intensity: how frequent do TDM measures' occur in documents. In order to eliminate the interference from unbalanced numbers of policy documents, the density is applied to represent the average intensity of TDM measures per policy document. Our assumption is that this reflects whether and to what degree governments are willing to design and implement TDM measures as a package rather than as separated tools.

Categorizations of TDM measures

A second relevant measure to understand TDM packaging is aimed at understanding categorizations of packages developed. What categorizations of TDM measure are taken? According to literature reviews, categorizations of TDM measures reflect preferences of governments in selecting appropriate measures. To come to this overview we further developed existing classifications of TDM measures. This study adopts two categorizations, target traffic modes and approaches to changing behaviours. Target traffic modes include pedestrian (P), bike (B), private car (C), public transit (PT), and taxi (T), while the approaches classification include campaign (c), regulation (r), economic (e), service improvement (s), and facility improvement (f) (details in Appendix A.1). First category can reveal which traffic modes governments focus on and regard as primary issues in the strategies, and second one implies governance styles in deal with traffic issues, soft or hard. Overall, the categorizations of TDM measures are measured and compared by both of their intensity and proportion in one package.

Interaction of TDM measures

A third and key measure to understand policy packaging is to understand to what extent those developing the policies see the measures in their mutual dependencies. To establish that we carried out a text analysis to see to what extent the texts suggest interactions between measures. In order to analyse interaction of measures, social network analysis measure is used. Network analysis is a set of methodological techniques aiming to explore the general patterns in social relationships formed within individuals and groups (Scott, 2000; Drew et al., 2011). Except active actors in social and political systems, the links of non-actor items such as papers and policy documents can also been investigated by the network analysis. For example, co-citation networks are formed based on the citing and cited relation within papers (Otte and Rousseau, 2002); the goal and targets networks is established to analyse the integration of policies of sustainable development (Davies, 2009).

This method is seemingly straightforward. All categorizations of measures are figured out by analysing related contents in policy documents. The links between two measures refer to their co-occurrence in one policy document. The interactions are strengthened with the replication of those same links in different documents. Then the matrix of links is created and used for 2-mode network analysis (De Nooy et al., 2011). Via simple network analysis techniques, the network of measures is formed and shown based on degree centrality (which counts how many neighbours a node has) (Davies, 2009). If one measure has the most connections with others, this measure is regarded as the central or primary measure in the packaging. Moreover, the density of networks, referring to

the portion of the potential connections in a network that are actual connections (Reagans and McEvily, 2003), is calculated to represent the degree of packaging integration. A packaging network with higher density means that these measures have been integrated better and this package is likely to make more synergized effects.

DEVELOPMENT OF TDM PACKAGING

A fourth measure to understand the dynamics of policy packaging focuses on the temporal development of packaging. This is especially important as we want to understand the possible effects of the packaging, which express themselves over time. This time dimension enables us to investigate the real packaging process from a dynamic point of view by examining the change of three characters. As policies always keep changing and significant changes usually happens in some crucial moments, it is useful to analyse them in different phrases of development (Bardach and Patashnik, 2015). No matter what kinds of changes happen, we can find how a policy package develop and compare packages in different phrases. Therefore, this study next analyses each character combining its development overtime.

2.3.2. THE INFLUENCE OF TDM PACKAGING

Finally, the literature expects an effect of policy packaging on the performance of the mobility system of the urban environment. Based on the measurement of TDM packaging above, we can explore the relations between TDM packaging and performances of transport systems. This is our fifth measurement. It should be noted that this study cannot conclusively prove the causal relationship between them because of current data limitation and the potential contextual factors such as economic and geographical ones. However, to examine the relation between development of TDM packaging and changes of performance of transport systems is to set the stage, which is regarded a meaningful pilot for the future research. Specifically, we examine whether the density, categorizations and interaction of TDM packaging can explain the change of transport performances.

In order to evaluate the influence of packaging on transport systems, indicators of sustainable transport systems are selected to evaluate their performances after issuing some TDM measures. The indicators, well established in existing research (Eads, 2001; Gilbert et al., 2003), generally include economic, social and environmental aspects with the data from objective documents and subjective evaluation. Considering the fact that packages target broad goals, as well as the availability of data, this study only selects two broad indicators: public transport sharing rate and congestion delay index (see Table 2.2.). Public transport sharing rates reveal the actual role of public transport in travelling, and congestion delay index mainly reflect the how much congestion travellers face when driving cars (Gaode Map., 2016). It is generally accepted that higher public transport sharing rates and lower congestion delay index can contribute to more sustainable and higher quality transport systems.

2.3.3. DATA

Content analysis is applied in this study, because key information of TDM packaging which has been implemented can be drawn from policy documents (e.g. laws notices, regulations and measures related to urban transport). Policy documents are collected

Table 2.2: Indicators of transport performances

Indicator	Explanation
Public transport sharing rate	The percentage of public transport trips in total trips
Congestion delay index	The quotient of free travel time divided by average travel time

if they include at least one TDM measure. The period of time is selected from 2006 to 2017, for these Chinese cases covering the 11th (2006-2010), 12th (2011-2015) and a part of 13th (2015 to 2017) five-year plans. These five-year plans provide opportunities for significant changes in policy strategies and specific measures in both of national and local levels. In addition, the data of performances of transport systems all come from the yearly statistic book and transport reports.

This study examines the methodology in two Chinese cities: Dalian and Shenzhen, during the stated period from 2006 to 2017. Multi-case analysis could test the proposed approach more effectively than single case and give a sense of its potential to reveal the influence of packaging (Yin, 2013). The reasons for selecting these two cities are shown as follows: (1) both are facing similarly severe traffic issues, but they have actually adopted different strategies in transport system development. Dalian is ranking 1st as "public transport city" in China in 2000, but private car increased dramatically since then. By contrast, Shenzhen is continuously developing public transport systems and surpassing Dalian, rapidly becoming one of nationally famous TOD cities. (2) Various TDM measures have been implemented to deal with mobility issues since 2006, which makes the study of the process of TDM packaging possible. (3) These two cities are representative ones in China because of significantly geographical difference (Dalian is located in the north, Shenzhen in the south), as well as the difference of administrative power and governance structure.

Several qualitative and quantitative analysis tools are used to analyse the data. The qualitative tool, MAXQDA 12 is used to code all collected policy documents based on keywords or sentences referring to any TDM measure. To be specific, one keyword or sentence of one specific TDM measure occurs, it is counted one point, but one same TDM measure is only counted once in one document. Descriptive analysis of TDM measures are then carried out by SPSS and the packaging relationships between TDM measures is based on a social network analysis tool, Netdraw.

2.4. TDM PACKAGING AND SUSTAINABLE TRANSPORTATION IN DALIAN AND SHENZHEN

2.4.1. TDM PACKAGING IN DALIAN AND SHENZHEN

This section presents the results of three characteristics of packaging, density, classification and interaction and their change overtime based on the data of collected policy documents

Development of TDM measures in density

This study first analyses the characteristic of TDM measures in terms of number, intensity, and density. In Dalian, 31 policy documents were found with at least one TDM measure mentioned; in Shenzhen, 42 policy documents were found. For both the documents were evaluated from 2006 to 2017 (Table 2.3). In both cities, the number of policy documents related transport demand management is increasing over time. It increases more rapidly in Shenzhen, especially in the beginning 2 years of 13th year plan period. The result indicates Shenzhen government puts more focus on implementing policies that include TDM measures when dealing with transport issues.

Table 2.3: Summary of TDM measures in Dalian and Shenzhen from 2006 to 2017

		2006-2010	2011-2015	2016-2017	Total
Policy documents	Dalian	10	17	4	31
	Shenzhen	10	19	13	42
Intensity of TDM	Dalian	23	82	12	117
	Shenzhen	47	117	48	212
Density of TDM	Dalian	2,3	4,8	3,0	3,8
	Shenzhen	4,7	6,2	3,7	5,0

The intensity and density of TDM measures in Shenzhen are higher than Dalian in all three periods (Table 2.3). The intensity indicates there are more measures issued or mentioned in Shenzhen than Dalian at the same time. Table 2.3 also shows that two governments tend to issue a large number of measures in the beginning year of plan, such as 2011 and 2016.

In order to check whether the higher intensity is the result of some policy each containing many measures or many different policies including a few measures, the density that intensity per policy document is calculated. It illustrates that Shenzhen government packages more TDM measures in one policy document than Dalian in general (see Table 2.3 and Figure 2.1). One of reasons why the trend reversed in 2007 is that Shenzhen issued few policies in that year. It also should be noted that, as TDM measures in the next 3 years of 13th five-year plan are still unknown, the density of TDM measures in the short period from 2016 to 2017 is lower than the earlier periods.

To sum up, the density of TDM measures in Shenzhen is higher than that in Dalian, and it increases dramatically in the first year of plans. Therefore, it illustrates that the propensity in Shenzhen is integrating measures more in one policy and as such has a higher packaging level than Dalian.

Development of TDM measures in categories

To reveal the overall characteristics of the packaging, the packages are analysed on categories of measures with a similar feature, rather than single measures. Before comparison based on categorization, it is necessary to illustrate how many types of measures have been implemented in two cities. Table 2.4 shows that Dalian has adopted a wider variety of measures than Shenzhen. One reason why Dalian government issued more

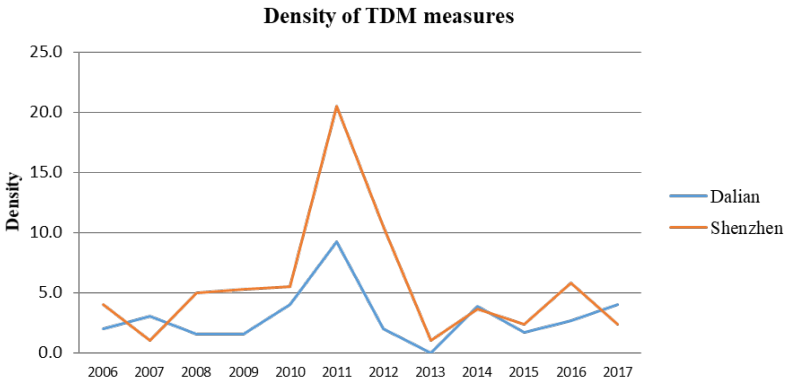

Figure 2.1: Density of TDM measures

categories of TDM measures from 2006 to 2017 is that the some types of TDM measures that had been issued before 2006 (for example in 2004 in Figure 2.3) are not included. Moreover, Figure 2.2 and 2.3 show that more TDM measures have been updated or continuously emphasized (▲ in row) in Shenzhen than Dalian. It illustrates that the Shenzhen government are more actively optimizing existing TDM measures, while Dalian tends to keep on piloting the effectiveness of new TDM measures.Here, the differences in the various proportions of categories of TDM measures are investigated. As stated above, this study selects two kinds of classification: difference transport modes targeted and different approaches to changing behaviours. The differences between the cities are shown below, in Figure 2.4 and 2.5. These figures show the percentage of TDM measure categories as mentioned as a proportion of the total mentioned through time on the bottom. On the top, the figures show the intensity of TDM classification that outlined in their cumulative occurrence of all types of measures. The measures are expected to produce effects continuously over the years, hence the intensity is looked at cumulatively, with the number in a specific year being the sum of the occurrences of new measures in that year and earlier mentions of policies that are still in place.

Table 2.4: Types of TDM measures

		2006-2010	2011-2015	2016-2017	Total
Types of TDM	Dalian	19	22	3	44
	Shenzhen	15	17	3	35

There are increasing TDM measures implemented in Dalian and Shenzhen and the specific compositions of TDM packages show a clear difference (Figure 2.4). Before 2011, measures in the regulation category represent the main approach to deal with traffic issues, in both cities. Both cities show a noteworthy shift in the adoption of different TDM measures. Facility (infrastructure for alternative modes) and campaign measures increase rapidly and take the most important role in the Dalian package. Economic mea-

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006 Standads of public transport services (PTs)	√											
2006 Standads of public transport facilities (PTf)	√											
2006 Total control of taxics (Tr)	√											
2006 Taxi operational management (Tr)	√										▲	
2006 Government determines taxi fees (Te)	√										▲	
2007 parking fee of non-operational parking lots (Ce)		√										
2007 Improving the ICT in parking service (CS)		√										
2007 Encouraging operation of non-operational parking lots (Cf)		√				▲				▲		
2008 Education & Campaign (Cc)			√	▲	▲	▲			▲	▲		
2008 Restriction on registration of vehicle from other cities (Cr)			√								✗	
2008 Bus franchise management (PTr)			√		▲							
2009 Subsidies on estabilishing of parking lots (Ce)				√			▲		▲			
2009 Staggered shifts in government, schools, and NGO (Cs)				√								
2010 Reform Intergaration of bus company (PTr)					√							
2010 Institutional financial support for public transport (Ptc)					√					▲		
2010 Increasing bus frequency (PTs)					√							
2010 More new energy buses (PTs)					√							
2010 Bus priority lane (PTf)					√	▲						
2010 Improving bus hub (PTf)					√	▲						
2011 Restriction on car usage based on plate number (Cr)						√						
2011 Restriction on car usage based on pollution emission (Cr)						√			▲			
2011 Differentiation of parking fee (Ce)						√			▲			
2011 Estabilishing new parking lots (Cf)						√	▲		▲			
2011 Tidal lane (Cf)						√			▲			
2011 One-way lane (Cf)						√			▲			
2011 Non-left lane (Cf)						√						
2011 Enhace the accessment between different transport modes (PTs)						√	▲		▲			
2011 Encouraging shuttle buses						√						
2011 Estabilishing BRT (PTf)						√						
2011 Supervision on the retirement of taxics						√						
2012 Division between sidewalks and vehicle lanes(Ps)							√					
2012 Enhace the accessment between different transport modes (Ps, Bs)							√					▲
2012 Paving more sidewalks (Pf)							√					▲
2012 Total number control on non-motor vehicle (Br)							√					
2012 Increasing curb parking lots(Cf)							√					
2014 Subsidies on parking fees around public transport station (Ce)									√			
2014 Subsidies on early retirement of motor vehicles (Ce)									√			
2014 P+R parking lots (Cf)									√			
2014 Subsidies on new energy buses (Ptc)									√			
2014 Subsidies on new energy taxics (Tc)									√			
2015 Usage Restriction on motorbikes and electric bikes in city center (Br)										√		
2016 Regulation on car sharing (Cr)											√	
2016 Regulation on car hailing (Cr)											√	
2016 Online hailing taxi management (Tr)											√	

Legend: √= start of a policy; ▲=update of a policy; ✗= cancellation of a policy; P= pedestrian; PT= public transport; C=cycling; C=car driving; T=taxi; s= service; c=campaign; e=economic measures; f=facility

Figure 2.2: The development of Dalian's TDM measures, mainly from 2006 to 2015

sures rank last in Dalian, throughout the years. By contrast, Shenzhen prefers to adopt measures in the service category, providing alternative transport services, in addition to facility measures as well as regulation measures in recent years. Campaign measures over the years had a much higher occurrence in Dalian than in Shenzhen.

As for the categories that look at the different transport modes, the two cities show two distinct development orientations of TDM measures (Figure 2.5). In both cities, before 2010, measures of car and taxi form the core, with significant growth for public transport measures. However, the growth in Shenzhen of public transport measures is much larger than in Dalian. After 2010, the measures oriented towards car and public transport increase most with Shenzhen showing a stronger focus on public transport. From 2013, measures of bicycle and walking increase slowly, more so in Shenzhen than in Dalian. The figure shows that the Shenzhen government has a stronger focus on public transport, walking and cycling.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2004 Standards for taxi service (Ts)	√													
2004 Total control of taxies (Tr)	√													
2004 Compensation for the taxi operation (Te)	√													
2004 Taxi mininum displacement control (Tr)	√													
2004 Polluted vehicle mandatory maintenance (Cr)	√		▲	▲	▲		▲	▲	▲					
2005 Bus priority lane (PTf)		√	▲		▲	▲	▲	▲			▲		▲	
2005 Bus compensation when shutdown (PTs)		√												
2006 BRT project (PTf)			√			▲		▲						
2006 Transport modes connection (PTs, Bs, Ps)			√		▲	▲		▲	▲	▲	▲	▲	▲	
2008 bus station (PTf)					√	▲	▲	▲	▲				▲	
2008 Campaign (Pc, Bc, Cc, PTc)					√	▲	▲	▲	▲			▲	▲	▲
2008 Bus price subsidies (Ptc)					√	▲		▲						
2008 Subsidies for new engery bueses (PTe)					√							▲	▲	▲
2008 increasing bus supplyment (PTs)					√	▲		▲	▲		▲			
2008 Bus franchise management (PTr)					√	▲								
2008 Sidewalk improvement (Pf)					√		▲	▲	▲		▲			
2008 taxi operation restriction (Tr)					√									▲
2009 One way lane (Cf)						√	▲	▲						
2009 Bus restriction eliminating (PTr)						√								
2009 Electric motorbike restriction (Br)						√				▲			▲	
2009 Taxi parking lots(Tf)						√								
2010 Parking lots improvement (Cf)							√		▲		▲		▲	
2011 Adjust parking fees (Ce)								√	▲		▲		▲	
2011 High occupied vehcile lane (HOV) (PTf)								√						
2011 encourage shuttle bus (PTs)								√					▲	
2011 integration of public transport modes (PTs)								√						
2011 Public bike rentting (Bs)								√	▲		▲		▲	
2011 Bike lane improvement (Bf)								√	▲		▲			▲
2011 cycling parking lots (Bf)								√					▲	▲
2011 Online hailing taxi (Ts)								√			▲		▲	▲
2011 Tidal lane (Cf)								√	▲		▲		▲	
2011 charging facility for new energy vehicle (Cf)								√						
2011 P+R (Cs)								√						
2011 congestion fee pilot (Ce)								√	▲				▲	
2011 Incentives for less car usage (Ce)								√					▲	
2011 Telework or staggered shifts (Cs)								√					▲	
2012 Subsidies for new engery vehciles (Ce)									√			▲	▲	
2015 Subsidies for new engery taxi (Te)												√	▲	
2015 Car purchase restriction (Cr)												√	▲	
2016 Bike sharing (Br)													√	✗
2016 Car use regualtion (Cr)													√	
2016 Car sharing (Cr)													√	

Legend: √= start of a policy; ▲=update of a policy; ✗= cancellation of a policy; P= pedestrian; PT= public transport; C=cycling; C=car driving; T=taxi; s= service; c=campaign; e=economic measures; f=facility

Figure 2.3: The development of Shenzhen's TDM measures, mainly from 2006 to 2015

In conclusion, results above provide that Shenzhen end up with a more divers set of TDM measures, which creates opportunities to enhance the connection of different measures, while Dalian keeps on focusing on car and public transport more. In addition, there is significant focus shift of measures in both cities. In Dalian, the focus shifts away somewhat from the private cars after 2011; however, Shenzhen government has a stronger shift and keeps improving public transit facility and services. Finally, the Dalian government prefers the measures that establish transport facilities and conduct broadly campaign (e.g., providing parking facility and media), while Shenzhen emphasize the improvement of public transport services (e.g. improving bus accessibility) and slower modes to attract people changing travel behaviours.

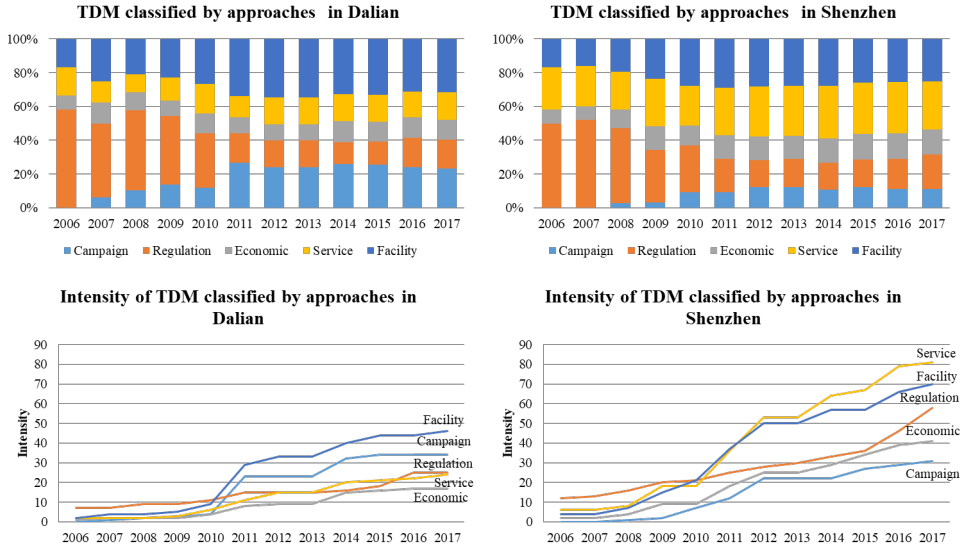

Figure 2.4: TDM categories by approaches to changing behaviors

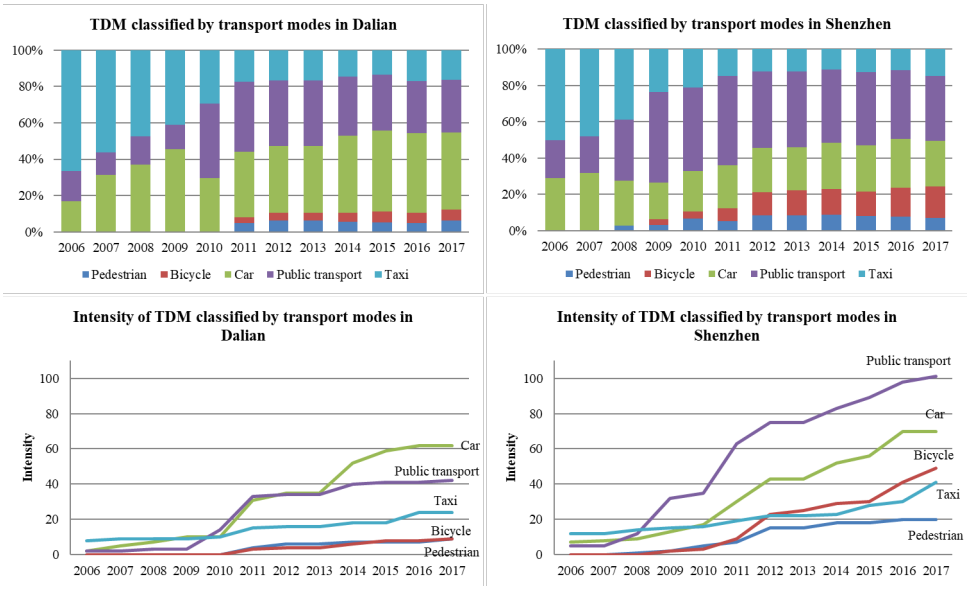

Figure 2.5: TDM categories by transport modes

Development of TDM measures in interaction

Above this article describes the characteristics of measures, components of packaging, the packaging network can present how measures interact with each other in the pack-

aging. The key to understanding policy packaging, however, is to see to what extent these measures were seen in their interdependencies, when the policies were developed and proposed. To assess that, social network theory is applied, to see whether these dependencies are revealed in the policy documents.

Figure 2.6 and 2.7 illustrate the density of packaging network and its development in three periods of plans in Dalian and Shenzhen. The dots refer to TDM measures as they were found in the documents, and the lines represent the connection between two measures as mentioned in the documents; a larger dot means this measure has more interaction with others. The results show that the trend of packaging in both cities is continuously becoming more integrative and complex. Compared to Dalian, the packaging network is more interactive and larger in the scale, develops more rapidly during the period of from 2006-2010, from 2011-2015, and from 2015-2017, and maintains in the higher level in the 13th five-year plan.

