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The ban of "*old man's joy*" in China

A transitions study of Beijing's regulatory change banning the use of *lǎo tóu lè* (老头乐) vehicles from 1 January 2024.

Author: Petru Simion
Supervisor: Stefan Brehm

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- *Petru Simion*
  May 2024

Abstract

This study examines the regulatory change banning the utilization of *lǎo tóu lè* vehicles in Beijing following January 1st 2024, while exploring its implications in relation to urban mobility and the livelihoods of the affected population. A qualitative approach of field observations and semi-structured interviews was instrumental in unveiling incompatibilities between top-bottom governance and emergent bottom-up adaptation responses. The findings suggest causal relations between the macro dimension of China's automobile industry development and its materialization as ripple effects in the micro dimension of local livelihoods. As such, the study aims to expand the field of transition studies by both showcasing its limited consideration toward livelihoods and scrutinizing the analytical operationalization of socio-technical transition frameworks. Distinctively, this is the first inquiry into the implications toward the affected population following the regulatory change. Consequently, the study serves as a valuable resource for policymakers to employ a more inclusive and just approach to transitions, including formulating regulatory changes that acknowledge the role of *lǎo tóu lè* vehicles in urban mobility.

Word count: 14994

“We old people in Beijing don't want to talk about joy, we don't think about it. A day alive is a day alive.”

- Anonymous *lǎo tóu lè* owner (2024)

Keywords and abbreviations

ICEV - Internal combustion engine vehicle

EV - Electric vehicle

AV - Autonomous vehicle

NEV - New Energy Vehicle; *all vehicles powered by alternatives to fossil fuels, such as electric vehicles, plug-in hybrids, and hydrogen-fuelled vehicles* (Sandalow et al., 2022)

lǎo tóu lè vehicle - three or four-wheel low speed vehicle

E-bike - electric motorcycles and scooters, powered by rechargeable batteries. The definition differs from the western description of ‘e-bikes’, which is more centered on electrically assisted pedal bicycles

MIIT - Ministry of Industry and Information Technology

Two Sessions - a critical series of meetings held annually, reviewing goals from the previous year, and defining the country’s economic and political priorities for the year ahead

Five-Year Plans - a series of social and economic development initiatives issued by the Chinese Communist Party (CCP) since 1953

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1. Introduction

Urban spaces have been subject to increased pressures to meet the mobility needs of China's continuously increasing urban population (Cao et al., 2012). While personal vehicles such as automobiles aim to meet those mobility needs, they also negatively contribute to creating the need to declutter from the same vehicles due to increased traffic congestion, pollution, and vast dedicated infrastructure (Yang et al., 2017). Among other personal vehicles such as bicycles, motorcycles, and e-bikes that act as less traffic-inducing personal means of transport, a different type of vehicle has emerged in China as a low-speed vehicle. Namely, the *lǎo tóu lè* vehicle emerged in the 2000s as a low-cost alternative to automobiles, increasing its presence on urban roads with more than 10 million units as of 2020 (Zhesheng, 2024). Its direct translation, "*old mans' joy"* is representative of the population it mainly serves the elderly and its role in contributing to their wellbeing. Its increased presence has, however, raised concerns about road safety and its lack of regulatory measures, as it operates under gray areas of governance and outside of traffic regulations (Zheng, 2021). More recently, increased scrutiny led to the materialization of a regulatory change banning the manufacture and use of *lǎo tóu lè* vehicles in Beijing (CCTV News, 2023b).

Given the prevalence of the vehicle, especially adopted by the elderly as a senior-friendly vehicle able to meet essential mobility needs, its ban raises questions of livelihood implications. Simultaneously, an inquiry is made to understand the mechanisms that shaped its presence outside of regulatory measures and the discourse of its negative connotation toward road safety. As such, the research seeks to reveal a comprehensive understanding of the role of '*lǎo tóu lè* vehicles, the mechanisms that shaped the regulatory change, and individuals' adaptation to the transition. The research inquiry is set in the context of China's automobile and passenger vehicles industry through the lens of the socio-technical transition.