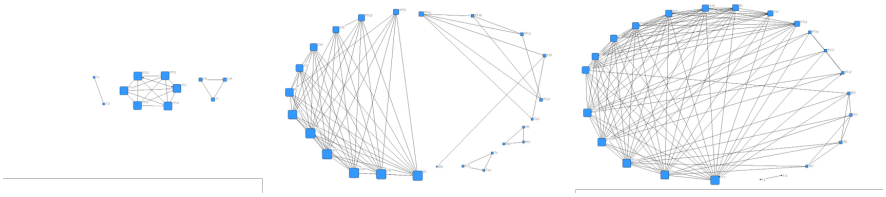

Figure 2.6: Dalian's TDM measures links from 2006-2010 (left), from 2011-2015 (middle) and 2016 and 2017 (right)

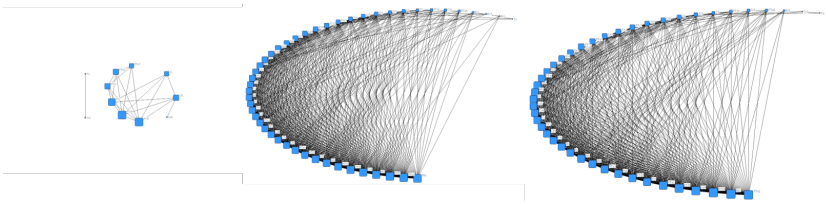

Figure 2.7: Shenzhen's TDM measures network from 2006-2010 (left), from 2011-2015 (middle) and 2016 and 2017 (right)

The 2006-2010 map of Dalian (Figure 2.6 on the left) shows that in Dalian, originally three different fields developed, with limited connections. That taxi policies (left line), car policies (right triangle) and public transport policies are dealt with in the documents as separate policy blocks. The 2011-2015 map for Dalian (Figure 2.6 in the middle) shows a large block, mostly car, on the left, and a large block, mostly public transport, on the right. The 2016-2017 map of Dalian (Figure 2.6 on the right) shows far more integration. The 2006-2010 map of Shenzhen (Figure 2.7 on the left) shows already more interconnections, illustrating that in the documents dependencies are already regarded between the different categories. The big policies on public transport and car are already regarded together. The 2011-2015 map for Shenzhen (Figure 2.7 in the middle) shows major step in looking at the different policies in their interdependencies, which stays high in 2016-

2017 map of Shenzhen (Figure 2.7 on the right), both showing high levels of integration, much higher than any of the Dalian maps.

Table 2.5, which presents top 10 measures that connect most to other ones in each period for each city, further illustrates that in Dalian in the period of 2006-2010 the interaction of measures is more car oriented, with a focus on facilities. Between 2011 and 2015, with the TDM measures of increasing integration, measures of private cars take the central role in packaging network. The connection between measures of private cars and public transport increase significantly. From 2016, policy makers begin to enhance the interaction among more various types of measures. As for Shenzhen, from 2016-2010, interactions link different kinds of TDM measures. With the number of TDM measures increases rapidly in the next period, the interaction of measures became rather tighter than Dalian at the same time. In the last period plan, the network gets even more integrative.

Next, the maps show that linking and density do not necessarily align. It means the measures that are often mentioned can have few connections. For example, Table 2.6 shows public transport subsidies (PTe) have been mentioned for most times in Dalian, but it is seldom packaged with other measures. It also presents that in the 2011-2016 period, there are 7 car measures and 1 public transport measure within top 10 core measures, but only 6 car and 4 public transport ones among top 10 high-occurrence measures. These core measures show the development of transport systems: Dalian turns to focus more on private car management and few efforts are taken to increase the integration of measures of public transport. For Shenzhen, it is the opposite.

In sum, the results of interaction indicate: TDM packaging is developing with documents, illustrating how policies are getting more integrative; Compared to Dalian, Shenzhen has a more connected and wider packaging network; the measures which frequently occur in policies may not be the ones playing a central role in the packaging; it is the core measures rather than high-occurrence ones can exactly reflect the general strategies and development orientation of cities.

Table 2.5: Top 10 of core TDM measures in packaging networks

Dalian			Shenzhen		
2006-2010	2011-2015	2016-2017	2006-2010	2011-2015	2016-2017
PTf3	PTc	PTc	PTf2	PTs1	PTs1
PTr3	Cf3	Cf1	PTf3	Bs1	Bs1
PTs7	Ce9	PTs1	PTc	PTf3	PTf3
PTf2	Cf2	PTf3	PTr3	Ce9	Ce9
PTc	Tc	PTf2	PTe1	PTf2	PTf2
PTe1	Cr2	Cc	PTs7	PTe1	PTe1
Cf1	Bc	Pc	Tc	Cf2	Cf2
Ce9	Cs2	Cf3	Cf1	PTs2	PTs2
Tc	Cs1	Tc	Ce9	Ps1	Ps1
Ts	Cr6	Cr2		PTs3	PTs3

Table 2.6: Top 10 of high-frequency TDM measures in packaging networks

Dalian			Shenzhen		
11th	12th	13th	11th	12th	13th
Cc	PTf1	PTe1	Cr3	PTs2	PTs2
Cf1	Ce2	Ps	PTe	Bs2	Bs2
PTr3	Cr2	PTs7	PTs	Cs	Br
PTs6	Ce7	Br2	PTs2	PTs	Cs
PTf2	PTf	PTf	PTf3	Br	PTs
Cr6	Cc	Pf1	Br	Cr3	PTr
Ce9	Cf4	Cr	Cf4	PTr	PTf3
Cs2	PTs4	Cf	PTr	PTf3	Be
PTc	PTc	PTc	PTs3	Bf	Bf2
Pte1	Ce3	Pf	PTf	PTf	Cr3

Conclusion

TDM packaging in Shenzhen is more integrative than that in Dalian. To be specific, first, Shenzhen government put more TDM measures in one policy which enforce their perspective on the interactions between measures. Dalian is starting to do the same in the nearest plan, but still has a way to go, compared to Shenzhen. Secondly, Shenzhen puts many efforts on public transport development, while Dalian turns to focus on private cars. The difference of core measures in packaging reflects two cities have different strategies in dealing with traffic issues. Thirdly, the interaction of measures between policies in Shenzhen is higher than that in Dalian, which illustrates compared to Dalian, Shenzhen emphasize the synergic effects of policies and has the capacity to deal with complex and comprehensive policy packaging process.

2.4.2. Influence of TDM packaging on transport systems in Dalian and Shenzhen

Introduction

After having applied the proposed approach for analysing TDM packaging in Dalian and Shenzhen, the question next is whether TDM packaging causes a positive effect on the development of transport systems. As there is limited research on assessing the effectiveness of post-ante TDM packaging, this study preliminarily explores whether TDM packaging can explain the change of sustainable development of transport. Four indicators, i.e. density, types, interaction and time, examined effective above are applied to analyse their relation with transport performances. Public transport sharing rate and congestion delay index are selected as indicators of performances of transport systems. They are rather broad, but that for the evaluation of policy packaging is a prerequisite rather than a weakness. It should be noted that the data of congestion delay index from transport reports only have been issued since 2010 and it is generally scale is from 1.5 to 2.5 (Gaode Map., 2016). Next, this study explains the different changes of transport performances in two cities from the point of view of packaging indicators.

Tentative outcome on the effects of TDM packaging on transport systems

The density, referring to the links between the TDM measures, in Shenzhen is higher than that in Dalian from 2006 to 2017, which means packaging in Shenzhen is more integrative. Figure 2.8 shows how the density of packaging network increases and how the percent of public transport sharing rate keeps on growing. Shenzhen achieves higher public transport sharing rate than Dalian, which could be related to both the stronger focus on public transport measures and the more integrative TDM policies have been implemented gradually.

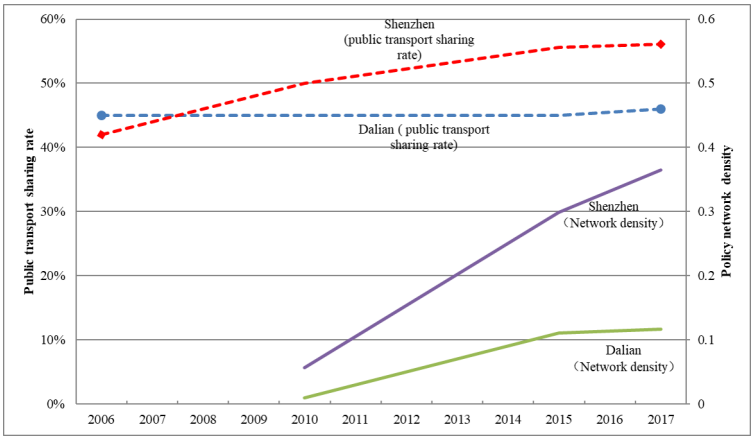

Figure 2.8: Public transport sharing rate and policy network density

Moreover, Figure 2.9 shows a significantly decreasing congestion delay index for both cities from 2013 to 2017, at the same time when more policy packaging of TDM is applied in both Dalian and Shenzhen. The decrease is much stronger in Shenzhen, with a stronger focus on policy packaging. Figure 2.9 also demonstrates the difference in development of packaging and the slow down after 2015.

As for the different types of TDM measures, Shenzhen continuously enhance in public transport, but Dalian turn to putting more focus on private cars regulation after 2010 (Figure 2.5). This can partly explain why bus sharing rate in Shenzhen increase rapidly, but lags in Dalian.

Conclusion

Above all, the degree of integration of policy packaging is shown to be consistent with the change of performances of transport systems. The cities differ on both a focus on types of measures (on public transport for Shenzhen, and on car for Dalian) as well as on the level of integration. Although the number of TDM measures increase fast in both Dalian and Shenzhen, the Shenzhen government integrates these measures much more and seems to achieve higher synergy effects than Dalian. It is likely to relate to Shenzhen having a more sustainable transport system. Although, we cannot prove that to what degree the TDM packaging influence performances of transport systems, the application presented here shows promise for the analysis of policy packaging using a much larger data set.

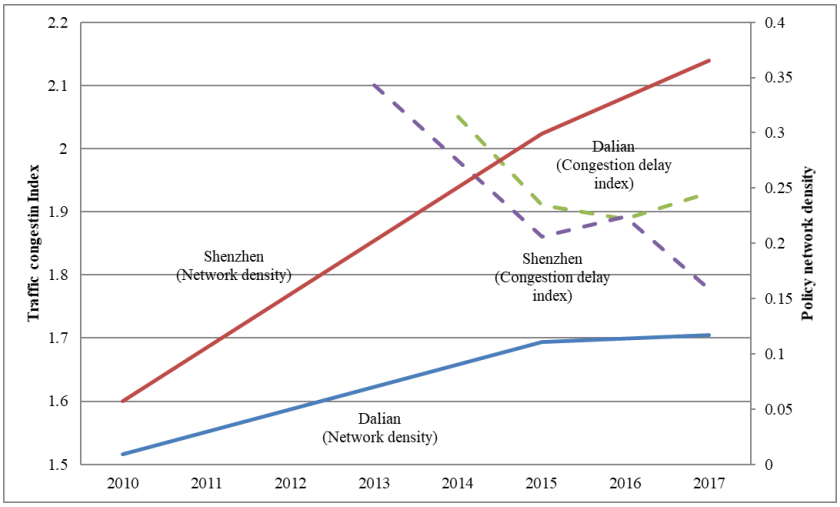

Figure 2.9: Congestion delay index and policy network density

2.5. ANALYSIS

The results above demonstrate how this methodology is able to comprehensively capture and analyze the practice of TDM packaging, as such filling a clear gap in the existing literature which just focuses on bundles of isolated TDM measures or the packaging at one specific time. The methodology includes four dimensions: density, categorization, interaction, and their change with time. Each of them shows one specific character of policy packaging. To be specific, density (refers to the average number of measures in one policy document) illustrates the degree of complexity of one policy as well as the interaction of measures within one same policy. It could directly reflect to what degree governments put efforts into packaging. Categorization dimension reveals the governments‘ preferences of transport measures and the orientation of packaging ‘s development. The network dimension shows the interaction of measures from different policies and the key measures supporting or supported by other measures. Moreover, changes of these dimensions with time illustrate how packaging develops and when the key window of packaging happens. As these four dimensions describe different aspects of packaging, it is better to analyze them together. Honestly, application in two cities is limited, but suited the purpose of this paper. The approach looks very scalable, for example in combination with a QCA approach to support more systematic cross-case analysis.

With this methodology applied in Dalian and Shenzhen, this study shows that both cities have continuously increased the number and the integrity of TDM measures, in order to deal with “wicked” transport issues. This confirms that TDM packaging is widely in these real-world transport systems. The analysis also illustrates that the development of packaging in two cities is quite different. We find that Shenzhen government has a more integrated strategy for and a more stable development of packaging. It keeps revising and updating measures after 2011, before which various measures have been issued, while Dalian adds and pilots more new measures into existing package. Moreover, Shen-

zhen continuously focus on public transport by increasing number of public-transport-related measures which is the most than of other transport modes. By contrast, Dalian shifts to emphasize private car-oriented measures, although Dalian has the largest percent of public transport measures before 2010. We also find the Shenzhen government prefers to integrate single measures into packages. The Shenzhen government regards more and a wider variety of measures in one policy document and adopts more various measures to deal with traffic issues, as compared to the Dalian government.

Although many contextual factors should be considered, the results at least show that a city, like Shenzhen, which has higher interactions between measures through packaging, could have better performances in sustainable development of transport. This finding is consistent with Givoni's the argument (Givoni, 2014).

2.6. Discussion and conclusions

TDM measures are widely used in current transport management, but a single measure or disjoint measures often fail to achieve multi-goals required of the real-world policies, and it may cause negative effects. Therefore, packaging of TDM measures receives increasing attention from researchers and practitioners. As there is limited research in assessment of policy packaging in practices and of its influence on transport systems, this article introduces a comprehensive approach to investigate policy packaging from the characteristics of its components (i.e. density, categorization and interaction) and of its development over time. This approach is applied to study TDM measures and their effects in Dalian and Shenzhen between 2006 and 2017, based on analysis of policy documents on transportation. The specific aim of this study is (1) to examine the applicability and possible effectiveness of this approach and (2) to describe and compare characteristics of TDM packaging over time in two cities and to analyze the empirical relation between TDM packaging and performances of transport systems.

First, the results show that this approach is an effective method to capture both overall and specific characteristics of policy packaging, and to compare different packaging. Without analysis complex policy processes, document analysis can be used as a proxy for the way in which policy packaging is developing. Among the dimensions of this approach, the density reveals how policy documents interrelate different (types of) measures; the categories indicate the direction and possible strategy of packaging, by presenting development of and links between different groups of measures; the interaction shows the connecting networks of measures and directly demonstrates the integration of packaging; the temporal factor enables us to understand how policy packaging keeps changing overtime, which is a vital point of view to analyzing the dynamic characteristics of packaging. This method fills the gaps of an efficient approach that can practically measure and compare policy packaging, and also provides an opportunity to analyze the influence of policy packaging on policy performances.

Secondly, we have shown that a city with higher integrative TDM packaging performs better in sustainable transport development, but only based on the comparison between Dalian and Shenzhen. That limited analysis should be extended before we come to definite conclusions, but tentative outcomes are that: packaging integration should be one major goal pursued by governments; efforts should be made to enhance the connections between existing measures rather than to issue more but isolated ones; the shift of

policy goals or strategies influences the components and integration of packaging. This conclusion keeps consistent with the findings of Kern et al (Kern et al., 2017).

Clearly, there are limitations to this research. First, the data only comes from secondary sources and some gaps exist in the data, especially for earlier years. Therefore, other kinds of data, such as interview, could be taken into consideration to further develop the understanding of the outcome of the document analysis and the reality of policy processes. Secondly, the causal relationship between policy packaging and performances of transport systems is a complex one. Many contextual factors are not included in the current analysis. A combination with a case study analysis could further the understanding of the practice of policy packaging and its effectiveness by interviewing policy makers and travelers and their experiences with policy packaging. Moreover, more quantitative analysis of a larger dataset could further the understanding of indices of packaging, like what we propose here, and indices of the quality of sustainable transport in a large number of cities. We recommend going both directions to better understand the potential beneficial effects of policy packaging. Finally, policy packaging not only the integration of measures in one horizontal municipal level, but also include the interaction among different governance levels. In further studies, we will attend to include that aspect and consider the influence of contextual variables.

3

MEASURING THE EFFECTS OF INTEGRATED TRANSPORT POLICY: A QUALITATIVE COMPARATIVE ANALYSIS OF TRANSPORT POLICIES IN 22 CHINESE CITIES

Transport demand management (TDM) packaging, an integrated combination of various TDM measures, has received much attention both from policy makers and researchers in combating "wicked" traffic problems, such as congestion and traffic pollution. However, there are few studies that check the effects of TDM packaging on relieving traffic-related problems and examine whether the proposed TDM packaging is effective across different real-world urban transport systems. The aim of this article is to empirically assess the impact of TDM packaging, in various scenarios of transport infrastructure supply, on congestion reduction. Relying on a fuzzy set qualitative comparative analysis (fsQCA) of 22 Chinese cities from 2011 to 2016, we find that when cities' GDP and mobility levels grow fast, neither any specific kind of transport infrastructure supply nor any unique TDM package reduces traffic congestion. Cities with different GDP levels should select different strategies to develop transport supply and TDM packaging. Whether these findings also apply to more mature cities with slower growth requires further examination.

The content of this chapter corresponds to a revised version of the article (under review): Measuring the effects of integrated transport policy: a qualitative comparative analysis of Transport Demand Management policies in 22 Chinese cities. Journal of Transport Geography

3.1. INTRODUCTION

Congestion in and pollution by traffic are amongst the most severe and urgent problems faced by both developed and developing countries these days. It is regarded as a "wicked" problem, which implies it is both hard to define the inherent problem and to find adequate measures to deal with (Rittel and Webber, 1973). The complexity of transport systems makes it impossible for policy makers to fully grasp the effectiveness of each measure or intervention in detail (Yang et al., 2018).

There are several widely-adopted approaches to combat congestion with the help of policy measures. Among them are providing transport infrastructures supply (TIS) and adopting transport demand management (TDM) policies. A great deal of capital is invested in transport infrastructures worldwide per year. China's government invested around 340 billion dollars in 2017, around 20,000 dollars per capita (NANTONG, 2018), on par with most Western countries. However, despite the continuously increasing investment, cities are facing only ever higher levels of congestion and pollution (Zheng and Kahn, 2013). Although many scholars debate the effectiveness of transport infrastructures, there is no communis opinio among them (Stopher, 2004; Anderson, 2014). The alternative approach, applying transport demand management (TDM) policies receive growing attention from researchers and policy makers in recent years. The advantages of TDM policies are to take full use of current existing transport infrastructures and focus on guiding commuters and passengers towards sustainable and environmentally friendly forms of travel behavior. Therefore, TDM policies theoretically cost less and are more to apply for urban policy-makers. However, the practical implications of TDM are still not entirely clear, especially in real-world application with different contexts and combined applications. Some TDM policies have proven less effective and can cause negative side impacts after implementation (Wang et al., 2014). Moreover, low political and public acceptance, for some measures such as road fees and restrictions, challenges the administrative capacity of policy makers and as such their applicability (Gärling and Schuitema, 2007). However, it has become clear that neither transport infrastructure supply nor a single type of TDM policy could solve congestion and pollution problems in the world's major cities.

In order to design a more feasible and effective approach, policy packing (or policy mixes, or policy portfolios) could provide a way forward. TDM packaging goes beyond the combination of various TDM measures and their respective focus on different aspects of "wicked" traffic problems. In addition, it looks at configurations to understand how they deal with contextual heterogeneity. The idea is, when we understand wicked problems as many interdependent mechanisms, it would make sense also to understand interventions in their interdependencies. Researchers and practitioners are currently examining concepts of policy packaging (ideal packages and potential barriers) at the level of theories (Givoni et al., 2013; Howlett, 2015; Yang et al., 2018). However, there are few studies that check the effects of TDM packaging on relieving traffic-related problems and examine whether the proposed TDM packaging always works effectively across different real-world urban transport systems.

The aim of this article is to empirically assess the impact of TDM packaging, in various scenarios of transport infrastructure supply, on congestion reduction. It is necessary to emphasize that issues regarding urban transport issues are seen as “wicked” prob-

lems, including congestion and pollution. With limited data available on transport related pollution in the case cities, this study only focuses on the impact on congestion. Relying on a fuzzy set qualitative comparative analysis (fsQCA) of 22 Chinese cities from 2011 to 2016, we find that there is no specific kind of transport infrastructure supply, nor is there a unique TDM package to reduce traffic congestion; therefore, we suggest to policy makers that it is necessary to adjust TDM packaging according to their context-dependent situations in terms of transport infrastructure supply in different stages of urban development.

This article is organized as follows. Section 2 very briefly presents, based on the literature, the two main groups of explanations of traffic congestion, including transport infrastructure supply and management of transport demand, and adds a brief link to the literature on more integrated transport policy through packaging. Section 3 discusses the methodology of the paper and explains the selection of fsQCA to analyze complex causality of transport supply and demand management on traffic congestion; it also introduces the variables, data and analytical process. Section 4 discusses the results and checks them back in the real typical cases in order to find the theoretical reasons of selecting one TDM package. Section 5 answers the research questions and provides suggestions for policy making and future research.

3.2. Literature review

Literature on congestion and the effect of various measures is well-established. It ranges widely from the modelling of travel given spatial and economic characteristics to more complex behavioral analysis of travelers, from the analysis of the effectiveness of specific measures, like road-pricing, to underlining the need of more integrated policy approaches. Here we present a limited overview of two different focal points of large parts of the literature related to transport policy: the focus on transport supply, in particular infrastructure, and the focus on transport demand, in particular the management of transport demand. In addition, the literature on policy packaging as a more integrated approach for dealing with the wicked aspects of transport problems is added.

3.2.1. Transport infrastructure supply

In the urban context, transport infrastructure supply consists of the provision of urban roads, public transport (bus ways and urban rail systems) and slow traffic lanes (lanes for bicycles and pedestrians). Although it is widely accepted that the investment in infrastructure supply could benefit urban economic and social development (Duranton and Turner, 2011; Hong et al., 2011; Chi, 2015), it has become clear that transport infrastructure supply alone has its problems as a tool to battle traffic congestion and the cities high economic growth are more possible to confront transport issues. The next paragraphs discuss the literature on transport infrastructure supply: road and public transit (including bus and urban rail transit).

Urban road

Local governments are generally intrinsically motivated to increase the provision of roads. However, their effect on traffic reduction tend to be disappointed. Antipova and Wilmot

(2012) indicate that improving the links of the existing road network may have reduced congestion levels examined in Baton Rouge.

However, an increase in road network density induces more travel, which may lead to new congestion (Su, 2011). Cervero and Hansen (2002) conclude that adding road lanes is both a cause and an effect in relation to the total vehicle mileage. Duranton and Turner (2011) prove that increased provision of roads will not solve traffic congestion after investigation in various US cities. In sum, the effective provision of roads should focus on their links and networks rather than simply on the length.

PUBLIC TRANSIT SYSTEMS

Public transit systems typically include fixed guideway transit modes (like tram, light rail, and subway) and mixed traffic modes (buses). In some research, public transit is regarded as a whole system (Stopher, 2004; Anderson, 2014), while others target buses specifically (Duranton and Turner, 2011) or urban rail systems (Nelson et al., 2007; Yang et al., 2018). After reviewing the recent research in the impact of public transit on traffic congestion, regardless of types of public transit referred to, there is no consistent conclusion on the question whether it is an effective strategy to deal with congestion.

Stopher (2004)argues that it is unlikely that increasing public transport ridership, for which huge investments are needed, reduces congestion. Anderson (2014), using a simple choice model, proves that public transit provision may have a large impact on traffic congestion in US cities. Beaudoin et al. (2015) after reviewing many recent empirical studies, conclude that public transit can reduce congestion, but overall benefits remain unclear.

To be specific, Nelson et al. (2007) find that rail transit systems can significantly reduce congestion and their potential for reducing congestion is 7 times larger than that of bus systems. In China, Zhang et al. (2017), based on the experiment of households living in resettlement and reformed housing areas in Beijing, show that subway proximity discourages household car mobility ownership in Beijing. Yang et al. (2018) further indicate that subway expansion sharply decreases short-run road congestion in Beijing. However, there are also studies giving opposite results. Baum-Snow and Kahn (2005) indicate rail transit investment seemingly cannot reduce congestion levels based on 16 new and/or expanded rapid rail transit systems over the period 1970-2000. Duranton and Turner (2011) confirm this argument and conclude that increased provision of public transit (large buses) will not help solving traffic congestion after investigating US cities.