1.1. Research questions

Urban mobility in China employs a number of personal vehicles as means of transportation, among which the *lǎo tóu lè* vehicle is a category of its own, as it lies outside the mainstream definition of passenger vehicles (Ling et al., 2019). While previous studies have investigated the preferences of using *lǎo tóu lè* vehicles as a means of transport in other provinces of China, this

is, to my knowledge, the first study to investigate the use of *lǎo tóu lè* vehicles in Beijing. Furthermore, it is the earliest inquiry into the effects and causalities of the regulatory change banning the vehicle's use in Beijing. Lastly, it is preliminary in exploring the interconnection between the socio-technical transition of New Energy Vehicles (NEVs) in the automobile and passenger vehicles industry in China and its ground-level implications on livelihoods. To pursue the research inquiry, the study aims to answer the following research question:

The research employs two theories of transitions to explore the mechanisms and dimensions involved in shaping the regulatory change of *lǎo tóu lè* vehicles, and its implications toward the livelihoods of the affected population.

What mechanisms shape the regulatory change banning the use of lǎo tóu lè vehicles in Beijing from January 1st, 2024, and what are the implications for the livelihoods of the vehicle's users?

The following research sub-questions are formulated to underline the different aspects of adaptation, governance, and transition, which contribute to a more comprehensive inquiry of the main research question:

1. To what extent can *lǎo tóu lè* vehicle users adapt to the new conditions and meet their mobility needs?
2. To what extent do policymakers facilitate the transition away from *lǎo tóu lè* vehicles?
3. How is the regulatory change positioned in relation to China's transition to adopting NEV technologies in the automobile and passenger vehicles industry?

2. Literature review

The following section aims to construct an understanding of relevant areas that influence the position and role of *lǎo tóu lè* vehicles. Aspects of urban mobility and road safety in China are discussed, with a focus on Beijing, followed by the development of the automobile industry and e-bikes as contextually relevant. Lastly, the section narrows the focus on the *lǎo tóu lè* vehicle, the recent regulatory change, and the various interpretations of the safety discourse.

2.1. Urban mobility

China's unprecedented urbanization has seen a continuous upward trend since 1980, which has led to more than 900 million people residing in cities as of 2023 (Statista, 2024a; Statista, 2024b). The main city hubs directly represent the leading provinces, with Beijing province having the second-highest urbanization rate at 87.57% (Statista, 2023). While regulations, such as the '*hukou system'*, were imposed to reduce urban migration, this did not address the hundreds of millions of internal migrant workers now residing in urban areas (Trishala, 2023). To meet the population's mobility needs in such highly dense urban spaces, policymakers responded on several fronts of urban mobility, from expanding the city area, developing an extensive public transport network, and investing in the development of the automobile industry (Zhang et al., 2013). The adoptation of bicycles, which later transformed into motorcycles and eventually electrically powered bikes and e-bikes, was also supported by policymakers (Zhang et al., 2013). However, citing traffic safety concerns, increased air pollution levels, and a vested interest in developing the nation's automobile industry, policymakers imposed policies that included a strict ban on motorcycles in the '90s and a forthcoming ban on e-bikes announced in 2002 (Zhang et al., 2013).

During the late 2000s, the major Chinese cities were still facing similar air pollution issues, additional congestion caused primarily by an uptake in automobiles, a still developing public transport unable to meet demand, and growing commuting distances (Wells and Lin, 2015; Zheng et al., 2021). The policymakers' reaction took a turn, this time aimed at limiting parking spots, enforcing a lottery system for acquiring automobiles, promoting public transportation, and shifting positions in supporting the use of bicycles and e-bikes (Zheng et al., 2021; Weinert et al., 2007). Beijing, specifically, reversed its position on e-bikes in 2006, aiming to introduce shared-bicycles programs, bicycle and e-bikes designated lanes, and addressing impediments for two-wheel vehicles which resulted in an abundant production of e-bikes. (Zhang et al., 2013). Importantly, these policies provided only short-term mitigation as the annual increase in automobiles and other vehicle types resulted in traffic congestion reaching levels as high as before the mitigation efforts (Zheng et al., 2021).

As part of the urban mobility umbrella, road safety was and still is an important aspect that consistently affects the livelihoods of China's population, where road accidents are the primary