The role of transport infrastructure supply on congestion is not clear and the empirical results even sometimes conflict. However, it is commonly agreed that one main reason for this is city heterogeneity (Baum-Snow and Kahn, 2005; Winston and Langer, 2006; Beaudoin et al., 2015). Therefore, it is necessary to consider more factors, such as TDM policies, which may end up playing a vital role in transport systems.

3.2.2. TRANSPORT DEMAND MANAGEMENT AND PACKAGING

Obviously, dealing with a growing demand for transport mobility can lead to a focus on providing infrastructures. However, the downsides of that approach, including high pressure on the natural environment, have become increasingly clear. Therefore, TDM and TDM packaging are becoming popular, expected to solve “wicked” transport issues

more effectively compared to providing infrastructures alone. Various cities around the world have designed and trialed different kinds of TDM packages according to their contextual conditions (e.g. GDP and existing transport infrastructures). Which particular package performs most satisfactorily in which kinds of cities or whether there is a universal effective package is still rare known.

Transport demand management

The attention for transport demand management or TDM took hold in the 1970s; it has a broad set of definitions, depending on the different background knowledge authors have. The shared perspective underlying TDM is that it focuses on transport demand management rather than supply and includes various kinds of specific measures (Meyers et al., 2007; Bamberg and Schmidt, 2001). Some typical TDM measures, such as road toll, congestion fee and public transport subsidies, are well known as economic instruments to stimulate travel behaviors; in the meanwhile, current studies in TDM also include the measures which improve the quality and services of public transport and slow traffic in order to attract more people to take non-motor travel behaviors are also regarded as one essential part of TDM measures toolkits. To be specific, TDM can be classified, based on target transport modes, in pedestrian, cycling, public transport, and car measures, or based on characters of approaches into campaign, economic, regulation, service and facility measures (Yang et al., 2018).

Some TDM measures have been proven effective in increasing transport performance. For example, congestion fees implemented in London, Stockholm and Singapore successfully relieved traffic congestion in specific areas (Vonk Noordegraaf et al., 2014). However, other TDM measures may cause negative side-effects. For instance, the subsidy for cleaner energy vehicles encourages people to purchase more cars, although its original goal was to reduce vehicle emission of polluting gases (Herring and Roy, 2007). Moreover, road pricing and bus subsidies, which have been widely adopted worldwide, have different effects in different cities.

TDM packaging

In order to deal with the disadvantages of TDM measures mentioned above, policy packaging has attracted attention in both professional practice and academia, because it is expected to improve the effectiveness of policies, and reduce both political and public obstacles (Givoni, 2014). Similar terms such as “policy packaging”, “policy mixes” and “policy portfolios” have been widely investigated in the fields of sustainable energy transition, industrial innovation and transport management (Givoni et al., 2013; Rogge and Reichardt, 2016).

Current research on policy packaging can be classified into two types: theoretical and empirical studies. Many researchers focus on establishing a normative conception of the policy packaging process (Justen et al., 2014a), selecting proper numbers and types of instruments (Givoni, 2014) and figuring out appropriate building blocks for policy packaging (Rogge and Reichardt, 2016). However, only a few studies examine the effectiveness of policy packaging in practice and emphasize the important role of contextual factors (Sørensen et al., 2014; Reichardt et al., 2017). For example, Filipe and Macário (2014) examine different policy packages in a BRT project, Davoudi and Sturzaker (2017) find that urban form influences the selection of different types of policy packaging, and Tønnesen

(2015) shows that state engagement is also a factor in policy packaging formation. Although these studies provide meaningful insight into the impact of several instruments and some contextual factors on policy packaging design and performance, they are still ambiguous when it comes to knowing which sort of policy package performs better in which empirical context.

To conclude, TDM packaging is a promising approach to achieve sustainable transport, but current research does not examine whether TDM packaging can perform as well as scholars expect based on empirical data; neither has it been able to offer specific guidelines on how to effectively package TDM measures according to various real-world transport systems. In order to fill this gap, we propose to take three steps. First, we build on the assumption that traffic congestion is determined by both transport infrastructure supply and TDM packaging in urban areas. Together we expect them to be relevant determinants of the level of congestion, beside spatial and population characteristics. Second, the qualitative comparative analysis (QCA) method can be applied to examine the effect of each potential configuration of the transport supply and demand management on the traffic congestion. Third, the QCA results have to be validated in real cases and examined by transport experts, to help verify the results.

3.3. METHODOLOGY

This section explains the methodology, with the choice for an fsQCA, case selection, the data gathered and a first description of the case set.

3.3.1. A QUALITATIVE COMPARATIVE ANALYSIS

This article adopts fuzzy set qualitative comparative analysis to evaluate hypotheses based on data from 22 Chinese cities. There are several reasons why fsQCA is a proper tool for macro-comparative research (Avdagic, 2010) and more specifically in this study. First, QCA (e.g. fsQCA, and msQCA) is a technique to analyze the relationship between impact factors (conditions) and outcomes (Ragin, 2008a). Compared to statistical analysis, QCA performs better in the research of "few cases and many variables" (Meuer and Rupietta, 2017). Moreover, the variables that transport supply and demand management literature provides cannot easily be put in simple presence/absence dichotomies (Ragin, 2008a). In contrast, fuzzy sets are powerful in setting values in the interval between presence (1) and absence (0), which ensures that calibrated variables represent those in the real world. Third, the literature indicates that most predominant variables cannot individually explain changes in transport performance. There is a need to investigate the joint effects of these various factors and to figure out different strategies of policy packaging in various transport contexts.

3.3.2. DATA AND DESCRIPTIVE ANALYSIS

Considering the data accessibility and the general effective number of cases in QCA, we selected 22 cities out of the 50 Chinese major cities ranked by congestion level in the annual transport report of Chinese major cities 2016 (Gaode Map., 2016). First, we excluded those cities for which full range of data were not available for our analysis, which led to 44 cities remaining. Second, to reduce the number of cases to a number more appropri-

ate for a QCA, we selected half the cities based on having an odd ranking number. Figure 3.1 shows the locations of selected cities and an indication of their congestion level.

Figure 3.1: Location and size of the case cities and their congestion levels. The dots indicate where case cities are located and the size of each dot represents the level of congestion which is shown in detail in Table 3.2 below. Source: Gaode Map. (2016) and MOHURD (2017)

Of the cities selected, we can describe 15 cities, including the largest one, as rail-oriented cities, with relative high densities of urban rail networks. One city, Huizhou, can be seen as a bus-oriented city, with a relatively high-density bus-network. The remaining cities lack high-density rail- or bus-networks and are seen as car oriented. Figure 3.2 illustrates the infrastructure orientation of the cities.

A second aspect important to this study is to what extent the cities apply TDM policy packaging, i.e. address mobility problems with more integrated policy approaches. We carried out a textual analysis of the relevant mobility policy documents of all case cities. The analysis looked at the mutual referencing of policy documents in different mobility related fields (Yang et al., 2018). This provided a density of references between the documents, which for the descriptive analysis were classified into four categories. First, we looked at density of references between the policy documents. If reference density is over 30 percent, we scored it as integrated, if it is under 30 percent, we scored it as isolated (details in Appendix A.2). Second, some cities have a number of measures mentioned in policy documents. If they have implemented more than half of the list of 48 possible TDM measures, we classify that set as large. If the city has implemented less than half, we classify that as small (details in Appendix A.2). Together, this provides four

types: large integrated sets (LIn), small integrated set (SIn), large isolated set (LIs), and small isolated set (SIs). Table 3.1 shows which cities are in which category.

Table 3.1: Classification in sets of TDM policy packaging in case cities. Source: government webpages of each case cities

		Reference density	
		Integrated (In)	Isolated (Is)
TDM type set	Larger set of measures (L)	Shenzhen, Nanjing, Dalian, Qingdao, Ningbo, Yangzhou	Beijing, Chongqing, Wuhan
	Smaller set of measures (S)	Changchun, Nanning, Luoyang, Shaoxing	Shanghai, Tianjin, Xian, Zhengzhou, Jinan, Suzhou, Tangshan, Baoding, Huizhou

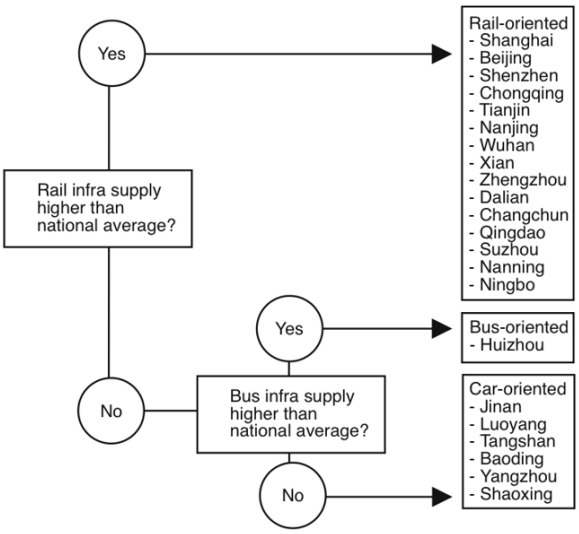

Figure 3.2: Categories of transport infrastructure supply for the case cities

3.3.3. CALIBRATION

Calibration of variables is a vital step for fsQCA (Ragin, 2008b). For a fsQCA, it is essential to be open about the calibration of the scores, so critical analysis is possible and alternative explanations can be developed by other researchers using the data. This paragraph very briefly introduces the approach. Full details on the calibration can be found in Appendix A.2. For this contribution, membership of variables is determined based on both

substantive and theoretical knowledge, as well as advice from related experts. Substantive analysis is based on data from mobility related databases for Chinese cities, with data on congestion and infrastructure in those cities. In terms of the level of TDM, primarily five-value fuzzy sets are used here. Table 3.2 presents the fuzzy membership in the casual conditions and outcomes. Next, we illustrate variables for the outcome, causal conditions and the measurement procedures.

Table 3.2: Truth table. Source: Gaode Map. (2016), MOHURD (2017), government webpages of each case cities

Items	City	TDM Packaging			Transport Supply			Context	Outcome
		References	Type	BorC	Road density	Bus density	Rail density	GDP	Congestion
Case1	Shanghai	0	0.25	0.04	0.06	0.88	0.98	0.99	0.71
Case2	Beijing	0.09	0.83	0.02	0.13	0.09	0.99	0.99	0.98
Case3	Shenzhen	1	1	0.15	0.51	0.83	1	0.94	0.79
Case4	Chongqing	0.14	0.5	0.05	0.25	0.04	0.89	0.89	0.96
Case5	Tianjin	0.01	0.04	0.5	0.66	0.45	0.86	0.91	0.35
Case6	Nanjing	1	0.91	0.12	0.94	0.06	0.99	0.53	0.43
Case7	Wuhan	0.11	0.88	0.23	0.91	0	1	0.63	0.57
Case8	Xian	0.21	0.02	0.03	0.35	0.03	0.98	0.11	0.65
Case9	Zhengzhou	0.05	0.05	0.03	0.03	0	0.96	0.22	0.68
Case10	Jinan	0.18	0.05	0.27	0.98	0.06	0.03	0.13	1
Case11	Dalian	0.99	0.99	0.02	0.62	0.01	1	0.25	0.77
Case12	Changchun	0.7	0.32	0.5	0.92	0.01	0.67	0.08	0.48
Case13	Qingdao	0.81	0.88	0.05	0.59	0	1	0.51	0.54
Case14	Suzhou	0.01	0.07	1	1	0.97	1	0.83	0.27
Case15	Nanning	0.96	0.05	0.03	0.1	0.02	0.98	0.02	0.5
Case16	Luoyang	0.81	0.01	1	0.01	0	0.03	0.02	0.38
Case17	Tangshan	0.05	0	0.12	0.29	0.01	0.03	0.11	0.31
Case18	Ningbo	0.96	0.97	0.09	0.25	1	1	0.3	0.17
Case19	Baoding	0.11	0.02	0.77	0.38	0.25	0.03	0.02	0.14
Case20	Huizhou	0.08	0.14	0.15	0.03	0.54	0.03	0.02	0.31
Case21	Yangzhou	0.99	0.69	0.34	0.96	0.35	0.03	0.03	0.25
Case22	Shaoxing	0.68	0.32	0.12	0.35	0	0.03	0.04	0.21

3.3.4. OUTCOME

The outcome in this article is traffic congestion, operationalized in a congestion delay index (CDI). In the literature, both congestion and pollution are widely used as indicators of transport system performance (Fazal, 2006; Prud'homme et al., 2011). However, since no exact data for traffic pollution exist in most case cities, only traffic congestion is adopted. CDI, which is defined as additional travel time caused by congestion and calculated as the time difference between actual travel time and free-flow travel time, is the main measurable and widely used indicator of congestion (Mohan Rao and Ramachandra Rao, 2012). The data for CDI in this study come from annual transport reports of Chinese major cities 2016 (Gaode Map., 2016).

3.3.5. CAUSAL CONDITIONS

Taken the literature review above together, seven causal conditions are analyzed in this study: GDP, road density (Road), bus line density (Bus), rail line density (Rail), TDM types (Type), "Bus or Car" (BorC) and TDM references (References). Data are compiled from various sources: data related transport supply (e.g. GDP, Road, Bus, Rail) come from 2017 China Construction Statistical year book (MOHURD, 2017); TDM packaging data are collected and calculated based on policy documents including TDM measures from 2011 to 2016. TDM measures issued in this period can best reveal the character of TDM packaging in each city, since they follow the implementation of an entire Five-Year Master Plan. A qualitative content analysis tool, MAXQDA 18, is applied to code the frequency of TDM measures in the policy documents. After calibration, Table 3.2 shows the fuzzy scores of all causal conditions.

TRANSPORT INFRASTRUCTURE SUPPLY

Measurement of transport infrastructure supply is done with three variables. As discussed in the literature, a city mainly provides three kinds of transport infrastructures in urban areas: roads, buses and urban rail transit systems. Although slow transport infrastructures, such as pedestrian and cycling lanes, also have a growing role in urban transport systems, they are still not included in this study because of their small proportion. In order to operate three variables, we adopt road density (Road), bus line density (Bus), and rail line density (Rail), which enables us to make a comparison among cities of different sizes, because they are calculated as the length of each line per urban district area.

In this study, the transport infrastructure supply can be divided into three categories based on the quality of the supply of roads, bus services and rail infrastructure. They are car-oriented (with low bus and rail transit density), bus-oriented (with high bus but low rail transit density), and rail-oriented (with high rail transit density) (details are shown in Figure 3.2).

TRANSPORT DEMAND MANAGEMENT AND PACKAGING

In order to measure policy packaging, we selected a set of variables based on the measurement developed by Yang et al. (2018). First, TDM types (Type) represent how many types of TDM have been adopted, reflecting local government capacity in design and application of TDM measures. We have summarized 48 general TDM measures which

have been implemented among case cities as well as others around the world (shown in Appendix A.3).Therefore, TDM types (Type) is measured as the proportion of TDM usage among 48. Second, as various types of TDM can be further classified by transport modes, we select "Bus or Car" (BorC) to show whether the major part of TDM packaging is taken by bus-related TDM measures or car-related ones. It is calculated by the comparison between their percentages in the TDM package. Finally, in order to understand how TDM measures in one package interdependent, we use the variable TDM references (references), for which text analysis was carried in all relevant policy documents to establish the connections of TDM measures formed by the co-occurrence of different TDM measures in policy documents. More details can be found in the article of Yang et al. (2018).

3.4. Analysis and findings

This paper follows the regular procedure for fsQCA analysis, which generally consists of two steps. First, it presents a necessary condition analysis, followed by a sufficient condition analysis. The necessary condition analysis is conducted in order to check whether a single condition is necessary (always present in the well-performing cases) for the occurrence of the outcome under scrutiny. We analyzed the necessity of each causal condition that was included in the analysis for the outcomes: Congestion (related to higher congestion) and ~ Congestion (related to lower congestion). As this study is small-number analysis, a higher consistency benchmark for necessary conditions (0.9) is selected (Avdagic, 2010).

Secondly, the sufficiency analysis is conducted with a "truth table" presenting all possible combinations of causal conditions which produce the outcomes under scrutiny, both high congestion and low congestion. In this study, there are 128 (=27) combinations for 7 casual conditions. Each condition has a membership score after calibration and each combination has a joint membership based on the scores of conditions under the Boolean rules. The joint membership (conditions occurring in multiple sets) is used to judge whether this combination of causal conditions is a consistent subset of the outcome (e.g. congestion). The cutoff for consistency in this study is 0.9 and the minimum number of represented cases is 1, again because of the limited number of cases (22) in this study.

The explanatory strength of a single condition or a combined solution in fsQCA is represented in two measures: consistency and coverage. Consistency refers to the extent to which the data correlate with a single condition (for a necessity analysis) or solution (multiple conditions for a sufficiency analysis) with the outcome. Coverage refers to the question which variability of a single condition or solution in a case explains which variability in outcomes.

The strength of the fsQCA is that it allows both a quantitative analysis showing patterns in the cases between multiple causal conditions (as independent variables) and outcomes (as dependent variable) and a more qualitative analysis to understand the correlations as provided by the fsQCA. Especially with the limited set of cases the Chinese cities provide, this was a fruitful way of applying it. Below we will present the fsQCA results together with a preliminary analysis of possible explanations. However, a more in-depth analysis of the real-world interactions among TDM measures, for example though process tracing cases, will help deepen our understanding, but this exercise will not be

carried out here.

3.4.1. NECESSITY ANALYSIS

The assessment of necessity shows how congestion occurs more in cities having TDM measures with a strong car-orientation (~BorC), with 0.919 consistency score between the two. This relation can obviously work in two ways. High levels of car congestion will trigger the need to act upon the problem, developing TDM measures geared towards the congested car system. At the same time, many of these car-oriented measures strengthen the car orientation of the city, in turn triggering a self-perpetuating loop.

Moreover, the cases illustrate how low bus line density (~Bus) shows relatively high consistency with high congestion and lower GDP with lower congestion levels. Both obviously are as expected, but they fail reach the 0.9 benchmark (shown in Table 3.3). The result also indicates that no other single condition is necessary for congestion or no congestion.

Concluding, the key outcome is that a high level of car-oriented measures does not seem to be consistent with low congestion, but conversely with high congestion. As stated, causally, this could work in both directions. In addition, having a low-density bus network has a high consistency with high congestion, leaving us to conclude that the cases show us that out of a wide variety of measures that can be promising in battling congestion, a good level of service in public transport is the most prominent necessary condition for dealing with congestion.

Table 3.3: Necessity analysis, with the most relevant outcomes bold

		Congestion		~Congestion	
		Consistency	Coverage	Consistency	Coverage
Context	GDP	0.587		0.432	
	~GDP	0.650		**0.825**	**0.648**
Transport supply	Road	0.591		0.612	
	~Road	0.663		0.664	
	Bus	0.290		0.365	
	~Bus	**0.847**	**0.591**	0.784	
	Rail	0.785		0.600	
	~Rail	0.286		0.477	
TDM packaging	References	0.486		0.574	
	~References	0.661		0.585	
	Type	0.531		0.452	
	~Type	0.631		0.724	
	BorC	0.296		0.445	
	~BorC	**0.919**	**0.643**	0.788	

Note: the coverage of each condition is only shown when its consistency is above 0.8

3.4.2. SUFFICIENCY ANALYSIS

The analysis of the sufficiency is conducted on a 7-condition model for the outcomes related to higher and lower congestion (Congestion and ~Congestion). The analysis requires the selection of intermediate solutions (with plausible remainders) (Ragin and Sonnett, 2005), as referenced in the literature. As such, the approach allows for the analysis of the way in which combinations of conditions occur together related to the outcome. The sufficient conditions and outcomes are presented in Table 3.4.

Table 3.4 indicates that on both solution coverage and solution consistency, the solutions explain the outcomes well. The solution consistency of Congestion and ~Congestion are both high, which means the data of the cases show that these six solutions are related to the outcome. The solution coverage of Congestion (0.729) is high. The coverage of ~Congestion by these solutions is lower (0.5697), indicating that less of the variability in the relation between solution and outcomes can be explained from the data, but that the outcome is still acceptable. It implies that the solutions together explain the lesser levels of congestion (~Congestion). Obviously, including additional conditions in future studies may increase the explanatory power.

As Table 3.4 shows, the analysis identified six paths (C1, C2, C3, C4, C5 and C6) related to high levels of traffic congestion. As, stated before, the solution coverage (0.7293) and solution consistency (0.895) are high enough to analyze the outcomes. As their scores of raw coverage (from 0.118 to 0.233) are similar, it means these paths have a similar capacity of outcome explanation. As the level of GDP as the contextual condition is relatively stable compared to other six conditions, the analysis is conducted based on cities with different levels of GDP. Traffic congestion exists in the cities with either high or low GDP. The different combinations of TDM packaging and transport supply leading to congestion are elaborated below.

In order to help readability, Figure 3.3 shows each 6 different solutions (combinations of conditions) to high and low congestion levels (Congestion and ~Congestion) in a graph. In the descriptive part we will limit us to the parts with the highest coverage and consistency, being C3 and C4 and NC3 and NC5, also the paths with the highest numbers of related cases. This is valuable in the fsQCA, as one can relate quantitative outcomes with contextual case situations. We will use the raw coverage, which is the extent to which the path explains the outcome. We will also look at consistency, to what extent the variability in the variability in path variables explains the variability in the outcome.

C3 and C5 are both paths with relatively high levels of congestion. C3 is a path with high road and rail density, low bus density, a relatively wide variety of TDM types which are related to each other in the policy documents, and with a relative bias towards rail. Typical cities are Nanjing, Dalian and Qingdao. Consequently, on this path, policies, even packaged policies aimed mostly at urban rail, have not proven to be effective at battling congestion. C5 is a path with a wider variety of TDM types with a bias towards rail-oriented policies, with policy packaging. Its closeness to C3 is reflected in its reference cities, now including Shenzhen. These cities all seem to be hallmarks of high economic growth in recent years, where on the one hand governments have been quite active in battling congestion, focusing on various alternative urban rail systems, but because of their explosion in GDP and mobility, they have nonetheless not been able to stay ahead of the curve and suffer widespread congestion.

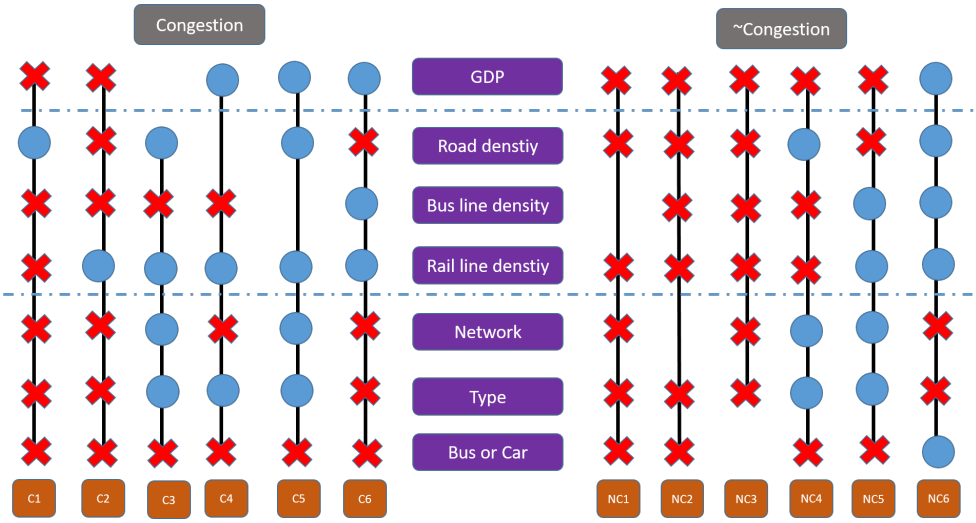

Figure 3.3: Sufficient solutions to high levels of congestion (Congestion) and low levels of congestion (~Congestion). Note: a red cross represents the negation of one condition, a blue circle means the occurrence of one condition.

NC3 and NC5 are both paths with relative low levels of congestion. Both paths have a relatively low level of GDP. NC3 is low congestion, and also relies on policy (packaging) and infrastructure expansion. An obvious explanation for this outcome is that their relatively low increase in prosperity has slowed their growth in demand for mobility. Reference cities are Tangshan and Baoding. NC5 is also referenced by a smaller city with a lower GDP, Ningbo. This path has a stronger focus on policies and for the path it seems effective. Interestingly, the only path with higher GDP and lower congestion (NC6) shows little focus on comprehensive policy packages, but much on across-the-board infrastructure supply, combining with several bus-oriented TDM measures. This city, Suzhou, appears the only example of a high GDP combined with low congestion. A possible explanation can be that high GDP could afford the high quality of overall transport infrastructure provision and the bus-oriented development cause positive effects.

By and large, policy packaging and applying a wide variety of TDM measures occur on both the highly congested paths and the low congested paths. They seem not to have strong explanatory power for the level of congestion. The outcomes show the complex patterns that exist between the performance of mobility systems and policies adopted to deal with mobility. The literature on policy packaging is generally positive on the value policy packaging can have on dealing with wicked problems, and it would make sense to agree at first sight. A more integrated solution should indeed be expected to have a stronger effect on congestion than separate solutions. However, the wickedness of the problem seems to go much deeper than wide and integrated application of TDM measures can handle.

Table 3.4: Sufficiency analysis for high levels of congestion (C1 through 6) and low congestion (NC1 through 6).

Items	Configurations	Raw coverage[a]	Unique Coverage[b]	Consistency	Case cities
	Congestion = f(GDP, Road, Bus, Rail, References, Type, BorC)				
C1	~GDP*Road*~Bus*~Rail*~References*~Type*~BorC*	0.1747	0.1092	0.9091	Jinan
C2	~GDPr*~Road*~Bus*Rail*~References*~Type*~BorC	0.1782	0.1092	0.9533	Xian
C3	Road*~Bus*Rail*References*Type*~BorC	0.2332	0.0376	0.8423	Nanjing, Dalian, Qingdao
C4	GDP*~Bus*Rail*~References*Type*~BorC	0.2218	0.1362	0.9769	Beijing, Wuhan
C5	GDP*Road*Rail*References*Type*~BorC	0.2183	0.0419	0.9328	Nanjing, Shenzhen, Qingdao
C6	GDP*~Road*Bus*Rail*~References*~Type*~BorC	0.1188	0.0734	0.9714	Shanghai
Solution coverage[c]		0.7293			
Solution consistency[d]		0.8950			
	~Congestion = f(GDP, Road, Bus, Rail, References, Type, BorC)				
NC1	~GDP*~Road*~Rail*~References*~Type*~BorC	0.2133	0.0218	0.8929	Huizhou, Tangshan
NC2	~GDP*~Road*~Bus*~Rail*~Type*~BorC	0.2265	0.0313	0.9560	Tangshan, Shaoxing
NC3	~GDP*~Road*~Bus*~Rail*~References*~Type	0.2464	0.0550	0.9594	Tangshan, Baoding
NC4	~GDP*Road*~Bus*~Rail*References*Type*~BorC	0.1403	0.0806	0.9250	Yangzhou
NC5	~GDP*~Road*Bus*Rail*References*Type*~BorC	0.0967	0.0739	0.9808	Ningbo
NC6	GDP*Road*Bus*Rail*~References*~Type*BorC	0.1365	0.1081	0.9172	Suzhou
Solution coverage[c]		0.5697			
Solution consistency[d]		0.9376			

Note: a, Raw coverage means the percentage of all cases in which a combination represents;
b, Unique coverage is the percentage of cases only covered by one particular combination;
c, Solution coverage indicates the proportion of cases which are covered by all the combinations as a whole solution;
d, Solution consistency means the degree to which all the combination as a whole solution result in the same outcome

3.5. CONCLUSION AND DISCUSSION

Amidst rapid economy in Chinese cities, traffic flows increase and traffic congestion seems inevitable. Local governments can build more transport infrastructures and adopt more TDM measures in order to deal with it. However, we find that none of them has been enough to keep up with traffic growth or handle the occurrence of congestion effectively. The analysis shows that in general limited economic development or high levels of infrastructure are the two main explanations for cities experiencing low levels of congestion.

We have focused on congestion but expect similar results in the field of emissions pollution and other negative effects of traffic, with one caveat. In cities with high GDP, infrastructure development seems to be the most promising path, more so than TDM measures and policy packaging. Obviously, it is highly unlikely that the effect of infrastructure development on reducing congestion will be the same on restricting car mobility, as it does not distinguish between the different modes, each clearly with a different environmental performance. Although our outcomes clearly show the limited effect of TDM measures and TDM packaging on congestion, it may well be that their impact on sustainability proves to be different and more promising. This would be something for further research, requiring a dataset with comparable emission data for these cities.

Our analysis demonstrates that cities with different GDP levels should select different strategies to develop transport supply and TDM packaging. As for cities with low levels of GDP, it can be effective for local governments to focus on designing and implementing TDM packaging rather than on investing transport supply. More specifically, they should beware of focusing just on road construction, which is likely to cause higher congestion by encouraging more car use. As for cities with high levels of GDP, even when local governments put substantial efforts in transport supply, congestion remains high. They should emphasize developing the supply of complete and comprehensive transport systems (e.g. all of road, bus and urban rail).

The hope expressed in the literature that policy packaging and strong TDM measures may help reduce traffic congestion (Givoni et al., 2013; Zong et al., 2016) seems overoptimistic for the particular levels of growth many Chinese cities are currently experiencing, at least for the timeline we examined in our study. It could be that behavioral change of consumers in a context of economic growth takes more time to respond to TDM measures, at least in ways such that our study was unable to capture this mechanism.

We acknowledge there are several limitations to this study. First, the final impact of TDM packaging on transport sustainability cannot be totally represented by the degree of solving congestion, which may be underestimated by us. Second, we currently do not know whether the results, drawn based on Chinese cities, can be robust in different cities in other nations, although we aim to carry out a systematic assessment of TDM packaging on transport sustainability. Third, the limited performance of TDM packaging is probably because it needs more time to fully function, when we make the evaluation. Last but not least, it is also possibly caused by the low quality of implementation, which cannot be tested by this study alone. Therefore, we would suggest further research by comparing the effect of policy packaging and TDM measures in cities that saw growth earlier and have longer histories of policy packaging and applying TDM. It may be that European and American cities offer hope for demonstrating a visible impact of sound

and integrated application of TDM measures in the longer run. Moreover, it is necessary to deep into the real TDM packaging process and examine whether and how implementation influence final performances.

4

Integrated transport policy packaging: Lessons from a Chinese city

Sustainable transport typically requires a broad spectrum of policy measures, with responsibilities shared by different authorities and with various public values competed with each other, such as commuting, health, spatial quality, and economic development. Designing and implementing integrated policy packages, with consideration for the interdependencies between measures and actors is a promising approach and thus an interesting research topic. A large part of the literature on transport policy looks at separate measures and their effects. These measures in reality always work in constellation with other measures and understanding their dependencies in a way to create synergies through packaging has been the topic of theoretical discussions. However, empirical research on policy packaging is sorely lacking. In this paper, we examine the implementation process of TDM policy packaging from the perspective of actors and their distinct roles and interactions. The data is collected by document analysis and interviews with officers in a Chinese city. Several major problems threatening the implementation of TDM packaging are detected, including overlooking implementation at district-level, resource competition between measures, and the absence of integrative monitoring. It provides a first answer to the discrepancy occurring in the promise of real-world crafting of well-integrated policies for sustainable mobility.

The content of this chapter corresponds to a revised version of the article published as Yang et al. (2020). Integrated transport management: Lessons from a Chinese city. Research in Transportation Economics, 100918.

4.1. INTRODUCTION

In recent decades, sustainable urban transport has been developed with a wide range of measures for transport demand management (TDM) (Bamberg and Schmidt, 2001; Eriksson et al., 2008; Gärling and Schuitema, 2007), as researchers and policy makers have understood that facilitating demand by building more infrastructure cannot successfully deal with "wicked" transport problems nor contribute to the achievement of a sustainable transport transition (Rittel and Webber, 1973). However, isolated TDM measures have shown to be unable to solve transport problems effectively and policy packaging by clever integration of various TDM measures is getting more attention(Yang et al., 2018).

TDM packaging integrates public values, measures, and actors, leading to higher complexity and uncertainty in design and implementation. Although many cities around the worlds have initiated TDM packaging (Taylor et al., 1997; Doremus, 2003; Givoni et al., 2013), the effectiveness of the approach is poorly examined and policy makers not only have a poor understanding of what TDM packaging means, but also lack a clear perspective on how to apply it. Moreover, existing research on policy packaging mainly focuses on its building blocks (Rogge et al., 2017) and ideal packaging process in a more theoretical way (Justen et al., 2014a), and the optimization of measures integration in the design phase (Tuominen et al., 2014), but empirical research on the implementation of packaging is still rare. Although there are rich studies on the implementation of various types of policy, the unique character and specific problems of implementing TDM packaging demands attention.

Therefore, this study aims to make a step towards filling this gap by laying bare the whole TDM packaging process in one Chinese city and explain why seemingly well-designed TDM packaging eventually fails to achieve its expected results. Although the conclusion from one case study maybe not representative, the study identifies some major but easily overlooked problems through its deep analysis of a real TDM packaging process. It can be a basis for further development of a sound understanding of the implementation of more integrated policy development.

The remainder of the article is as follows: Section 2 presents the literature on policy packaging, policy implementation, and the research framework. In Section 3 clarifies the approach taken, including the case selection, data collection and analysis is introduced. Section 4 reports the main finding on TDM packaging implementation in the case, and Section 5 presents the conclusions and limitations of this article.

To understand better how integrated policy development and implementation through policy packaging could support policies aimed at effective and sustainable transport system, this section discusses transport demand management. In addition, it looks at the literature on the integration of policy development through packaging and the roles of different actors in that process.

4.2. LITERATURE REVIEW: LEVELS OF GOVERNMENT INTEGRATING TRANSPORT POLICIES

To understand better how integrated policy development and implementation through policy packaging could support policies aimed at effective and sustainable transport sys-

tem, this section discusses transport demand management. In addition, it looks at the literature on the integration of policy development through packaging and the roles of different actors in that process.

4.2.1. TDM MEASURES

TDM measures are referred to the policy instruments aiming at managing unbalanced transport demand and disorderly traveler behavior (Meyer, 1999; Bamberg and Schmidt, 2001). TDM measures can be classified into different categories. For example, based on the difference of transport modes, TDM measures include pedestrian, cycling, public transport, and car-related measures; according to different management approaches, they can be divided into campaigning, economic, regulation, service and facility measures(Yang et al., 2018).

Different types of TDM measures normally have different levels of effectiveness and feasibility. "Hard" TDM measures regulation of transport use are expected to be more effective but less acceptable to politicians and the public; In contrast, the "soft" measures such as campaigning and services are more easily accepted but the effects may be less significant in the short term (Meyer, 1999; Gärling and Schuitema, 2007). The predictability of the effect of TDM measures has shown to be not very straightforward. The effectiveness and feasibility of measures can be different in different contexts. In addition, TDM measures that have the desired effect are shown also to have negative side-effects. For example, clean car subsidies can encourage people to drive more(Herring and Roy, 2007). Measures can be combined to overcome these issues, but the interaction is not always predictable. Therefore, in the design and implementation process, policy makers could benefit from a better understanding of the interaction between possible TDM measures before they select different measures in order to address a specific problem situation.

4.2.2. POLICY PACKAGING

In order to improve the effectiveness and feasibility of measures and deal with possible negative side-effects mentioned above, policy packaging is widely regarded as a promising approach (Givoni, 2014). Existing research on policy packaging heads towards two directions. One is the more theoretical discussion focusing on establishing normative building blocks for policy packaging (Rogge and Reichardt, 2016), ideal packaging processes (Justen et al., 2014a), and optimizing the combination of different measures combination(Tuominen et al., 2014).

The other is focusing on the empirical design and implementation process of policy packaging. For example, Tønnesen (2015) highlights the role of state government engagement for policy packaging implementation, and Davoudi and Sturzaker (2017) discuss the influence of urban forms on designing policy packages. Implementation of policy packaging cannot be conducted without the cooperation of policy actors from different tiers of government. Just as Rogge and Reichardt (2016) highlight, the implementation of policy packaging is embedded across different levels of governance from transnational to sub-municipal levels. Howlett et al. (2017) emphasize that 'verticality 'in the involvement of multilevel policy actors makes the policy packaging design and implementation more complex and difficult. The conflicts between elements of pol-

icy packaging, such as between goals and measures and between different actors, occur more easily and frequently. Some studies have proved the importance of enhancing intergovernmental cooperation (Howlett et al., 2015; Tønnesen, 2015). However, the empirical research on policy packaging is still missing and there is a lack of an applicable approach to dissect the complex policy packaging process and identify problems.

4.2.3. Roles in policy packaging

Policy analysts sometimes frame the policy maker to be one single and purposive actor which takes charge of the whole policy process. However, in reality, policy making and implementation are rarely finished by one single actor or agent (Howlett et al., 2009). This framing easily leads to overlooking the roles and actions of other authorities or groups within the government (Flanagan et al., 2011). As policy packaging involves multiple values, multiple measures, and multiple actors, it is essential to include these different roles and actions of actors, rather than regard integrative policy making it as an action of a single policy maker.

Various roles can be played by individuals, groups and organizational actors. As this study focuses on the roles and actions of government authorities, five major roles are identified in the TDM packaging process: policy principals (who identify the problems and initiate policy making process), designers (who design components of packaging), implementers (who execute the designed packaging), sponsors (who provide financial support for the whole packaging process) and monitors (who monitor performances of other roles). The types of roles and types of actors are not mutually exclusive. One actor may take several roles at the same time, and one role may also be shared by differ(Flanagan et al., 2011). Moreover, interaction of different roles can be produced only by one actor, for example, one authority can design and implement one policy with its own budget, and different actors interact with each other when they share the same role. In the policy making process, although ideal roles of one actor have been mostly shaped by the formal institution and other historical factors, this actor can still have the freedom to decide which role is primary and to which degree one role can be played.

4.3. Methods: Process tracing in a single deep case study

As clarified above, the literature mentions the theoretical advantage of policy packaging in dealing with complex problems as sustainable mobility. However, the empirical evaluation of the effect of policy packaging in 22 Chinese cities was less promising. This discrepancy can only be understood by analysing better the causal chain between the inclination for policy packaging of policy makers, as was indicated by links in policy documents between various measures for TDM and levels of congestion in these cities.

This means a more detailed look at the policy packaging process is needed, to understand how documents showing the positive intention on policy packaging relate to a less positive outcome in terms of congestion. In addition, it provides the possibility to look at the effect on other aspects, such as emissions. For that we chose a case study approach (Yin, 2017). In those cases process tracing was applied, following the developments in the case through time, focusing on the interactions between the different policy measures and how the respective actors sustained the integrated perspective. Bennett and

Checkel (2015) make clear that process tracing is a vital method to understand causal mechanisms. We focused on evidence provided by actors and their motivation for actions while implementing policies for mobility, following the perspective of Dubois and Ford (2015).

The choice was made for a single case study at this initial stage, analysing how theoretical functioning of policy packaging relates to the real-world empirical functioning. The aim was to understand which factors explain that difference. This can be a stepping stone towards including more cases to see whether factors explaining that distinction vary in different cities. However, at this point we had no meaningful way of finding explanatory factors, which would allow us to select additional cases providing alternative factors and answers.

4.3.1. CASE SELECTION

For exploring the problems in the real-world implementation of TDM packaging in China, we select the case of city X[1]. It is a representatively common city in China in various relevant aspects: geography, GDP per capita, population density, transport infrastructures, etc. First, the city is located in the centre of Hubei Province, and also central to China, regarded as "the heart" by the city X local government. Secondly, it has a GDP per capita in 2016 of 52,425 yuan (7634 USD, 6717 Euro), similar to the average level of national GDP per capita 53,980 yuan, (7,861 USD, 6,915 Euro) (JMBUOS, 2016). Thirdly, the population density of the total area in 2016 (2124 persons/square kilometer) is close to the national average level (2408 persons/square kilometer) (JMBOEAE, 2016). Fourthly, city X is engaging on extending its urban road network structure by pursuing the goal of "3 rings and 8 arterials roads" (JMDARC, 2014). This trend is also widely spread among many larger and smaller Chinese cities, all implementing policies triggering rapid urban sprawl (Kim, 2019). Above all, the analysis of super-mega cities, such as Beijing, Shanghai, and Shenzhen, would have provided singular data point, hard to reproduce in other cases because of comparability issues with other cities. Because of that, we deemed it more meaningful to select city X as the case representing the status quo of many more Chinese cities. With the rapid urban sprawl and increasing transport problems in the recent decade, the city X government focuses both on the supply of urban road infrastructures and the management of transport demand by TDM packaging. Just like many other Chinese cities, the local government still cannot successfully design and implement TDM packaging. Therefore, the problems revealed in the empirical packaging process can provide useful insights. Finally, access to data and local governments was established in city X, allowing for the deep kind of analysis needed in a case like this.

4.3.2. DATA COLLECTION

In order to fully understand the whole design and implementation process of TDM packaging, we adopted two steps to collect data. The first step was to understand how the policy packaging in city X relates to other Chinese cities. For this policy documents from 2011 to 2016 mentioning at least one TDM measure were selected to establish to what extent these policy documents were cross-referencing various TDM measures. This period

[1] We anonymize the name of City with City X, which allows us to openly describe the developments.

covers the time of the whole 12th and the beginning of the 13th 5-year urban plan, which captures enough of a period in which policy packaging could pay off. For the analysis, a list of possible TDM measures was needed, to both select documents as well as for the analysis of cross-references. On that, we used the classification of TDM measures and the frequency statistics as developed by Yang et al. (2018).

In the second step, we selected the TDM measures from the documents and reconstructed the process. Whatever was mentioned in the selected documents drove our prioritisation of what measures to focus on and what actors to select, related to those measures.

In a third step, 22 officers from 8 related authorities at both municipal and district level and from 1 state-owned investment and financing platform were interviewed. The interviews focused on process tracing.

They were interviewed about the TDM measures, with a focus on the dependencies they expected between their key measures and other measures and to what extent they were dealing with the dependencies through the five-year period. The interviews included their perceptions of current TDM packaging, the roles of different authorities in the packaging process and the problems or obstacles they mainly faced during implementation.

4.3.3. Data analysis

In this paper, we developed a timeline of the implementation of the different measures. We looked at the timeline and the role of different stakeholders to evaluate whether the implementation was focused on an integrative approach. We examined first whether the performance of TDM packaging was satisfactory; We identified obstacles for packaging and integration and how the eventual effect of the process could be explained by the level of success of policy packaging and possible other explanations.

4.4. Case description

4.4.1. Examination of TDM packaging performances

In order to examine the results of TDM packaging which have been designed and implemented from 2011 to 2016, we looked at three indicators that car ownership, traffic congestion, and air pollution. It should be emphasized this examination will not provide a rigorous evaluation of the effectiveness of the policies on these indicators, but rather a descriptive view of the packaging process.

One of the policy goals is restricting car ownership. However, in the five-year period, car ownership in central areas keeps showing a rapid increase of about 15% per annum (shown in Figure 4.1). Also, traffic congestion is worsening, especially in the city center and at peak hours. Although city X does not have a specific congestion index, (Yang et al., 2018), most of the interviewees confirm traffic slowing down. Moreover, air pollution is becoming a growing problem in city X. The index of the ambient air quality standard shows the quality rate drops sharply from 87.4% in 2011 to 72.4% in 2016 (shown in Figure 4.1). Although there is no evaluation of the amount of pollution caused by transport, it is reasonable to infer that the increase is partially due to increasing car purchase and usage. The city X government really pushed for a reduction of air pollution by the chem-

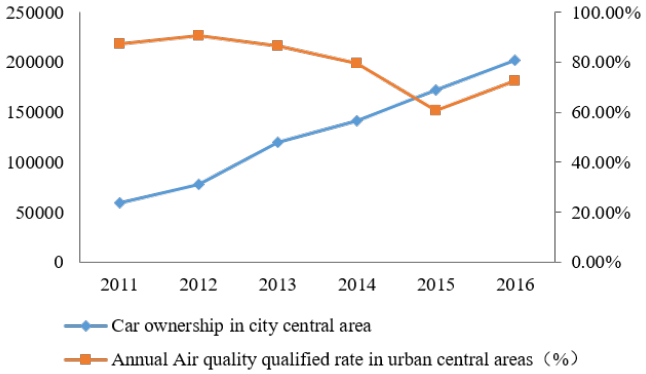

Figure 4.1: Car ownership and air quality. Sources: JMBUOS (2016) and JMBOEAE (2016)

ical and construction industries. In total, the performance of TDM packaging in city X is not satisfactory, despite efforts to come up with more integrated transport policies. In the next section, we explore the why.

4.4.2. Examination of various TDM packaging elements

To understand to what extent city X aimed for policy integration, we measured the extent to which government policy documents including one TDM measure, cross-referenced different TDM measures and goals. The elements of policy packaging normally include these two parts: goals and measures (Reichardt and Rogge, 2016). Comprehensiveness and consistency are two characteristics we evaluated. The former describes the degree to which TDM packaging includes the measures to achieve the goals and the latter one captures whether the elements in TDM packaging are well integrated with each other and not contradictory.

First, we looked at the goals of transport system development set in the 12th 5-year city urban plan in from 2011 to 2015, which has the character of a general guideline for city development in the following five years. Its goals were emphasized in the 2015 city transport plan and 2016 public transport plan. The goals mentioned throughout the documents and adopted by us as the goals for the overall package TDM, included establishing a sustainable and green transport system with low congestion, high traffic safety and little air pollution. Measures focused on three elements: dealing with traffic congestion, especially in city central areas, improving the facilities and services of public transport and slow traffic and reduce air pollution mainly caused by vehicle emission.

When looking at documents that are more aimed at implementation, we see improving the quality of transport of all modes (private cars, public transport, and slow traffic), and other goals of restraining the fast growth and disorderly use of private cars. The documents related to the overall plans and were expected to contribute to the achievement of the primary goal of the whole package.

Of our total list of TDM measure (Yang et al., 2018), 10 types of TDM measures were adopted in city X between 2011 and 2016. Most of them were implemented in 2011 and

were emphasized or updated in 2014 and 2016 (shown in Figure 4.2).

The local government preferred TDM measures improving services and providing transport facilities to those focusing on campaign, economic incentives and regulation (in Figure 4.3). Interviewees did not see significant conflicts between the various TDM measures, with the exception of the continuous emphasizes on providing more parking facilities, which does encourage private car use. Moreover, the relatively low diversity of TDM measures, for example, the lack of economic tools and regulation, as well as the shortage of slow traffic-related measures, points at an imbalance in promoting sustainable development of the whole transport system. In sum, the packaging components were considered to be consistent and of acceptable comprehensiveness, which means the expected performances of this TDM packaging should be promising.

Based on the examination of TDM packaging elements above, it is reasonable to believe TDM measures as laid down in the policy documents were relatively well integrated with relatively high coherence and comprehensiveness. However, problems could be expected during the implementation, leading to a less positive overall performance of the TDM packaging.

	2011	2012	2013	2014	2015	2016
Walkway facilities improvement (Ps1)	√					▲
Provision of public bicycles (Bs1)	√					▲
Increasing parking lots (Cf3)	√					▲
Bus station improvement (PTf2)	√			▲		▲
Increasing the number of buses (PTs2)	√					▲
Bus priority lane (PTf3)	√			▲		
Bus access (PTs3)	√			▲		
Restriction on car usage (Cr4)	√					
Car campaign (Cc1)	√					
Parking fees adjustment(Ce4)		√				
Restriction on car usage(Cr4)					√	

Legend: √= start of a policy; ▲=update of a policy; ; P= pedestrian; PT= public transport; C=cycling; C=car driving; T=taxi; s= service; c=campaign; e=economic measures; f=facility

Figure 4.2: Time-line of TDM measures from policy documents in city X from 2011 to 2016

4.4.3. Examination of the TDM packaging process

As the TDM packaging recorded in policy documents only provides a picture of what the packaging is expected to be before implementation, it is more useful to investigate how the TDM packaging is perceived by policy makers who really are involved in the packaging process and how it is implemented by the interaction of different authorities.