contributor to deaths for the population under the age of 45 (Wang et al., 2010). Some road users are disproportionately more vulnerable to injuries or deaths, such as pedestrians or users of motorized two- or three-wheel vehicles (WHO, 2015). To put the fatalities into perspective, as per Yuanyuan (2023): "*In 2019, one scooter rider died and five were injured every hour on China's streets"*. Others, such as automobile users, are not only less impacted, but they also disproportionately contribute to the fatalities rate, with studies showing that 92% of road fatality cases in China involve a four-wheel vehicle (Zhang et al., 2012; Wang et al., 2010). Additionally, in comparing risk behaviors in intersections, most traffic conflicts stem from automobile drivers not respecting the right of way and yielding to other vehicles, such as electric bicycles or regular bicycles (Bai et al., 2013). Disparities are also seen across age groups, as elderly Chinese are less likely to injure others, as they tend to drive at slower speeds, not engage in multitasking or distractions while driving, and are slower in merging at crossings (OECD, 2001). From a policymaking perspective, studies highlight the potential effects of increasing road fatalities by implementing policies that aim to reduce the presence of such low-speed vehicles, as per Cherry (2007, p. 153): "*..the impacts from the small percentage of those shifting to cars dominate the impacts and negate most of the benefits of the positive shift to cleaner or safer modes*". Thus, urban mobility in China signals an intricate environment characterized by vulnerabilities and disparities among traffic participants.

2.2. Automobile industry

In order to build a comprehensive understanding of urban mobility and the position of *lǎo tóu lè* vehicles, the automobile development and its industry in China must also be taken into account. The automobile industry has a long history as a pillar industry in China, highlighted in several five-year plans, starting in 1991 with a shift toward developing passenger Internal Combustion Engine Vehicles (ICEVs) (Zhao, 2008). In the 2000s, development policies focused on developing New Energy Vehicles (NEVs), with Beijing being one of the 13 cities initially selected for the 2009 *NEV Pilot Program* (Yang et al., 2015). More recently, the importance of NEVs has been highlighted in the 14th *Five-Year Plan (2021-2025)* and the 2024 *Two Sessions,* where policymakers made references to supporting their development, while encouraging innovation, low-carbon practices, and sustainable development (ADB, 2021; Xiaoying, 2024). The added efforts and automobile-centered policymaking materialized in China's 2023 Gross

Domestic Product (GDP), where clean energy, including NEVs, was the highest economic contributor (Myllyvirta, 2024). Overall, these development policies aim to strengthen China's position as the frontrunner in transforming its economy, including the automobile industry, through sustainable development (Chu, 2021).

The NEV category also includes mini-NEVs, smaller versions of passenger vehicles that have gained attention, given their affordability and convenience (Al Jazeera, 2021). Its starting price is 30.000 RMB and is regulated as an automobile requiring a driver's license, registration, road taxes, and insurance (Junxi, 2024). Policymakers have promoted them as alternatives to *lǎo tóu lè* vehicles, citing their durability as more economical in the long term. This position is in line with NEV policies reaching a stage of strategic deepening, where technological breakthroughs are facilitated and strengthened, as part of China's 2021-2035 industry plans to reshape the automobile industry (Zhou et al., 2020; Wu et al., 2021). The means of reshaping are described well by Chu (2021, p. 1): "*..demand for vehicles will trend toward autonomous, connected, electrified, and shared mobility"*.

Autonomous capabilities, referring to driverless vehicles that can detect traffic, routes, and hazards and adjust their course and speed accordingly, are also highlighted in NEV policies (Wanqing, 2021; Garsten, 2024). Consequently, manufacturers of NEVs and mini-NEVs are heavily investing in developing these capabilities, while support from policymakers is shown in opening certain public roads, such as existing highways, and constructing new roads to cater to AVs' knowledge development (Al Jazeera, 2021; Wanqing, 2021). While this support enables the automobile industry's progress, other vehicles are excluded, as per Yuanyuan (2023): *"China's transportation industry is devoting significant energy to researching and experimenting with highly speculative autonomous driving models, while the hundreds of millions of Chinese who use scooters every day go overlooked*". Adding to the aspect of exclusion, the elderly are predominantly reluctant to adopt AVs due to their technological complexity (Zhao, 2008).

Aside from automobiles, it is essential to note the industry development of e-bikes, which has been growing considerably without extensive policy support and market subsidies (Zhang, 2024). By 2019, the e-bike adoption rate in China exceeded the adoption of EVs by roughly 15 times, reaching a total of 300 million units registered and in use (Weinert et al., 2007; Zhang,

2024); this is close to the total of 329 million units of registered automobiles in China (CEIC Data, 2023). Furthermore, the industry is also present in the Association of Southeast Asian Nations (ASEAN) region, with six Chinese manufacturers listed as best-selling two-wheel models. While this presence captured only approximately 5% of the ASEAN market, it highlights the industry's naturally derived development (Le and Yang, 2022).