First, we asked for the perceptions of policy makers regarding the implementation of TDM package elements. Among the goals of TDM packaging above, one major and short-term goal is to relieve traffic congestion, especially in the city's central areas. However, the local government policies linked TDM to string infrastructure development,

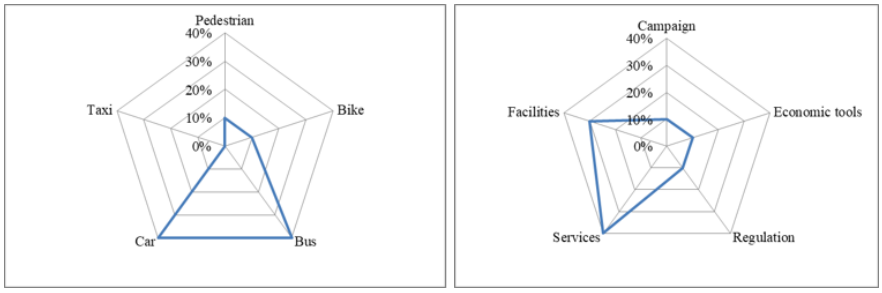

Figure 4.3: Classification of TDM measures based on transport modes (left) and governance approaches (right)

making that part of the package. They deeply believed that the continuous construction of urban road networks was vital in dealing with traffic congestion and in attracting investment and tourists outside the city. In doing so, their attention moved away from more “soft” and “indirect” measures that could align demand with supply.

Also, for the second goal, they saw the need for the long-term in the development of more facilities and services for public transport and slow traffic. The interviewees all consider this goal as effective, but not feasible in the short term. They provided two distinct reasons. Some of them believe it can be hardly achieved because of the lack of financial investment and administrative support. However, others consider the facilities and services of public transport and slow traffic as already reaching the acceptable level compared to other Chinese cities.

The third goal aimed at establishing green transport systems was a response to the call of higher-level governments. Most local authorities interviewed do not believe the changes in transport systems contribute much to solving air pollution, because they believe this problem is mainly caused by industry rather than transport. Moreover, as for TDM measures, interviewees perceive that although it seems that TDM measures can be coordinated with each other in packages, there are potential conflicts in their implementation process because of the shortage of financial and administrative sources. In sum, from the interviews, it became clear that the TDM packaging, in reality, is perceived by the policy makers not as well-integrated with high coherence and comprehensiveness as the above examination based on policy documents.

The TDM packaging process involves various types of authorities across multiple administrative levels and fields, state-owned companies and social groups. In this study, we mainly focus on the roles and actions of government authorities during the whole process. To be specific, MG, BoURP, CoHURD, BoP, BoT and their district-level authorities that DG, DBoURP, DCoHURD, DBoP, DBoT take different but vital roles in TDM packaging and their roles in each TDM measure design and implementation are shown in table 1.

Principals

The MG and DGs, as the principals, mainly take the responsibility of identifying the problems, set the general goals of TDM packaging, initiate the policy packaging making process and make the final decisions. They normally do not take charge of the specifics

of policy design and implementation which are finished by the various other authorities. MG focuses on making policy packaging covering the whole city areas; DGs, as the subordinate units, mainly manage the packaging referring to their own districts under the guidelines of MG. Compared to MGs, DGs‘ principal roles less clear and weaker, although MG often inquires DG‘s advice.

As the initiators and principals of policy packaging, MG and DGs profoundly influence the other authorities‘ perceptions and preferences regarding TDM packaging and determine the priority of policy goals and distribution of various types of resources and tasks. During the interviews, one argument widely shared by interviewees is that “we should keep consistent with the leaders (MG and DGs) spirits and instructions”.

Designers

Because of the different distribution of authorities’ rights and responsibilities, the designers of packaging changes with different types of TDM measures. In city X, BoURP and DBoURP focus on the design of the city master plan and provide support to other authorities for other specific transport plans, such as city transport plan and slow traffic plan. BoT and DBoT provide and manage the transport infrastructures outside the city central area and regulate the operational vehicles such as taxis, buses and freights. CoHURD and DCoHURD are responsible for the provision and regulation of transport infrastructures within the city center. BoP and DBoP take charge of the order and safety of private vehicles drivers and other travelers. Just like the relation between MG and DG, the authorities in municipal levels take the leading role and their subordinate units mainly provide suggestions and are responsible for their own district matters.

Implementers

As for the implementers, besides provinging input to the authorities taking charge of designing policies for different traffic modes mentioned above, they are the key responsible for the corresponding implementation. We see two significant differences between designers and implementers.

The first observation is that the clear boundaries of implementation exist between municipal-level and district-level authorities. The municipal-level authorities seldom provide instructions or orders and financial support for implementation. This institutional arrangement allows district-level authorities taking more tasks in implementation. In the design phase, the municipality takes little input from the district and takes a hands-off approach and shows limited agency in the implementation phase.

The second observation is that as some authorities (such as BoURP and BoP) as package designers do not participate in the implementation of TDM measures. The absence of a role in implementation likely leads to neglecting the difficulties in implementation during the packaging design process. Moreover, the distributions of roles as we defined above reveals that CoHURD and BoT implement measures of services and facilities, which usually require a large amount of investment and long duration of implementation; by contrast, BoP executes the measures about campaigning, regulation, and tolls, which can be done relatively swiftly because of low investment and easy administrative enforcement. Therefore, this design of TDM packaging leads to the unequal distribution of tasks and responsibilities among different authorities, which is highly likely to hinder multilevel and interdepartmental cooperation.

Sponsors

There are usually three ways for authorities to raise money for the implementation: financial budgets, state-owned investment platforms, and social investments. In our case, the first two are the main approaches, although social investments, like PPP projects, are getting increasingly popular and promising.

First, in the current, Chinese financial budget system, established after the tax-sharing reform in 1994, established budgets of municipal- and district-level governments are separately and approved by municipal and district People's congresses. It means district-level authorities are not led by municipal monitoring in their financial budget management. The primary purpose of this arrangement is to enable district-level governments and authorities financial freedom in their own jurisdictions (shown in figure 4.4). However, this may lead to some negative effects in that administrative mandates or instructions from municipal-level authorities are no longer easily and unconditionally executed by the subordinate authorities in the districts, or superior authorities may overlook the subordinates' budget capacity when distributing tasks, on packaging implementation.

Another sponsor is a state-owned investment and financing platform, called CICo., Ltd in city X. With the duty of maintaining state-owned assets, it mainly concentrates on the investment in large infrastructure construction in municipal level rather than isolated district areas, and on the construction of urban road networks, which generate revenues from land use and real estate. In contrast, investing in public transport and slow traffic usually is not the first choice, because they regard it "high cost and low gain".

Monitors

The role of monitors is easily overlooked in TDM packaging. With the increase in goals, measures, time and authorities from different levels and sections involved in the packaging process, successful implementation cannot be achieved without monitors to deal with complexities and uncertainties. The monitoring generally comes from the higher-level government.

In this case, the implementation of TDM measures at the municipal level is primarily monitored by the municipal government. As for the district-level implementation; the monitoring could be carried out both by the corresponding municipal-level authorities and district governments. In the case of city X, there is no formal institution of monitoring of integrated implementation and the monitoring at the district level is much weaker than that at the municipal level.

Summary

Based on the above analysis of authorities' five roles and their performances in the TDM packaging, several conclusions can be summarized as follows. First, the implementation of TDM packaging is easily overlooked in the district level, leading to low package completion. As for the roles in the district level, designers have limited influence on the package design, which is mostly determined by the municipal designers. Implementation, however, is carried by the district governments, which control their own human resources and financial budgets. In addition, their direct authorities in the municipal level often do not have an integrative perspective but are responsible for a specific task and specific public values. If there is a conflict between two leading authorities, often implementers postpone implementation in order to avoid potential administrative risks. For

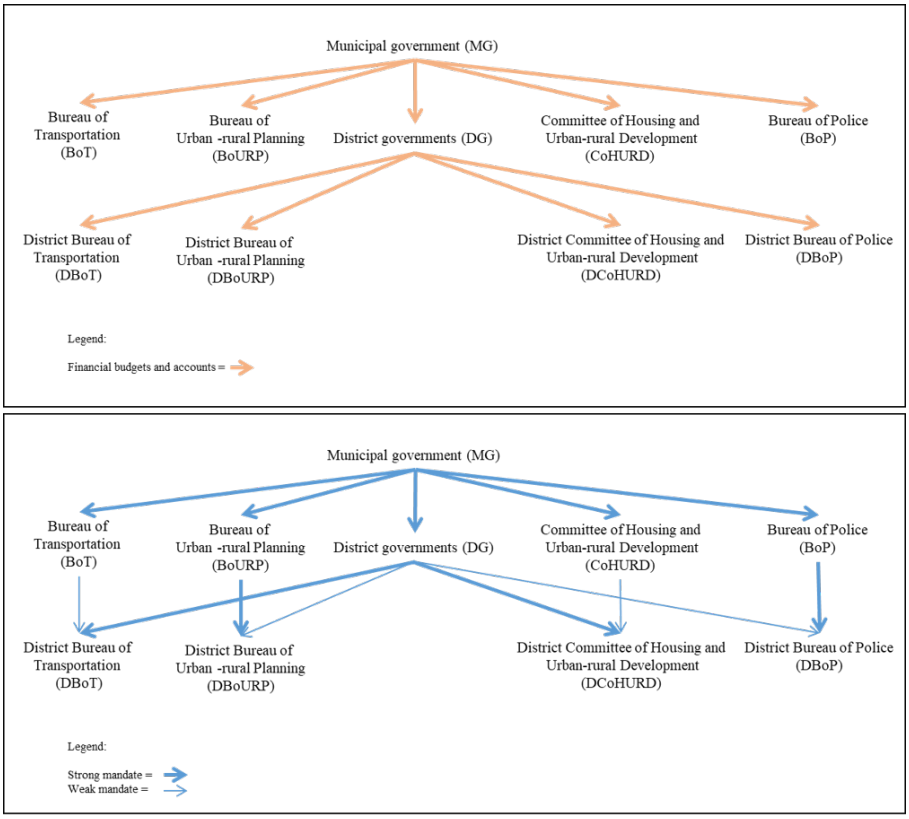

Figure 4.4: Financial and agency links between municipal and district levels in city X (the structure of budget approval on the left and the structure of administrative mandate on the right)

example, BoT distributes the tasks of improving the quality of walkways to all the DBoTs, but the Dongbao district government pushes DBoT and other authorities to focus on the construction of road infrastructures. As a consequence, the DBoT temporarily had to stop the implementation of the TDM measures. Sponsors on the district level have far less budget and financial support, compared to the municipal level. Because of the different economic capacities of district governments, their sponsors from different districts also invest differently in the implementation. Last not the least, as the leading authorities and district governments are aware of the implementation difficulties. However, the monitoring on integrated implementation is often absent.

Secondly, coherent TDM measures sometimes conflict with each other in the process of implementation because of the resource competition within one authority or between multiple authorities. One authority is usually responsible for the implementation of several TDM measures. For example, BoT had to execute the measures that improve bus stations, increasing the number of buses, and establish bus priority lanes at the same time. Because of the limitation of financial and human resources, BoT only fully finished

the last measure and had to postpone the first two measures, although three measures together would have provided a better-integrated bus solution. On the other hand, two measures implemented by different authorities also provide a resource conflict. For example, two measures increasing car parking and a bus station were implemented and funded by CoHURD and BoT separately. A conflict emerges when one public garden in the city center would be transformed into a two-floors parking building or a bus hub. Although the BoURP has made the plan of this garden for a new bus hub, the municipal government finally persuaded them to establish a parking building for private car, because of the severe shortage of parking lots. Therefore, many potential conflicts are likely to appear in the process of implementation, even though the TDM packaging at the policy level is well designed.

Finally, monitors play a vital role for the successful implementation of TDM packaging. With more goals and measures included in the package, the complexity and duration of implementation are also increasing. Monitors remind actors in other roles to proactively deal with problems in implementation and finish on time. In this case, monitors are often absent, partly because there is no formal monitor institution and no urgency from the higher-level governments. The case provided one promising example of a monitor, the temporary leading group. This was initiated by the mayor and composed of the heads of transport-related authorities and districts governments in order to ensure the progress of the project of Xiangshan arterial road reconstruction and integrated governance. As this arterial road is the most important road for daily commuting and tourists' travelling, its implementation receives much attention of local governments and the public. Under the monitoring of the leading group, the TDM measures related to the infrastructure development have been successfully implemented for this arterial road and its neighboring district areas.

4.5. Conclusion: The daunting details of policy package implementation

We see two main limitations in this article. First, the conclusions are based on a single case. Whether its outcomes are robust should been examined in different types of cities within and outside China and in different policy areas. Second, the evaluation of the success of TBM policy packaging is based on limited data, because of issues around data availability.

We believe our study makes three contributions to the literature. First, this article underlines the importance of implementation for successful policy packaging by an empirical case analysis. A policy package should seek input from those that eventually have to implement the measures. The efforts on designing good policy packaging have been proven meaningful but are not enough for a high performance.

Second, this study demonstrates that to identify key roles played and actions taken by different actors is a meaningful and helpful approach for analyzing complex policy packaging processes and detecting potential problems. The role identification can simplify a large number of complex actors from multi-level and multi-fields into several clear roles which promote a policy packaging process. We can quickly detect problems in a packaging process by checking whether key roles are absent. For example, the absence of

monitors leads to the low completion of many TDM measures. Moreover, in current policy packaging studies, conflicts between different roles of one actor, and the conflict between different actors sharing one similar role are often overlooked. Both provide a useful perspective to explain why similar policy measures cannot be equally implemented at different levels of governments and why one authority has different attitudes or preferences to different measures. For example, in this case, CoHURD occupies the role of implementer in the TDM measure of walkway improvement, but CoHURD shares the role of designer with two other authorities (such as BoURP and BoP). Therefore, the other designers give extra implementation pressures to COHURD and sometimes requirement from them are easily ignored by CoHURD.

Third, policy makers are suggested to pay much attention to three problems during the implementation of policy packaging. The implementation of TDM measures from an integrative perspective is easily overlooked at the lower governmental levels, responsible for the implementation of some of the measures. The same holds for sectorial fragmentation; this can also trigger new dynamics, hampering an implementation of measures that overall makes sense. Implementation gets its own dynamic at different levels of government and different sectoral departments, leading to the low packaging completion. Next, coherent TDM measures may conflict with each other in the process of implementation because of the resource competition within one authority or across multiple ones. And the absence of monitors will threaten the whole TDM packaging process, especially with growing complexity.

Obviously, this single case study in China does not provide generic answers to the challenges of policy packaging. It provides first answers on why policy packaging is promising in theory, is indeed adopted often in the design of policies for sustainable transport, but still proves to not deliver on the promise. The key is governance of implementation, keeping the integrated perspective through different implementing levels of government and departments within the government. A restructuring of financial streams, agency and monitoring could be developed to strengthen the integrative perspective. The case does not provide answers as to what could actually work in that field. This is a question for further investigation.

5

Integrated transport policy packages: Lessons from Stockholm, Edinburgh, Amsterdam, and Lisbon

Transport policy packaging is widely regarded, by researchers and policy makers, as an effective approach to deal with "wicked" transport issues and achieve sustainable mobility. In contrast to the expectations of many, the policy packaging, in reality often does not prove very successful. Policy makers usually do not consciously understand the difference between policy packaging and traditional single measure policies and lack the experience to make such packages. There is also a lack of research in explaining why policy packages succeed or fail, reason why lessons for actual policy practice cannot be clearly drawn. Therefore, this study aims to fill the gap by examining what and how key factors determine the empirical policy packaging process through a comparative analysis of four European cases: congestion charging in Stockholm, a 20mph speed limit package in Edinburgh, the North-south metro line package in Amsterdam, and a slow traffic package in Lisbon. The data is collected from policy documents and semi-structured interviews. The main conclusion of this study is that powerful political support, sufficient financial support, and institutional support are vital factors in the success of policy packaging. Although these factors are also important for general single policies, policy packaging puts forward higher requirements. Besides, this study verifies the consistency and robustness of each factor's impact in different contexts: in Europe as well as in China, where we conducted an earlier trial study (Yang et al., 2020).

The content of this chapter corresponds to a revised version of the article (under review): Integrated transport policy packages: Lessons from Stockholm, Edinburgh, Amsterdam, and Lisbon. Transportation Research Part A: Policy and Practice

5.1. INTRODUCTION

Transport policy packaging is widely regarded, by researchers and policy makers, as an effective approach to deal with "wicked" transport issues and achieve sustainable mobility development (Givoni, 2014; Hull, 2008; Yang et al., 2020). In contrast to its popularity around the world, policy packaging in reality often proves not as successful as expected. For example, in Europe, congestion charging package is successful in Stockholm and London, but fails in Edinburgh and Copenhagen for various reasons (Optic, 2011); even in one Chinese city, a car parking package (including tiered parking price and park & ride measures) is fully implemented, but a bus improvement package (containing increasing bus station and lower price of tickets) has been postponed for a long time (Yang et al., 2020).

A successful policy package should not be limited to a static combination with established measures, but a feasible policy integration that is designed in the consideration of specific contexts and can be completely implemented (Givoni, 2014; Yang et al., 2020). However, policy makers in reality usually are not very aware of the different characteristics of policy packaging as compared with traditional single measure policies and lack the skills and expertise to handle policy packaging well. Moreover, the lack of research into the empirical policy packaging process rarely explains the reasons why policy packaging succeeds or fails, which makes it hard to draw lessons for policy practice.

Therefore, this study aims to fill the gap by examining what and how key factors determine the empirical policy packaging process through comparison analysis in four European cases. The results not only verify consistency and robustness of each factor's impact in different context conditions in Europe as well as in China where we conduct a trial study earlier (Yang et al., 2020), but also provide detailed descriptions of how different cities react to these factors. It provides a solid foundation for further research into policy packaging implementation elsewhere.

The remainder of the paper will proceed as follows: Section 2 clarifies key concepts in the study and outlines the research gap in the literature on the implementation of policy packaging; Section 3 introduces the qualitative case comparison approach, including case selection, data collection, and analysis; In Section 4, all four cases are described, concentrating on the role key actors play and the influence of key factors in the policy packaging process; Section 5 summarizes the findings based on the four case comparison and Section 6 provides the conclusions and limitations of this study.

5.2. LITERATURE REVIEW

Policy packaging is referred to in different names in different research fields, such as "policy mixes" (Howlett and Rayner, 2007) and "policy portfolios" (Jordan and Lenschow, 2010), and "policy integration" (Vieira et al., 2007). In this study, policy packaging is defined as *"a combination of policy measures designed to address one or more policy objectives, created in order to improve the effectiveness of the individual policy measures, and implemented while minimizing possible unintended effects, and/or facilitating interventions' legitimacy and feasibility in order to increase efficiency"* (Givoni et al., 2013) and normally includes primary and ancillary measures or instruments.

Policy packaging research can be categorized into two parts. One part focuses on

theoretical research, such as, setting up basic building blocks of policy packaging (Rogge and Reichardt, 2016), proposing a theoretical policy packaging process (Justen et al., 2014b), and optimizing formulation of policy packages in a virtual environment (Taeihagh et al., 2014). Another line of research concentrates on the empirical policy packaging process. Although the claim that policy packaging has more advantages than single measures at solving complex problems (e.g. in mobility sustainable development) is widely accepted in the literature, a growing number of empirical studies has shown that successful implementation of policy packaging is not easily achieved and the empirical research on policy packaging is necessary but far from well-developed.

Among the research into policy packaging implementation, identification of key factors (success factors and barriers) and strategies to take advantage of success factors or manage barriers, increasingly raises the attention of researchers. Both success factors and barriers can be regarded as key factors in the policy packaging process, with the difference mainly denoting whether the factors can promote or hinder the performance of policy packaging under specific conditions (Optic, 2011). Therefore, the identification of key factors is useful to diagnose problems in packaging process as well as provide successful lessons. There are various categories of factors to policies in different research fields. In Banister's research on sustainability policies, barriers come from six dimensions: resources, institution, legislation, culture, side effects from implementation, and other physical barriers (Banister, 2005). Optic (2011)based on studies on transport policies in European cities, provide a modified classification to policy formation and implementation, including seven categories: 1) cultural conditions (public acceptance), 2) political conditions, 3) legal and regulatory conditions, 4) organizational and institutional conditions, 5) information and knowledge conditions, 6) fiscal and financial conditions and 7) technical and technological conditions. In a previous empirical study (Yang et al., 2020), we found that political support, financial support and institutional/organizational set up are vital factors for a successful transport policy package in a typical Chinese city.

Political barriers can be presented in the failure of earning enough political attention, support and leadership in the policy making process. Timing and attention are scarce resources in the policy making process (Cohen et al., 1972). As policy packaging revolves around multiple goals, multiple measures, and multiple actors it is more complex and resource-consuming than adopting isolated policy measures, "windows of opportunities" and political consensus (Ison and Rye, 2005), outstanding political leaderships (Söderholm et al., 2019), and long-term commitment and patience (Sørensen et al., 2014) are far more important factors for successful policy packaging.

One key task of policy design is to decide where the financial resources come and go. As a bundle of measures in the package should be decided in a relatively short time-span, the overall pressures on providing funding for the whole policy packaging and effectively distributing resources among different measures can be far more demanding. As Yang et al. (2018) demonstrate, measures that improve public transport services often do not receive enough financial support due to tight budgets.

The implementation of policy packaging requires institutional and organizational support. Institutional barriers can result from unclear distributions of responsibilities, lack of governance capacity, and weak collaboration within and among organizations.

Policy packaging is highly likely to confront institutional barriers, as it calls for closer collaboration in different dimensions. Collaboration happens in the interaction between different layers of governments (Tønnesen, 2015), between different authorities taking in charge of different fields (e.g. collaboration between transport and environment departments) (Geerlings and Stead, 2003) and crossing different physical boundaries (Costantini et al., 2017). In addition, the role of the monitor is regarded as a vital one in the dynamic and long-term process of policy packaging implementation, through keeping key actors in view, evaluating outcomes and resolving various problems (Ramjerdi and Fearnley, 2014; Yang et al., 2018).

Although the studies above illustrate the general factors in policy design and implementation, actual empirical study of key factors particularly in policy packaging is still rare. It is worthwhile unfolding the policy packaging process in detail and exploring what and how key factors influence the empirical policy packaging process in different context conditions.

5.3. METHODOLOGY

To explore the influence of key factors on the policy packaging process, this study chooses a qualitative approach, i.e. a comparison of four cases. First, this allows us to analyse the whole packaging process in detail: which measures are selected into a package, how various actors play their roles in the process, and what successful or failed lessons about packaging can be drawn. Second, case comparison enables us to examine the relevance between external factors and policy results, especially when one research field has not enough systematic studies (Yin, 2013). Last but not the least, case comparison within a few samples can achieve a better balance between data availability and conclusion generalization.

5.3.1. CASE SELECTION

The cases were selected as follows. First, we have selected four medium-sized cities with different contexts throughout Europe: Stockholm, Edinburgh, Amsterdam, and Lisbon. These cities not only have fruitful experience of dealing with severe traffic issues but also are relatively more representative in terms of city scale, compared to the megacities such as London, Berlin, and Paris. Then one major recently completed or ongoing urban mobility project in each case city was collected, enabling us to get easy access to adequate and accurate data from interviewees as well as policy documents. We wanted to explore the impact of key factors on general transport policy packaging, so there was no strict requirement regarding the similarity of the composition of the packages. However, it should be noted that the composition of a policy package can be changed with the investigation from different dimensions (e.g., time, geography, policy fields, and governance levels) (Rogge and Reichardt, 2016). For example, one urban transport policy package can be part of a larger mobility package at the regional level, form a joint package in combination with other measures regarding environmental protection, or become more complicated throughout a longer period of time. Therefore, this study, to make it clear, defines it as a transport policy package that includes policy measures which are formally designed in policy documents for the transport project or have an important influence

on the project in terms of urban mobility through the whole packaging process. Finally, to empirically explore the impacts of key context factors and corresponding strategies, the cases should be distinct from each other in the design and implementation of transport policy polices. The focus of the selection is not on the evaluation of the final performance of each package but on the examination of the features of design and the completeness of implementation. Four policy packages in four cities were selected: the congestion charging package in Stockholm, the 20mph speed limit package in Edinburgh, the North-South metro line package in Amsterdam and the slow traffic package in Lisbon. In a nutshell, the Lisbon and Stockholm packages were well integrated and fully implemented (Sørensen et al., 2014; Serdoura, 2018); the Edinburgh package had a relatively comprehensive composition but failed in complete implementation (Atkins, 2018); by contrast, the Amsterdam package wa loosely coupled and gradually formed by dealing with various incidents during the implementation (Mottee et al., 2020) (shown in Figure5.1). The evaluation is shown through the discourses of the respondents and the details are shown in the next section.

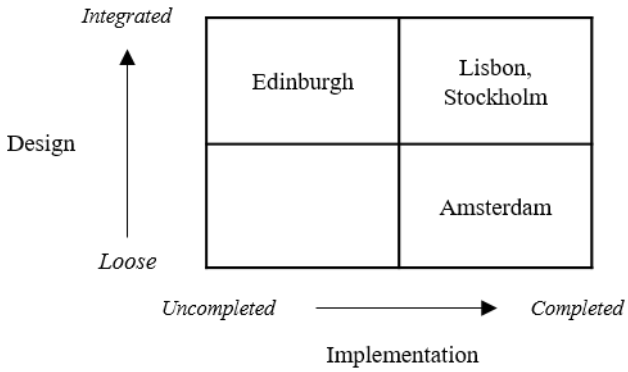

Figure 5.1: Case comparison of the design and implementation of the transport policy packaging

5.3.2. Data collection and analysis

Data was collected through existing literature, policy documents, and interviews. We conducted semi-structured interviews with key actors by snow-ball sampling. Interviewees included politicians, civil servants, operator representatives, independent researchers, all of whom were closely connected with the policy packaging process (shown in Appendix A.4).

We filtered and then applied the data to trace the whole packaging process and find the key moments in each case. Process tracing has proven to be an effective approach to mapping causal mechanisms in a quantitative study (Bennett and Checkel, 2015). In addition, the role analysis approach was taken to analyse what and how the factors impact how actors play their roles in the packaging process. In this approach, five major roles: principals (who initiate the policy packaging process), designers (who design details in policy packages), implementers (who execute the package), sponsors (who pro-

vide financial supports for implementation), and monitors (who monitor performances of other roles) were identified and their interaction was analysed (Yang et al., 2020). The final conclusions were drawn based upon the results of the four-case comparison.

5.4. FOUR CASES OF TRANSPORT POLICY PACKAGES IMPLEMENTATION

This section first introduces the background and component of each package. Then we unfold the real packaging process from formulation to implementation through role analysis in detail, and at last, we present a preliminary discussion of the strategies responding to different factors in each city.

5.4.1. STOCKHOLM CONGESTION CHARGING PACKAGE

Traffic issues have been at the top of the policy agenda in Stockholm for decades. Congestion charges have been discussed for a long time in Sweden since the 1970s. After decades of political controversy and technical feasibility analysis, the congestion charging package was trailed in 2006 and formally established one year later.

The primary measures are a congestion tax, which requires a comprehensive charging system, including physical charging facilities, the rules of different charging rates according to different vehicles in different charged areas and time, and the cooperation of various city administrations, social groups, and companies. In order to ensure effectiveness and increase acceptance of congestion tax, two main ancillary measures (shown in Figure 5.2): extending public transport sports (e.g. 14 new bus lines, 18 bus lines with higher frequency, more and longer trains) and Parking and Riding (P+R) facilities (e.g. 2500 new park and ride places), were implemented before the trial, partly under the political understanding that combining “sticks” and “carrots” was required (Kottenhoff and Brundell Freij, 2009). The revenue of congestion taxes is dedicated to the implementation of ancillary measures as well as other public transport development. After the trial and the permanent decision of adopting congestion tax, various other transport measures (e.g. bypass project construction) have been gradually introduced on its basis and were ncorporated in the Urban Mobility Program (The City of Stockholm Traffic Administration, 2012) to achieve the comprehensive goals before 2030.

The main actors and their roles are shown in Figure 5.3. The congestion tax was initially proposed by the city council, widely discussed in the national and regional governments, and finally enacted by the Swedish Parliament. There are three main actors performing the implementation of a congestion tax trial. The city council was responsible for sharing information of the trial and monitor the P+R provision in the city. Stockholm Transport (SL) was required to extend public transport and P+R facilities outside the city, and the Swedish Road Administration (SRA) took charge of the charging system to collect the congestion tax. The Congestion Charge Secretariat (CCS), especially established by the council, was enjoined to monitor and evaluate the trial and works as a coordinator to organize and oversee the network of actors, including city administrations and various related companies. The national government (Ministry of Finance) is responsible for collecting the congestion tax and distributing the revenues to the County and City of Stockholm, as well as providing financial support for the whole trial process.

Some successful lessons can be drawn from the Stockholm case. First, strong political commitment opens "a window of opportunity" for adopting the congestion tax. After the election in 2002, the Green Party successfully balanced the power among various parties and across different levels of governance, which ensured the congestion tax as a priority scheme on the policy agenda. Afterward, in order to make full use of the brief opening of a policy window, a political coalition under the push of the Green Party and a specialized administrative organization (that CCS) was established, which laid an institutional foundation for the implementation of the congestion tax. Secondly, a healthy plan consisting of tax and financial support provided sufficient resources for the project. The tax is collected by the national government, but the county and local governments are allowed to decide on its usage, for example, earmarking the tax for the regional public transport during the trial. Meanwhile, the national government guarantees that the congestion tax does not reduce the amount of existing national funding to local transport investment, eliminating the fears local governments have of budget cuts. At last, a policy package requires an integrated design of existing or new organizations to implement it. In this case, the key actors, such as city council, SL, and STA, were given clear roles. A special organization, the Congestion Charge Secretariat (CCS), was established and fully incapacitated by the city council to evaluate and monitor the whole congestion tax project and organize the cooperation between various authorizes and private stakeholders.

The congestion charging package also confronted several challenges. The city council was hardly able to make a long-term and systematically integrated transport plan. The plan only could only be made after a long discussion and agreement from the national, regional, and local governments. The content of the package is vulnerable to political changes in the parliament. For instance, the revenue of congestion tax, earmarked for the public transport at first, invested in the other project that bypass construction after the 2006 elections, although this change is regarded as being in conflict with the original goal of the congestion tax, the result of a compromise owing to a change in office. Moreover, the performance of a long-term transport package plan is vague in the short duration of an administrative term and the comprehensive package more easily confronts challenges from other political parties than just one single measure. In sum, the time-consuming process of policy making, the instability under the influence of political system change, the lack of outstanding performance in a short term, and the highly likely exposures to challenges prevented an integrated policy packaging from taking shape. In addition, the city council lacked the capacity to convince SL to maintain the bus extension after the trial. The bus services are provided by Stockholm Transport (SL), the company running all of the land-based public transport systems in Stockholm County and monitored by the Stockholm county council. SL is reluctant to continue the enhanced services after the trial, partly because extended bus services do not achieve an anticipated increase in bus share rate (0.1% at most), although traffic volume has reduced 22% over the cordon (Eliasson, 2009). Another reason is that the tax revenue originally on public transport was shifted sharply to big bypass road infrastructure constructions after the reintroduction of the congestion tax, as a compromise resulting from a political power shift.

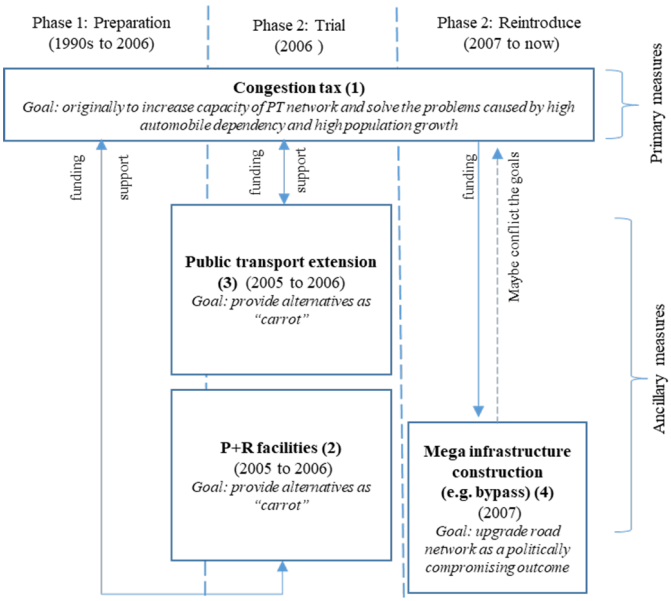

Figure 5.2: Congestion charging package in Stockholm

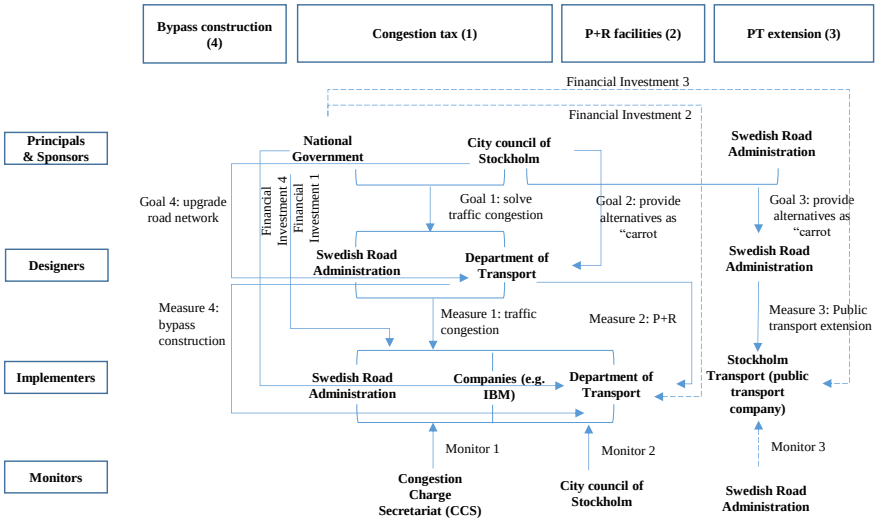

Figure 5.3: Role analysis of Stockholm case

5.4.2. 20MPH SPEED LIMIT PACKAGE IN EDINBURGH

A 20 mph limits package, to reduce car casualties and encourage walking and cycling, has been continuously carried out in Edinburgh since 2010. This project was included

in the Active Travel Plan 2010, with other walking and cycling actions to ensure active travel. A pilot project, targeting nearly 80% of the entire road network of Edinburgh, was approved in 2014, finalizing the criteria for the city's streets in the 20mph network Transport and Committee (2016). Base on the pilot's success and citizen's support, the city council decided to sequentially roll out the 20mph limits to citywide networks in 4 phases from 2016 to 2018. In 2018, Edinburgh became Scotland's first city to implement a city-wide network of roads with a 20mph speed limit and a full assessment of the impact of this project was carried out in the following year.

The 20mph speed limits project mainly contains three types of measures, education or campaign, enforcement, and engineering measures that include physical traffic calming measures (e.g. speed bumps) and soft engineering measures (e.g. Vehicle Activated Speed Signs (VASS)), shown in Figure 5.4. Combining with the primary actions, several ancillary measures, such as improving walking and cycling facilities and services, and integration with public transport, were adopted in mobility plans. For instance, to systematically increase levels of walking and cycling, the city council initially designed the Active Travel Action Plan (ATAP) in 2010 and renewed it in 2016, in which actions were divided into joint actions, walking actions, and cycling actions. The introduction of the area-wide 20mph speed limit is the key part among them; walking actions and cycling actions were supposed to be coordinated with each other. Another fundamental plan was the Local Transport strategy (2014-2019), which finalized the criteria for the city's streets to be included in the 20mph network and enhance the connection between public transport and active travel modes.

The Department of Transport (Transport and Environment committee of Edinburgh) took the lead in the whole project. The overarching project was designed by the city council, although they should ask for an exemption from the national government for enacting the speed limit. During the implementation phase, various authorities and groups were involved (shown in Figure 5.5). The speed detection and driver education could only be executed by the Lothian and Border Police and paid from their own budget. The police have limited time and resources to monitor the whole 20mph areas. Moreover, as the Traffic Regulation Order (TRO) only provides a principle order rather than penalty enforcement, the police also lacks motivation to help in its execution. Last not least, as the police are monitored by the Police Scottish rather than the city council, which the Department of Transport is unable to change. The education campaign, signage and road marking, and physical traffic calming measures (e.g. bumps) are completely handled by the Department of Transport. Because of a shortage in financial resources and the dismissal of relevant staff, the relatively "cheap" measures (education and signage) became the final choice in implementation, although the physical measures were widely regarded as a necessary and effective component for successful implementation of the policy package by our respondents.

Except for the primary measures, the ancillary measures (e.g. improving cycling and walking, and public transport connection), which were empirically implemented separately, hardly produced any synergic effect, although they were packaged in same mobility plans. These measures are mainly drafted and coordinated by the Department of Transport, the Culture and Communities Committee, and Sustrans. Most existing active travel actions required a large amount of financial support to ensure their feasibility.

Due to the tight budget, Department of Transport to can hardly ensure sufficient investment in both primary measures and other ancillary ones at the same time. Although there are some external investments from lobby groups, such as Living Streets Edinburgh and Spokes, they are far more enough to release the shortage. Moreover, Department of Transport cannot decide and monitor whether the extra Lothian bus services connected with the 20mph speed limits are provided, given that they under the council but operated separately.

Two main positive lessons can be drawn from the 20mph speed limit package. First, a pilot is important for the successful implementation of complex and challenging policy packages. Perceptions surveys, conducted by the council before and after the implementation, showed that people were supportive and also of its later extension to the whole city. The pilot also provided the council opportunities to adjust the action plan in practice. Another key point is that the city council has taken full use of its unique political status, the capital city, to raise more political and public support, compared to other cities in Scotland

Compared to the ambitious goal of reducing car casualties and improving active travel, the 20mph limit package was designed as a rather compact package, only including education and signage measures as the core part. Although this package is regarded as a success to some extent, several obstacles in the design and implementation process prevented a higher performance. The project was designed as a small and standalone policy package and failed to be well integrated with other active travel actions. Although all of them were incorporated in the wider Active Travel Plan, the 20mph speed limit package operated at the margin of the whole plan, without enough connections in terms of financing support and multi-actor cooperation. Due to the lack of finance and human resources allocated and the improper distribution of administrative power during the package formulation, the city council faced difficulties during the implementation, such as the tight budget for engineering measures, enforcement shortage for strict implementation rules, and a passive attitude of the bus company.

To raise political and public acceptance and ensure successful implementation, a “compact” and “cheap” policy package proves to be more feasible. As the 20mph speed limit project indicates, policy packages sometimes take a lot of time and resources but taking effect only slowly and slightly; consequently they are not popular enough for political decision-making with a short time horizon.

5.4.3. Amsterdam North/South metro line package

The North/South metro line (NZL) package aims to construct a 9.7 km metro line, connecting Amsterdam North and Amsterdam South to the existing metro network. The general consideration behind the construction of the NZL was that the above-ground public transport system will not meet the travel demand created by the rapidly increasing population growth in the city in the coming years and the polynuclear economic development also requires the support of an integrated metro network. To preserve mobility and relieve the pressure of the above-ground public transport system (PT), a metro line, shifted to the underground, was needed.

NZL is a loosely designed policy package centring around the construction of a new metro line as the core element at first, with other measures to be gradually grafted unto

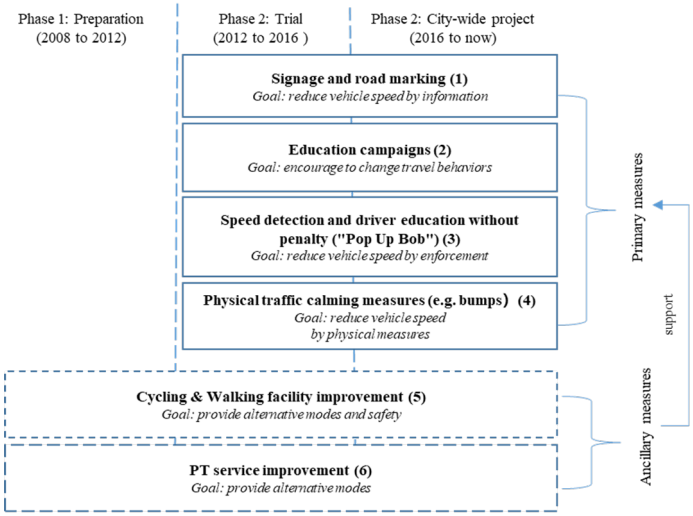

Figure 5.4: 20mph speed limit package in Edinburg

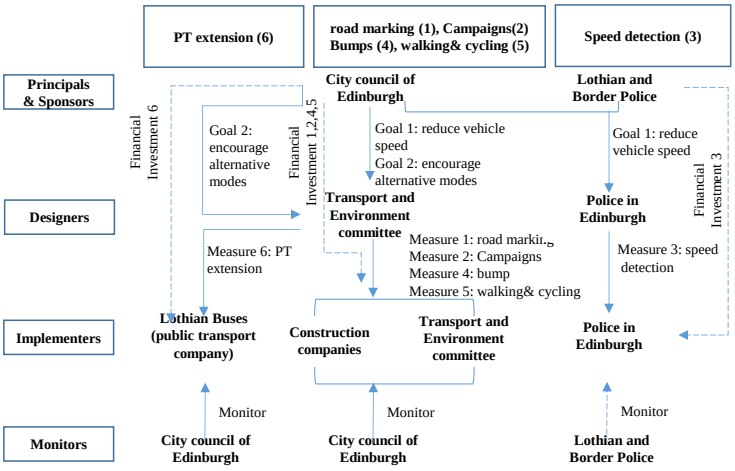

Figure 5.5: Role analysis of Edinburg case

it to deal with the challenges during construction (shown in Figure 5.6). Parking and cycling lanes surrounding the construction as well as in the whole city were gradually improved at the same time. After the severe soil subsidence of adjacent houses in 2008, a formal communication strategy was adopted to enhance the community‘s engagement in the project and put the community‘s needs first (Mottee et al., 2020). The consequences of NZL for the rest of the public transport network were not thought through

in detail at the beginning of implementation, but later the NZL nearing completion provided an opportunity to redesign the existing network and increase the quality of the network: the tram and bus networks were recalibrated into a fish-bone, with trams and bus lines as bones to support the NZL as a backbone.

The NZL was initially proposed by the city council of Amsterdam in the Stadsspoor (city rail) metro plan in 1968. The routes of NZL were determined by Amsterdam Board of Mayor and Councillors (the College van B&W) in 1988. After several years' investigation and negotiation with the National government on finance, construction was approved by the House of Representatives in 1999 and then the city council in 2000. In 2002, the City of Amsterdam finally approved the construction investment, with a fixed amount of over 1.1 billion euros from the National government, and 317 million euros and any risks paid by local government (Vaillant, 2017). The construction started in 2003. A severe incident with soil subsidence of adjacent houses due to drilling activities in 2008 led to a one year suspension of the project. Due to issues of safety, environmental protection and viability of the project, a special committee, the Veerman Committee, led by a former minister, was set up to investigate the whole project in 2009 and concluded that public participants, risk transparency and compensations should be improved (Mottee et al., 2020). The project was eventually completed and Gemeentelijke Vervoerbedrijf (Municipal Transport Company or GVB) began to operate the NZL metro in 2018. The final cost of the project was about 3.1 billion euros and the city council was burdened with an extra 1.4 million Euros compared to the original estimation (Mottee et al., 2020). Besides the construction of NZL, the improvement of parking and cycling infrastructures was also led and funded by the city council at the same time. Transport Authority Amsterdam with GVB recalibrated the tram and bus lines to upgrade the existing public transport network and reduce the disturbance that NZL would bring to other transport modes in terms of passenger flows (shown in Figure 5.7).

The NZL package as a long-term, infrastructure-oriented project was not comprehensively designed beyond just its technical project management in the early stages, but gradually developed into an integrated policy package which paid more attention to community value and environmental protection after a number of serious incidents, and enhanced the connection with other traffic modes after the construction had ended.

One main lesson of success from Amsterdam's NZL package is that the city council adopted a pragmatic approach to design and implement policy packaging, especially for a 35 years long project: it made full use of the emerging challenges and opportunities to improve the synergy within the policy package by adding new ancillary measures to solve negative effects of initial measures and redesigning existing ancillaries to promote positive effects of new packages. It epitomizes that a dynamic, flexible packaging process cannot be achieved without the strong commitment of political and administrative support and an open mind. Another key consideration is that the monitoring of the special committee (Veerman Committee) promoted an attitude shift of the project management team from a closed technical focus to an open consideration of social impact and community engagement, contributing to the resolution of the biggest crisis in the NZL construction.

In the process of NZL package design and implementation, one main challenge was the shortage of financial support hindering policy integration. Amsterdam municipality

has borne a huge burden of the NZL construction especially after national funding ran out and unpredictable accident happened. It had to suppress the investment in other ancillary measures, such as P+R and cycling facilities surrounding NZL to secure the primary metro line construction.

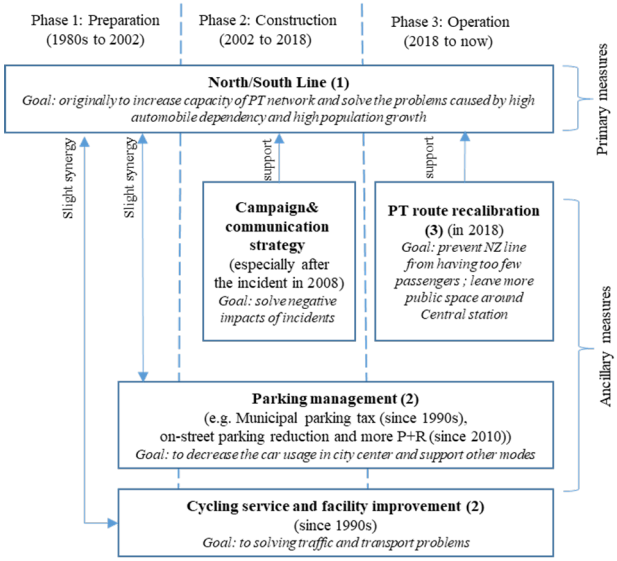

Figure 5.6: NZL package in Amsterdam

5.4.4. LISBON SLOW TRAFFIC PACKAGE

Under the pressures of economic crisis and loss of city vitality since 2018, Lisbon keenly felt the necessity to solve crucial problems in the city, such as the fragmentation of metropolitan administration, the slow pace of urban regeneration, and the ongoing environmental and sustainable challenges (Seixas, 2011). Moreover, the city council of Lisbon, as well as others in Portugal, had few integrated strategies and plans in terms of making the city sustainable. Therefore in 2009, the mayor established an independent commissariat to develop the Lisbon Strategic Charter (2010-2024), which initiated city-wide and profound reforms in Lisbon future vision, administrative public capacities, and relations between politics and citizens. One important strategy in transport development was the slow traffic package, aimed at improving the liability and attractiveness of the city. Instead of solely focusing on discouraging car use, the city council focused on modifying public transport and micro mode policies to achieve this ambition. The outcome was that number of cyclists tripled to 0.6% in 2017, cycling lanes were extended to 210 km, and a large bike-share and e-scooter system was set up (Félix et al., 2019).

The slow traffic package primarily included the improvement of cycling lanes and sidewalks and the increase of bike sharing since 2015, and later on since 2017, new transport micro modes (e.g., e-scooters) were also encouraged. To lay a solid foundation for these main measures, several additional measures were carried out in advance to re-

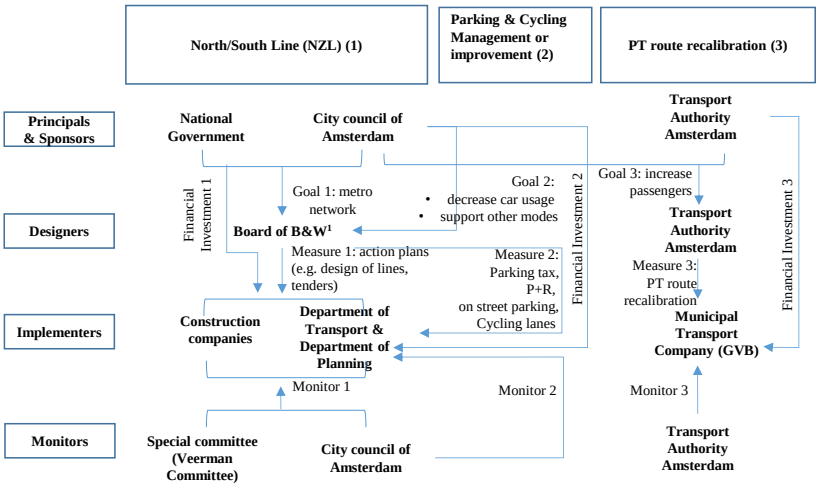

Figure 5.7: Role analysis of Amsterdam case

duce the attractiveness of car use and increase the convenience of slow traffic since 2007 (shown in Figure 5.8). Turning parking places into public space for slow traffic provides more space for the further development of slow traffic. Besides, integration of micro modes to public transport (e.g. bikes are allowed to get aboard on buses) increases the convenience for cycling passengers. Last not least, a single ticket with discounts for all public transport modes further encouraged people to take more public transport and drive less.

The city council, as the principal of the slow traffic package, established the primary goals that encourage slow traffic and reduce car usage. The transport & planning department designed the primary and ancillary measures in the package. It also cooperated with various operators, such as the public transport company (CARRIS), e-scooter companies (e.g. LIME) and the Lisbon Mobility and Parking Municipal Company (EMEL) to implement the measures. Funding for implementation was provided mainly from the national carbon fund and the Lisbon municipality. The implementation was monitored by Lisbon municipality. To improve the effectiveness of monitoring and enhance cooperation between council and operators, a monthly meeting called “Traffic room” was part of the institutional design (shown in Figure 5.9).

Successful implementation of the slow traffic package could not be achieved without powerful political support. The former mayor of Lisbon fundamentally changed the direction of urban development and emphasized the importance of long-term, comprehensive sustainable mobility plans and a new mobility culture for slow traffic. After becoming the minister, he also transferred executive powers about mobility strategies and policies from the national government to the local municipalities. This provides the opportunity for cities to constitute their mobility strategy and impose urban change.

One major change consisted of the right to decide on investments in transport projects, which enabled city councils to provide sufficient investment in slow traffic packages. Therefore, as a consequence of strong political support and sufficient financial support, the slow traffic package could be designed and implemented without large confrontations. Another useful lesson is that communication and collaboration can be enhanced by institutionally designing regular meetings with key actors, such as traffic officials, operators, and the public to discuss the problems of implementation and the consideration of various options from different angles. For example, especially when there is no clear plan on how e-scooters can work effectively and safely in Lisbon, the monthly meetings proved effective, and resulted from the openness of the agenda setting and the wide variety of issues under discussion.

The main challenge for the slow traffic package is shown as the conflict between long-term policy implementation and the short-term elected city councils. The current sustainable mobility plan was approved, because of a powerful political leader and widespread political acceptance of the parties asking for a healthier environment. However, before that, this plan had to wait a long time for approval, as not enough power had been collected to unify all the parties around the vision.

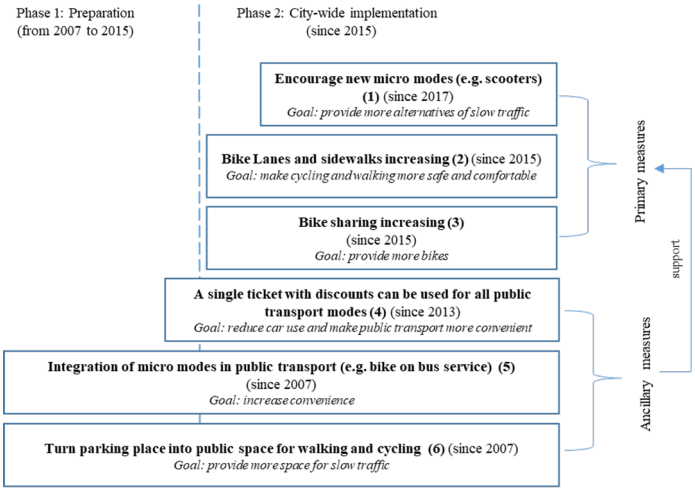

Figure 5.8: Slow traffic package in Lisbon

5.5. FINDINGS

This study has examined three key factors influencing the design and implementation of policy packaging and strategies responding to these factors in each case city (shown in Table 5.1). These factors and strategies are identified based on the empirical study of four cases analysed above, and were combined with insights derived from existing theory as found in the literature reviewed in Section 2. Policy makers choose different strategies not only to make full use of successful factors but also to manage the barriers to decrease the loss, as these factors play a vital role in the policy packaging process and most

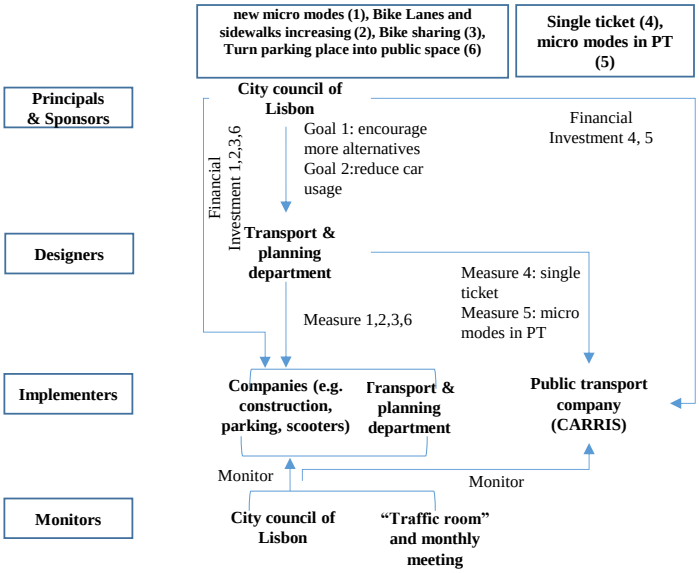

Figure 5.9: Role analysis of Lisbon case

of them cannot be easily changed in the short term. The generalized findings, pointing to the general policy packaging process, can be also effective and meaningful for policy packaging beyond the transport field, as well as adopted for different geographical boundaries.

First, political support determines the formulation of policy packaging. Integrated, long-term transport policy packaging require powerful, stable political support to set policy agendas, collaborate with a large number of actors, and provide sufficient funding. In the Stockholm case, the Green Party successfully balanced the power among various parties and across different levels of governance, which ensured the congestion tax as a prior scheme in the policy agenda; in Lisbon, the former Mayor of Lisbon, becoming the prime minister later, made full use of his political influence to promote the approval of Lisbon's sustainable mobility plan and empower municipal transport authorities more rights and freedom from the national government to design their transport policy packages. In contrast, when political support is limited, a "simple" and "feasible" rather than "ambitious" policy package is more feasible in the real world, which is one practical strategy for having a policy package survive. For instance, as for the 20mph speed limit project in Edinburgh, several measures with a higher requirement of resources or cooperation had to be postponed or even terminated, leaving only "soft" measures (e.g. campaigning and signal marking) in the package, although politicians showed willingness to become the first city in Scotland to set the 20mph speed limit package in the initial phase. Besides, the short electoral term and frequent switch of ruling party often hinder the formulation of comprehensive policy packages, the final effects of which can only be

seen in the long run, and also threaten its completeness during the implementation. For example, after the Stockholm election in 2006, the usage of tax was pulled from public transport to bypass construction. This change is regarded as being in conflict with the original goal of the congestion tax, but this resulted as a compromise strategy to handle the power change after the election. Besides, due to the short coalition period and the dynamic characteristics of a city, designing long term planning supporting the NZL project is difficult in general.

Second, the presence of financial support affects the degree to which policy packaging can be implemented. Sufficient national financial support can effectively promote successful implementation (Tønnesen, 2015). In the Stockholm case, national investment, targeted by Stockholm municipality on public transport extension before the trial, increased public acceptance of the congestion tax. Moreover, the effective design that the revenue of congestion charging is earmarked for the improvement of municipal public transport provides sufficient investment for the costly public transport and also raises public acceptance of the controversial charging; moreover, the Lisbon slow traffic package was mainly supported by national carbon funds as well as the municipal budget. This speeded up the development of slow traffic infrastructures and public space, laying a good foundation for other measures (e.g. bike and scooters sharing) in the package. In contrast, as for the NZL, although the national government initially took up a large part (1.3 billion euros) of budget, a large remaining part and additional expenses made necessary because of accidents (ending at 1.7 billion euros) was the municipality's responsibility. Considering the large financial burden, Amsterdam municipality has to decrease its investment in other measures in the NZL policy package to maintain the NZL construction itself. Besides, Edinburgh municipality had to cut back the 20mph speed limit package and implement only that part of the measures which cost less in the short term but also severely limited the positive effects. In sum, sufficient financial support should be clearly allocated to each measure when a package is being designed. Municipalities should strive for national investment in large-scale policy packages to ensure the implementation of all measures included. If any shortage of funding is inevitable, a more feasible and flexible package will be more effective.

Last but not least, an appropriate organizational and institutional set-up ensures the successful implementation of a policy package. Compared with single policy measures, policy packages require a higher level of cooperation across sectors and cause more difficulties in the monitoring of a packaging process. Therefore policy packaging will create new challenges to existing organizational arrangements (Sørensen et al., 2014). A new structure is thus a smart choice. In Stockholm, a special organization, the Congestion Charge Secretariat (CCS), was established for this purpose and fully entitled by the City Council to evaluate and monitor the whole congestion tax project and organize the corporation between various authorizes and private stakeholders; In Amsterdam, a special committee led by the former minister was set up to evaluate the NZL project after serious incidents. This new committee not only provided useful suggestions and guidelines for implementing the NZL package in the future but also helped reacquire political and public support. Except for setting up a new organization, Lisbon municipality institutionalized monthly meetings with traffic managers, transport operators and citizens to discuss the challenges and issues in the implementation of the slow traffic package. On

the other hand, regulating vehicle speed, obviously a key measure within the 20 mph speed limit package, failed to be implemented in Edinburgh. One main reason was that Edinburgh municipality lacked institutional monitoring power over Lothian and Border Police to execute the measure, and was unable to provide extra subsidies to secure implementation. The only feasible approach was through informal cooperation, but that proved ineffective. Above all, we must draw the conclusion that new institutional and organizational arrangements for policy packaging to promote effective communication and cooperation with different actors and monitor challenges and difficulties only promote successful implementation if both willingness and capacity among policy makers is strong.

5.6. CONCLUSIONS

This chapter was inspired by existing limitations in existing empirical research on policy packaging processes and the expectation derived from a previous study that contextual factors have a major impact on the transport policy packaging process (Yang et al., 2020). TTo solve these issues, this chapter examined the influence of key context factors on different transport policy packages in four representative European cities: Stockholm, Edinburgh, Amsterdam, and Lisbon, with very different political and administrative structures, and reviewed the practical strategies applied for making full use of or releasing the impact of these factors. The main conclusion is that powerful political support, sufficient financial support, and institutional support are vital factors in the success of transport policy packaging. This conclusion is consistent with previous findings in a Chinese case (Yang et al., 2020). It also confirms that these key factors generally play vital roles in real-world policy packaging processes regardless of context. Although these factors are also important for the formulation and implementation of single measure policies, policy packaging is more vulnerable to their impact (Givoni et al., 2013): the corresponding strategies are simply more complicated and require higher levels of flexibility in handling contextual changes.

When political support is sufficient, a complicated design of the policy packaging becomes feasible. Strong political commitment can help prioritize policy packaging on the decision-making agenda and contribute to the convergence of various resources, such as finance, human resources, and institutions, which all are necessary for its implementation (Tønnesen, 2015). In the Stockholm case, the approval of controversial congestion charging is widely attributed to the existence of political consensus, created by the Green Party through a successful exercise in balancing political power among various parties. In Lisbon, it was the prominent former mayor of Lisbon who led a series of outstanding reforms in establishing a liveable and sustainable city, achieving a dramatic change in mobility culture from a car-prioritized one to one characterized by popularity of public transport and slow traffic. In contrast, when political support is insufficient or unstable, policy package must be compromised to survive. This can be seen in the Stockholm case, when conflicts arose after election, and the Edinburgh case, when some "hard" measures were given up during the implementation. Moreover, four cases all prove that a trial is an effective strategy to gain political and public support at the beginning of the packaging implementation, which aligns with Sørensen et al. (2014)'s research about the road pricing package and Ćetković and Skjærseth (2019)'s studies on the policy mix for

climate change in Norway.

If financial support is sufficient, especially extra national support (Tønnesen, 2015), full implementation of each measure can be pursed to produce the required synergy between measures of which a policy package consists, laying strong initial foundations. In this study, adequate budget can make the adoption of ancillary measures possible and increase public acceptance of controversial measures such as congestion charging in Stockholm and ensure the approval of the costly policy packages, including large-scale infrastructure construction in Lisbon and Amsterdam. However, with limited financial support, this suppresses investment in ancillary measures (after budget deficits due to incidents as happened in Amsterdam) or requires the finding of additional funding (e.g. support from a campaigning group in Edinburgh). Another tactic to handle the shortage of financial support is to earmark the benefits of charging measures to the others in the package, as in Stockholm.

If a municipality has a strong wish and enough capacity for decent preparation of a policy package and its implementation, monitoring committees, such as the Congestion Charge Secretariat (CCS) in Stockholm and the Veerman Committee in Amsterdam, should be set up to evaluate and monitor the whole packaging process and organize the corporation between various authorities and private stakeholders (Justen et al., 2014a). Moreover, monthly meetings as the ones in Lisbon, adopted as part of a formal institutional design, can also function well. In contrast, the strategy to tackle the lack of organizational or institutional support reflects making full use of informal cooperation, such as the cross-sector tacit agreement between the municipality and the police formed by past experiences in collaboration in Edinburgh.

Although this study as such is only a first contribution to understanding the successful implementation of transport policy packaging, it still has several important implications. First, before taking full advantage of transport policy packaging, policy makers should prepare for dealing with its challenges in implementation. Although policy packaging is theoretically regarded as more effective and acceptable than single policies, policy packaging in the real world is more vulnerable to the impact of contextual factors, requiring more knowledge and skills to design feasible packages, more effort to enhance collaboration among various actors, and more patience to let the combination of measures take their full effect. Second, some of the contextual factors can hardly be altered in a short period of time. Therefore, a successful policy package has to be designed as a feasible combination of measures while considering what influence these factors have, and be flexible and sensitive to changes in contextual conditions and prepared to take responsive action. These implications could be also suitable for policy packaging in other policy areas. Lastly, a good analysis of the roles various actors play is examined as an effective approach to empirically investigate complicated policy packaging processes, especially given the fact that some actors may take various roles and some roles are played jointly by many actors. It provides a quick detection of problems through identifying the presence or absence of key roles. In this sense, to clearly distribute each role to specific actors and adjust the role distribution when new actors emerge is a vital task for managing the packaging process.

We also acknowledge that there are several limitations in this study. First, although this study aims to identify factors for general policy packages, we cannot eliminate the

interference of heterogeneity of policy packages, as well as other external factors, such as luck, unpredictable events and coincidence in the packaging process. Besides, the causal inference between key factors and policy package performance should be logically examined through a more rigorous approach, such as qualitative comparative analysis (QCA), by adding more cases with distinct characteristics. Last but not least, limitations in time and data accessibility prevented deeper investigation into each of the four transport policy packaging processes under study. For instance, the detailed interaction between different roles and actors, and the formation and change of policy maker‘s perceptions of the policy packaging can be quite meaningful extension of our work in future research.

Table 5.1: Strategies responding to key factors on policy packaging process in four case cities

		Stockholm	Amsterdam	Lisbon	Edinburgh
Political support	Sufficient	Political consensus is strived by Green Party through successful balancing the power among parties: A quick implementation of congestion charging package with sufficient financial and institutional support	Strong political willingness to establish metro line: Municipality gives strong commitment to the completion of NZL construction	The prominent former mayor of Lisbon led a series of reform to establish a sustainable mobility city: Slow traffic package achieve a continuous implementation	Edinburgh, as the capital city, gains strong political willingness to become the first city in Scotland to set 20mph limit : The trial and later citywide implementation are carried out
	Insufficient	New term of election: Package adjustment results from compromise to party switch			Speed limit project is at the margin of political agenda: The package maintains a “compact” and “cheap” version
Financial support	Sufficient	National investment: invest in the ancillary measures to support congestion charging	National investment: It contributes to a good start-up of the NZL package	National carbon funding and municipal budgets: Provide sufficient cycling infrastructures, laying good foundation for other measures in the package	
	Insufficient		Municipal budget deficit due to severe incidents: municipality decreases other investment in order to maintain the primary construction		Lack of national investment and tight municipal budget: The package supports the primary measures and finding extra social investment
Institutional/ Organizational support	Sufficient	Municipality has the willingness and capacity in supervision: Congestion Charge Secretariat (CCS) is set up to enhance supervision and cooperation with actors	Municipality has the willingness and capacity in supervision: Veerman Committee rescued the NZL project through providing useful guidelines for rectification	Municipality has the willingness and capacity in supervision: Monthly meeting in Lisbon with traffic managers, operators and citizens to discuss issues in time	
	Insufficient				Municipality lacks the capacity of supervisions on key actors: The supervision can only be carried out through informal, soft cooperation.

6

CONCLUSION

6.1. INTRODUCTION

To achieve sustainable transport systems, "wicked" transport issues must be solved. For governments across the world, providing transport infrastructures and managing transport demand are two kinds of measures available for transport policies. Many studies have shown how separate transport measures are vulnerable in terms of political and public acceptance and produce the expected effects. Consequently, expectations on transport policy packaging are high from both policy makers and scholars. However, the design and implementation of policy packages is usually chaotically, and seldom as successful in reality as expected; moreover, empirical research on transport policy packaging has been sorely lacking, especially in a more systematic comparative approach.

This thesis, to answer the central research question *Q "How can transport policy packaging be developed and implemented in the real world?"*, has answered three sub-questions covering the whole policy packaging process from design to implementation in sequence: Q1 "What are the general characters of well-integrated transport policy packaging? How can they be empirically measured and used as a comparative approach between various cases? (in Chapter 2)", Q2 "Will well-integrated transport policy packaging effectively reduce traffic congestion? As for the cities in different levels of economic development, what are the proper strategies to provide transport infrastructures and take transport policy packaging? (in Chapter 3)", and Q3 "What key factors determine transport policy packaging process and how? What are the proper responsive strategies? (in Chapter 4 and 5)".

In this chapter, section 6.2 gives the answers to all this research's sub-questions and draws the conclusions. Section 6.3 reflects on the limitation of this study and provides possibilities for future work.

6.2. ANSWERS TO THE RESEARCH QUESTIONS

Q1: What are the general characteristics of well-integrated transport policy packaging? How can they be empirically measured and used as a comparative approach between var-

ious cases?

There has been limited attention on the way in that transport policy packaging as a concept works in a real-world context and little clarity on the methodology to evaluate the effectiveness of transport policy packaging based on its characteristics from a dynamic and historical perspective. Therefore, Chapter 2 provides a methodology for analyzing transport policy packaging in four dimensions (including density, classification, reference and time) which are summarized according to a theoretical perspective of transport policy packaging. These dimensions respectively reveal how many and what kind of TDM measures have been implemented, how they interact in a package, and how these characteristics change over time. The research examines this methodology through comparative case studies based on policy document analysis in two Chinese cities, Dalian and Shenzhen, both of which adopt a large number of TDM measures.

The results first show that this approach is an effective method to capture both overall and specific characteristics of policy packaging, and to compare different packaging. Without analysis of complex policy processes, document analysis, more specifically looking at cross references between transport policy documents, can be used as a proxy for the way in which policy packaging is developing. Among the dimensions of this approach, the density reveals how policy documents interrelate different (types of) measures; the categories indicate the direction and possible strategy of packaging, by presenting development of and links between different groups of measures; the interaction shows the connecting networks of measures and directly demonstrates the integration of packaging, albeit on paper; the temporal factor enables us to understand how policy packaging keeps changing overtime, which is a vital point of view to analyzing the dynamic characteristics of packaging. Secondly, the results have shown that a city with higher integrative transport policy packaging does perform better in sustainable transport development, although only based on the comparison between Dalian and Shenzhen. That limited analysis should be extended before the research comes to definite conclusions, but tentative outcomes are that: packaging integration should be one major goal pursued by governments; efforts should be made to enhance the connections between existing measures rather than to issue more but isolated ones; the shift of policy goals or strategies influences the components and integration of packaging.

To sum up, this methodology based on document analysis primarily proved effective and applicable in the analysis of policy packaging in transport, and is also expected the similar use in broader areas where policy packaging is a potential route for targeting wicked problems. It also lays a foundation for us on examining the effects of transport policy packaging on sustainable transport development in the following research.

Q2: Will well-integrated transport policy packaging effectively reduce traffic congestion? As for cities at different levels of economic development, what are the proper strategies to provide transport infrastructures and demand management and take up transport policy packaging?

As there are few studies checking the effects of transport policy packaging on relieving traffic related problems and examine whether the proposed transport policy packaging is effective across different real-world urban transport systems, Chapter 3 empirically assesses the impact of transport policy packaging, in various scenarios of transport infrastructure supply and GDP, on congestion reduction, relying on a fuzzy set qualitative

comparative analysis (fsQCA) of 22 Chinese cities from 2011 to 2016.

First, this research finds that neither any specific kind of transport infrastructure supply nor any unique transport policy packaging reduces traffic congestion, with fast growth of cities' GDP and mobility levels. The analysis shows that in general limited economic development or high levels of infrastructure are the two main explanatory factors for cities experiencing low levels of congestion. Moreover, it is unlikely that a general package of transport infrastructure supply and transport policy packaging fits any city with different contexts.

Secondly, the results demonstrate that on one hand, cities with different GDP levels should select different strategies to develop transport supply and demand management policy packaging. Also, as traffic congestion has the tendency to continuously reappear with increased supply oriented measures and demand grows with urban development and economic growth, the strategies for the city needed to be adapted over time. As for cities with low levels of GDP, it can be effective for local governments to focus on designing and implementing transport policy packaging rather than on investing transport supply. More specifically, they should beware of focusing just on road construction, which is likely to cause higher congestion by encouraging more car use. As for cities with high levels of GDP, even when local governments put substantial efforts in transport supply, congestion remains high. They should emphasize developing comprehensive transport systems (e.g. covering road, bus and urban rail).

Last but not least, although the results are not enough "significant" or "concise" to draw an "encouraging" conclusion, the analysis reveals the actual complexity of traffic congestion and also reminds us to detect deeper explanations in the policy packaging process. A well-integrated policy packaging requires not only a well-designed document design at the start, but also a successful implementation to achieve it.

Q3: What key factors determine transport policy packaging process and how do they work? What are the proper responsive strategies?

Sustainable transport typically requires a broad spectrum of policy measures, with responsibilities shared by different authorities and with various public values competing with each other, such as commuting, health, spatial quality, and economic development. However, research of problems around the development of the policy package and particular package implementation is lacking. In Chapter 4 and 5, the research aims to fill this gap by examining the implementation process of transport policy packaging from the perspective of actors and their distinct roles and interactions in different contexts. The data is collected by document analysis and interviews with officers in a Chinese city at first and then in four European cities.

In Chapter 4, the research makes three contributions to the literature. First, the research underlines the importance of the implementation phase for successful policy packaging through an empirical case analysis. The development of a policy package requires input from those that eventually have to implement the measures. The earlier research on designing good policy packaging have been proven meaningful, but are not enough for a well performing packaging. Second, this study demonstrates how the identification of key roles played and actions taken by different actors can be a meaningful and helpful approach for analyzing complex policy packaging processes and detecting potential problems. The role identification can simplify a large number of complex ac-

tors from multi-level and multi-fields into several clear roles which promote a policy packaging process. The research helps to quickly detect problems in a packaging process by checking whether key roles are absent. For example, the absence of what this research identifies as supervisors leads to the limited role out of specific transport measures in the package, harming the integrity of that package. Moreover, in current policy packaging studies, conflicts between different roles of one actor, and the conflict between different actors sharing one similar role are easily overlooked. Both provide a useful perspective to explain why similar policy measures cannot be equally implemented at different levels of governments and why one authority has different attitudes or preferences to different measures. Third, policy makers are suggested to pay a great deal of attention to three problems during the implementation of policy packaging. The implementation of measures from an integrative perspective is easily overlooked at the lower governmental levels, responsible for the implementation of some of the measures. The same holds for sectorial fragmentation; this can also trigger new dynamics, hampering the implementation of measures that overall makes sense, but locally might be controversial. Implementation gets its own dynamic at different levels of government and different sectorial departments, leading to the low packaging completion. Next, coherent measures may conflict with each other in the process of implementation because of the resource competition within one authority or across multiple ones. And the absence of supervisors will threaten the whole transport policy packaging process, especially with growing complexity.

In Chapter 5, we examine the robustness of conclusions in Chapter 4, by examining what and how key factors determine the empirical policy packaging process through comparison analysis of packaging around signature measures in four European cases: congestion charging package in Stockholm, 20mph speed limit package in Edinburgh, North-south metro line package in Amsterdam, and slow traffic package in Lisbon. The data is collected from policy documents and semi-structured interviews. The main conclusion of this study is that powerful political support, sufficient financial support and institutional support are vital factors in the success of policy packaging. First, political supports determine the formation of policy packaging. Integrated, long-term transport policy packaging needs powerfully, stable political supports to set key agendas, collaborate a large number of actors, and provide sufficient funding. Secondly, financial support impacts the degree to which policy packaging can be implemented. Sufficient national financial support can effectively promote a success implementation (Tønnesen, 2015). Last but not the least, organizational or institutional set-up ensures the successful implementation of a policy package. Compared to single policy measures, policy packaging requires higher level of cooperation across sectors and cause difficulties in supervising complex packaging process, both of which will create new challenges to the existing organizational arrangement (Sørensen et al., 2014). Therefore, a new organizational or institutional set-up can be a smart choice. Although these factors are also important for general single policies, policy packaging puts forward higher requirements. The results can not only verify consistency and robustness of each factor‘s impact in different context conditions of Europe as well as in China where we conduct a trial study earlier (Yang et al., 2020), but also provide detailed actions how different cities react to these factors.

Q: “How can transport policy packaging be developed and implemented in the real

world?"

In sum, this thesis alone is far from enough to provide the final answer to this question, but several important implications and reflections for a successful transport policy packaging can be drawn. First, policy makers should form a new perception of policy packaging, distinguishing it clearly from traditional single policy making. This research reveals that many policy makers, in most Chinese and European cases, usually regard the transport policy packaging only as a static combination of several measures and easily overlook extra efforts and investments in the complicated packaging process, which to a large extent leads to the failure of seemingly well-designed packages in the implementation. Another scenario is that the policy packaging is gradually formed during the implementation to deal with unexpected incidents rather than purposely designed at the initial stage when policy makers do not deem it is necessary or feasible. However, the passive reaction and hasty preparation restrain its synergy effects. Therefore, to take full advantage of the transport policy packaging, policy makers should clearly understand that it posses stricter requirements for both careful design and firm implementation than single policies; a successful policy packaging is not only a combination of required measures, but also a perceptual convergence of policy integration and a dynamic integration of packaging process.

Second, to enhance the intensity and interaction of measures, provide a unified direction of development, and take sufficient time for full implementation all are key elements of a promising approach to policy packaging. The four general characteristics of the policy packaging: intensity, type, interaction and time, proposed in this thesis, can provide a guideline rather than a uniform quantitative standard for the design of policy packaging. Although these characteristics do not provide a perfect standard for all, the policy packaging still can be continuously improved along these dimensions. The case provide several successful and critical examples. For instance, the Stockholm congestion charging and the measures of public transport improvement form a positive interaction, achieving a high level of public acceptance of the former one and the sufficient subsidies for the later one at the same time; the slow traffic package in Lisbon includes the measures of improving slow traffic facilities and services, and restraining car use to enhance the intensity of the packaging, and promises a stable institutional environment and implementation period by a series of integrated mobility plans.

Last but not least, powerful political support, sufficient financial support and institutional support are vital factors in a success of policy packaging. A transport policy package should be designed with the consideration of these context factors, besides the general characteristics mentioned above, and also stay flexible and sensitive to the change of those context conditions and require timely responsive strategies. For example, when political and financial supports are sufficient, a comprehensive, nearly ideal policy packaging can be designed and fully implemented; when the opposite is the case, a "compact" package with a trial is more effective and feasible; institutionalized cooperation and supervision ensures a smooth packaging implementation, when there is strong willingness and capacity in organizational/institutional preparation. By contrast, the strategy to manage the lack of organizational/institutional preparation is to take full use of informal institutional cooperation.

6.3. RESEARCH LIMITATION AND FUTURE WORK

Several limitations, however, have to be taken into consideration in this research. First, this thesis is facing a common limitation in policy and governance studies: the problem of data accessibility and reliability. In Chapter 3, due to the lack of data, the performance of transport policy packages was limited to the effect on congestion, while the effect on sustainability are obviously also very important. This has introduced an analysis bias of causal relationship in the qualitative comparative analysis (QCA), which the article tries to deal with. Moreover, the same issue on data availability occurred in Chapter 5 in a different way.It compares four different transport policy packages in four different cities, the original idea being to find more comparative situations with similar packages. The challenge of data accessibility is surging with the research scale and number of cases raising.

Another main limitation is that this thesis cannot investigate all dimensions of transport policy packaging. There are four different dimensions: governance levels (e.g., national, region, and local levels), policy fields (e.g., environmental protection, land use, and public healthy), geography (e.g., in America and Africa), and time (e.g., before and after the economic crisis of 2018) (Rogge and Reichardt, 2016). The investigation from each dimension can produce unique lessons and experiences of policy packaging, all of which can benefit the development and implementation of a successful package. For example, a lightly change in the scope of the concept of transport policies, in this thesis, largely impacts the examination of its effectiveness on dealing with real mobility issues. To be specific, Chapter 2 initially examines the effectiveness of Transport demand management (TDM) packaging but later Chapter 3 discovers that it alone hardly makes significant a impact on solving mobility issues without the consideration of transport infrastructure supply (TIS). Therefore, the extended concept of transport policy packaging (TPP), including the measures on both demand and supply sides, is adopted in Chapter 4 and 5, which provides a more precise perspective to investigate how the packages are designed and implemented based on the specific context conditions, such as physical infrastructure conditions and institutional connections. However, despite this, this thesis, mainly focusing on finding key factors for transport policy packaging processes in general through case comparison, has little capacity to deepen the research into each of these dimension in detail.

Last but not least, the generalization of findings in this thesis is still challenging at should be the result of far more research and other academics furthering this promising field. Generalization is considered more complex and controversial in qualitative studies than quantitative ones Glaser (2002). In Chapter 4 and 5, the primary goal is to explore key factors that determine policy packaging in one Chinese city and preliminary examine the validity of the roles of these factors in four European cities. Other disturbing factors, such as different policy packaging itself, and different institutions and cultures, can challenge the generalization of the findings in the thesis. This research could provide the basis for more quantitative and large scale analysis of the factors this inductive research have uncovered.

Therefore, these limitations provoke several following ideas for research in the future. At first, it is meaningful to reexamine the findings in Chapter 3, by adding the perspective of implementation, to be specific, the degree to which the characteristics of packaging

formulation and key factors of packaging implementation influence the performance of a policy packaging. Second, a more integrated approach can be proposed, combining characteristics analysis of package formulation and investigation of key factors of the packaging process, to comprehensively evaluate the effectiveness of transport policy packaging in different context conditions. Finally, studies of policy packaging across geographical, governance-level, research-fields, and time dimensions can be carried out to further examine the findings of this thesis or explore more insights for the design and implementation of policy packaging, in transport and other policy fields.

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ACKNOWLEDGEMENTS

If a PhD is a long journey full of constant challenges, I cannot successfully reach the end without the precious supports from the professors, colleagues, friends, and family. I am so glad to have the opportunity to say thanks to you all.

First, I want to express my gratitude to Prof. Xi, as my supervisor during the master's degree program at Dalian University of Technology. He encouraged me to bravely step outside the comfort zone and pursue a challenging PhD degree abroad. His talent, elegance, and determination impressed me deeply. I regret that I did not say many thanks to him when he was still alive. May him rest in peace. Besides, Prof. Li, Prof. Liu, and Prof. Ma, thanks for your continued supports since my bachelor's program.

Prof. Martin de Jong, thanks for your invitation and open doors for me at Delft University of Technology. I clearly remember, at the beginning of the PhD, communication was still a problem, partly because of the language barrier and partly of cultural difference, but you were always patient and helpful for me to have a good start. Prof. Wijnand Veeneman, I want to express my sincere gratitude. Thank you so much for your inspiration for my research, your generous support for my PhD extension, and your warm concern in helping me get rid of depression during the pandemic of Covid-19. You both teach me how to become an independent researcher and how to achieve a research-life balance.

Thanks also to my colleagues in the O&G section, I have enjoyed working with and learning from you all. Martijn and Mark, I enjoyed the pleasant time when we did the project together in China; Kees, Orçun and Maria, thanks for so many interesting chats during coffee breaks and lunch; Fabio and Didier, it is a sweet memory with you, as Wijnand's team, sitting on the ground and sharing experiences at the end of the conference in Singapore.

I am also thankful for the company of Chinese colleagues. Changjie, Xiuyun, Haiyan, Zhijie, Xu Xie, Ying Zheng, and Li Sun, I'm grateful for all of your understanding and help, especially when I just arrived in the Netherlands. Yun Song, Wenting, Biyue, Zhaowen, XinYu, and Shuhong, I had so many unforgettable memories of working and hanging out together with you.

Outside the research group, many extraordinary friends also help me survive in daily life in the Netherlands. Riming and Hao Yu, thanks for tolerating my dark cuisines and accompanying me throughout the adjustment phase in the first year; Shengyue, thanks for taking me to try something new and exciting which I hardly did alone; Yi Yin, I appreciate your generous invitations for home parties; Hongxiao, and Nan Jiang, our foodie group has brought me much happiness, and will never be disbanded. In particular, my sincere thanks go to my roommate, Han; You have witnessed my good and bad time in the last four years and you are the one I truly trust and rely on. Thanks for your unexpected and priceless friendship.

Finally, I owe my family too much. Ye, thanks for your unconditional trust and support for the pursuit of my dream, although I, as the husband, cannot stand beside you in the last five years. Mon, grandma, and uncles, you are always my safe heaven and solid backing. Without all of your support and encouragement, I cannot reach the end of the PhD journey.

Besides, thanks for the scholarship provided by China Scholar Council, enabling me to pursue my study in the Netherlands as a PhD.

APPENDIX

Table A.1: Abbreviation and Categorizations of TDM measures

Items	Variables	Explanation	Items	Variables	Explanation
1	**P**	Pedestrian TDM	42	**Cs1**	Car parking & ride
2	**Pc**	Pedestrian campaign	43	**Cs2**	Telework or staggered shifts
3	**Pr**	Pedestrian regulation	44	**Cs3**	Parking service
4	**Pe**	Pedestrian economic incentives	45	**Cf**	Car facility improvement
5	**Ps**	Pedestrian service improvement	46	**Cf1**	Parking lots improvement
6	**Ps1**	Pedestrian access	47	**Cf2**	Tidal lane
7	**Pf**	Pedestrian facility improvement	48	**Cf3**	One way lane
8	**Pf1**	Pedestrian lane	49	**Cf4**	Narrow lanes
9	**B**	Bike-TDM	50	**PT**	Bus-TDM
10	**Bc**	Bike campaign	51	**PTc**	Public transport campaign
11	**Br**	Bike regulation	52	**PTr**	Public transport regulation
12	**Br1**	Shared bike legislation	53	**PTr1**	Eliminate restriction
13	**Br2**	Bike regulation- provide restriction	54	**PTr2**	Shuttle Public transport legislation
14	**Br3**	Electric bike use restriction	55	**PTr3**	Public transport franchise management
15	**Be**	Bike economic incentives	56	**PTe**	Public transport economic incentives
16	**Bs**	Bike service improvement	57	**PTe1**	Subsidies from governments or companies
17	**Bs1**	Bike access management	58	**PTs**	Public transport service improvement
18	**Bs2**	More / various supplement	59	**PTs1**	Public transport access management
19	**Bf**	Bike facility improvement	60	**PTs2**	BRT
20	**Bf1**	Bike parking lots	61	**PTs3**	More public transport options
21	**Bf2**	Bike lane	62	**PTs4**	Punctuation
22	**C**	Car-TDM	63	**PTs5**	Services in special events
23	**Cc**	Car education & campaign	64	**PTs6**	Public transport condition improvement
24	**Cr**	Car regulation	65	**PTs7**	Raising public transport frequency
25	**Cr1**	Ride sharing	66	**PTf**	Public transport facility improvement
26	**Cr2**	Pollution regulation	67	**PTf1**	HOV lane
27	**Cr3**	Car punishment	68	**PTf2**	Public transport station improvement
28	**Cr4**	Second-hand car dealing	69	**PTf3**	Public transport priority lane
29	**Cr5**	Car purchase regulation	70	**T**	Taxi-TDM
30	**Cr6**	Car use regulation	71	**Tc**	Taxi campaign
31	**Ce**	Car economic incentives	72	**Tr**	Taxi regulation
32	**Ce1**	Less car use pride	73	**Tr1**	Taxi punishment
33	**Ce2**	Cordon tolls	74	**Tr2**	Taxi use restriction
34	**Ce3**	Distance based fees	75	**Tr3**	Taxi operational regulation
35	**Ce4**	Fuel tax	76	**Tr4**	Taxi online hailing legislation
36	**Ce5**	Green energy subsidies	77	**Te**	Taxi economic incentives
37	**Ce6**	Ridesharing discount	78	**Te1**	Decreasing fees
38	**Ce7**	Road fees	79	**Te2**	Taxi pride from companies
39	**Ce8**	Congestion fee	80	**Te3**	Taxi green-energy subsidies
40	**Ce9**	Parking fees	81	**Ts**	Taxi service improvement
41	**Cs**	Car service improvement	82	**Tf**	Taxi facility improvement

Table A.2: Date description and thresholds for fuzzy-set membership assignment

	Definitions	Thresholds		Explanation
Congestion Index	Additional travel time costed by congestion and calculated as the time difference between actual travel time and free-flow travel time	full membership	2	Thresholds are selected according to the standards in the report of Amap (2016). Double or above longer than free-flow travel time means severe congestion; from 1.8 times to double means moderate congestion; from 1.5 to 1.8 means slightly congestion; less than 1.5 times mean no congestion
		cross-over threshold	1.8	
		full nonmenbership	1.5	
GDP	Gross domestic product	full membership	2	GDP as the contextual factor denotes the different levels of economic development among case cities. Double, equal, and half of the average GDP of the selected cities are set the full membership, cross-over, full non-membership thresholds.
		cross-over threshold	1	
		full nonmenbership	0.5	
Network	Density of TDM packaging network	full membership	40%	The number of links among each TDM measure is larger than or equal to 40% of all the potential links means well-integrated network; figures from 30% to 40% represent moderate integration; those from 20% to 30% indicate slightly isolation, those smaller than 20% reflect a totally isolated network.
		cross-over threshold	30%	
		full nonmenbership	20%	
Type	Types of TDM measures	full membership	0.66	Three thresholds are set as two-third, half and one-third of the total number of TDM measures (n=48) .
		cross-over threshold	0.5	
		full nonmenbership	0.3	
BorC	The ratio of bus-related TDM measures to car-related ones	full membership	1.5	Larger than or equal to 1.5 times means the feature of TDM packaging is mostly bus-oriented packaging; the same to less than 1.5 times means moderate bus-oriented one; half to the same means slightly car-oriented one; smaller than half means car-oriented one.
		cross-over threshold	1	
		full nonmenbership	0.5	
road	Density of road (the ratio of the length of road to the acreage of urban built area)	full membership	1.5	To infer the conclusion to the whole country, we select the national average level as the cross-over threshold. The density is mostly high when it is 1.5 or more times larger than the national average level; the figure from the equal to 1.5 times larger indicates moderate high density; 0.7 to 1.5 times means slightly low density; 0.7 time or below represents mostly low density.
		cross-over threshold	1	
		full nonmenbership	0.7	
bus	Density of Bus network (the ratio of the length of Bus network under Operation to the acreage of urban built area)	full membership	1.5	To infer the conclusion to the whole country, we select the national average level as the cross-over threshold. The density is mostly high when it is 1.5 or more times larger than the national average level; the figure from the equal to 1.5 times larger indicates moderate high density; 0.7 to 1.5 times means slightly low density; 0.7 time or below represents mostly low density.
		cross-over threshold	1	
		full nonmenbership	0.7	
rail	Density of rail (the ratio of the length of rail network under operation to the acreage of urban built area)	full membership	2	We select the national average level(density=0.7) as the cross-over threshold but use the mean value of case-level(density=2) as the full membership, and adopt the value 0.01 as the full non-membership threshold to distinguish whether urban rail systems exist.
		cross-over threshold	0.7	
		full nonmenbership	0.01	

Note: as this study aims to draw direct conclusions in a Chinese background, the cross-over thresholds are set as the national average level. The full membership and full non-membership are carefully selected based on both substantive and theoretical knowledge, as well as advice from related experts, partly because there is no former study providing a theoretical basis. In the meanwhile, we also find the solutions keep consistent after some changes in the full membership/non-membership thresholds (e.g. changing the full membership of bud density from 1.5 to 2)

Table A.3: The summary of 48 TDM measures selected in this research

Items	Codes	TDM measures
1	Cc1	car education & campaign
2	Ce1	car green energy subsidies
3	Ce2	P+R subsidies
4	Ce3	Subsides on high-pollution vehicles elimination
5	Ce4	Parking fees adjustment
6	Cr1	No left turning
7	Cr2	Enforcement on illegal parking
8	Cr3	Encouraging second-hand car dealing
9	Cr4	Restriction on car usage
10	Cr5	Restriction on car purchase
11	Cr6	Carpooling
12	Cs1	Parking and Riding (P+R)
13	Cs2	Electronic Toll Collection (ETC)
14	Cs3	Telework or staggered shifts
15	Cf1	Car charging facilities
16	Cf2	One-way lane
17	Cf3	Increasing parking lots
18	Cf4	Tidal lane
19	Tc1	Taxi campaign
20	Te1	Subsidies for taxi operation costs
21	Te2	Subsidies for taxi fares
22	Tr1	Control of overall taxi scale
23	Tr2	Taxi franchise management
24	Tr3	Taxi online hailing legislation
25	Tf1	Taxi parking lots
26	PTc1	Bus campaign
27	PTe1	Bus subsidies
28	PTr1	Public transport franchise management
29	PTs1	Increasing the types of buses
30	PTs2	Increasing the number of buses
31	PTs3	Bus assessment
32	PTf1	Bus rapid transit (BRT)
33	PTf2	Bus station improvement
34	PTf3	Bus priority lane
35	PTf4	High occupied vehicles (HOV) lane
36	Pc1	Walking campaign
37	Ps1	Walkway facilities improvement
38	Ps2	Pedestrian accessment
39	Pf1	Pedestrian zoon
40	Pf2	Vehicle-free walkway
41	Bc1	Bicycle campaign
42	Br1	Restriction on regular bike usage
43	Br2	Restriction on E-bike usage
44	Bs1	Provision of public bicycles
45	Bs2	Encouragement of shared bicycles
46	Bs3	Bicycle assessment
47	Bf1	Bike parking lots
48	Bf2	Bike lane

Table A.4: Overview of interviewee sample

City	Person	Category	Description
Stockholm	S1	G	Green Party in Stockholm Council, Spokesperson
	S2	G	Swedish Infrastructure Administration, Minister
	S3	G	Public transport sector in the City of Stockholm, Senior Economics Policy Adviser
	S4	G	Environment and Health Administration in the City of Stockholm, Department head
	S5	G	Swedish Transport Administration, Senier adviser
	S6	A	KTH, Professor
	S7	C	Swedish society of nature conservation (a non-profit environmental organisation), Consultant
	S8	G	Transport Planning in City of Stockholm, Department head
Edinburgh	E1	G	Transport Research Institute, Director
	E2	G	The City of Edinburgh Council, Transport Planner/Project Manager
	E3	A	University of Edinburgh, Professor
	E4	C	Spokes (the Lothian Cycle Campaign), Project manager
	E5	G	Green Scottish party, Politician
	E6	A	Transport Research Institute, Researcher
	E7	C	Living Streets Edinburgh (a national charity), Covenor
	E8	C	Living Streets Edinburgh (a national charity), Senior consultant
Lisbon	L1	C	Lime (a e-scooter company), employee
	L2	C	Bird (a e-scooter company), employee
	L3	A	University of Lisbon, Professor
	L4	G	City of Lisbon, Mobility Adviser of the Deputy Mayor
	L5	A	University of Lisbon, Professor
	L6	G	City of Lisbon, Mobility Adviser of the Deputy Mayor
	L7	G	Transport authority for the Lisbon Metropolitan Area, Consultant
Amsterdam	A1	C	Goudappel Coffeng (Dutch consultancy company), Consultant
	A2	C	GVB, Transport developer
	A3	G	Municipality of Amsterdam, Policy advisor
	A4	G	Amsterdam Transport Region, Senior advisor
	A5	G	Party C66 in Amsterdam council, Councilor
	A6	C	Volt Strategy (a consultancy), Head
	A7	A	University of Delft, Professor

Abbreviation of category: Academia/research institutions (A),

Government official/regulator/advisor (G), Consultancy/Company/ Association (C)

CURRICULUM VITÆ

Wei Yang was born and raised in Liaoning, China. He earned a bachelor and master degree in Administrative Management at Dalian University of Technology in 2012 and 2015 respectively. On September, 2015, sponsored by China Scholar Council, he started PhD research at Organization and Governance section, Delft University of Technology. He pursed a PhD degree on transport policy packaging, under the supervision of Dr. Wijnand Veeneman and Prof. Martin de Jong. In particular, his PhD thesis investigates how transport policy packaging can be successfully designed and implemented in the real world. He also worked as a researcher in the same group of Delft for a half year from 2019 to 2020.

LIST OF PUBLICATIONS

5. **Yang, W.**, Veeneman, W., de Jong, M., & Song, Y. (2020). Integrated transport management: Lessons from a Chinese city. *Research in Transportation Economics*, 100918.

4. **Yang, W.**, Veeneman, W., & De Jong, M. (2018). Transport demand management policy integration in Chinese cities: A proposed analysis of its effects. *Energies*, 11(5), 1126.

3. **Yang, W.**, Veeneman, W., & De Jong, M. (*under review*). Measuring the effects of integrated transport policy: a qualitative comparative analysis of Transport Demand Management policies in 22 Chinese cities. *Journal of Transport Geography*.

2. **Yang, W.**, Veeneman, W., & De Jong, M. (*under review*). Integrated transport management: Lessons from Stockholm, Edinburgh, Amsterdam, and Lisbon. *Transportation Research Part A: Policy and Practice*.

1. Liu, Y., & **Yang, W.** (2019). Leadership and governance tools for village sustainable development in China. *Sustainability*, 11(20), 5553.