2.3. The *lǎo tóu lè* vehicle

The constantly changing policies toward two- and three- wheel vehicles, combined with the evolving needs of the population contributed to the emergence of the *lǎo tóu lè* vehicle, as a low-speed vehicle that shapeshifted from e-bikes (Ling et al., 2019) (see Figure 1). The name and translation is highly representative, as the term *joy* refers to how the vehicle can make a person's day enjoyable by helping them complete all their daily activities, according to Zhesheng (2024): "*They could head to the market in the morning and easily bring back a cart full of fresh produce. In the afternoon, they could pick up their grandchildren from school, and in the evening, they could ferry their spouse to a public square and end a fulfilling day with dancing*". In Beijing, this type of vehicle is highly present among the communities residing in the *hutong* areas, which consist of narrow alleys connecting old residential buildings and historical courtyards in the city center (China Highlights, 2024).

Figure 1: lǎo tóu lè vehicles observed in Beijing's hutong areas (Simion, 2024)

A combination of aspects beyond its usability has led to more than ten million *lǎo tóu lè* vehicles on the streets of China by 2020 (Zhesheng, 2024; Guangming Daily, 2021). These aspects include affordability, as the typical cost ranges from 1.000 to 30.000 RMB, lack of requirements for a driving license, no additional tax road or vehicle insurance, and electrically-powered which provides a cheaper alternative to fossil fuels (Ling et al., 2019; CCTV News, 2023a). However, this affordability came with a cost of safety, as the vehicles typically lack seat belts, airbags, impact-absorbent structural materials, and crash tests are not included in the manufacturing process (CCTV News, 2023a; Li, 2023). Additionally, the *lǎo tóu lè* vehicles vary in size, carrying between two to four passengers and reaching speeds of up to 70 km/h while expected not to exceed 20 km/h (Guangming Daily, 2021; Ling et al., 2019). In more recent versions, the *lǎo tóu lè* vehicles are manufactured as look-alikes of luxurious car brands such as Land Rover or BMW to attract different consumer groups (Hersey, 2016).

The *lǎo tóu lè* vehicle, while a motorized vehicle, even in its variant of an electric vehicle, is not included under the MIIT catalog, which is the precondition to regulate all vehicle types (Zheng, 2021). As early as 2014, the MIIT aimed to regulate the vehicles through a standard of requirements on both manufacturing and road use (Kalinowska, 2021). However, the published standard was not mandatory; hence, manufacturers did not comply with it, and the production and sale of the vehicles continued without modifications, as per Kalinowska (2021): "*As MIIT only started to include electric 3-wheelers into their catalog in late 2014, most of the electric 3-wheelers in use today are not in the catalog and cannot be registered*". Consequently, the distinction of not being included in the MIIT catalog, removes the *lǎo tóu lè* vehicles from the benefits of government programs, subsidies, and policies aimed to develop the industry of passenger vehicles (Yang et al., 2015).

In more recent efforts from 2018, six ministries endorsed a "*Notice on Strengthening the Management of Low-Speed Electric Vehicles*", primarily focusing on strict governance and notably in 2020 when the MIIT released its "*Technical Conditions for Electric Passenger Vehicles*" focusing on safety standards and battery specifications (Guangming Daily, 2021). The mentioned efforts highlighted a temporary inclination toward recognizing *lǎo tóu lè* vehicles as traffic participants and a need to enforce a nationwide standardization and regulation of such low-speed vehicles.

2.4. Regulatory change and discourse

In 2021, the Beijing local government announced that the illegal three- and four-wheel vehicles, namely the *lǎo tóu lè* vehicles, would be banned from the 1st of January 2024 (CCTV News, 2023b; Li, 2023). This included banning the vehicles from using public roads and their production and sale within the jurisdiction of Beijing (Li, 2023). During the transition period, 2021-2024, more than 1.000 collection points were set up across the city, users were directly informed through local authorities, offline posters, social media posts, and a compensation scheme was set to promote an early handover of the vehicles (Zhesheng, 2024). The rationale for the change was based on several accidents, including road fatalities, as per Li (2023): "*For example, a report from Beijing in 2022 revealed that there were 131 fatal traffic incidents involving the vehicles, which resulted in 138 deaths*." Other reports included the same figures, additionally citing that the fatalities of *lǎo tóu lè* vehicles contributed to 10% of Beijing's total road fatalities (CCTV News, 2023b).

As an alternative to the *lǎo tóu lè* vehicles, the local authorities promoted using other means such as public transport, mini-NEVs, shared bicycles, and taxis (Zhesheng, 2024). Additionally, in recognizing the role of the *lǎo tóu lè* vehicles in family activities, a shuttle bus program would be introduced across eight districts to transport students to and from school, in early 2024, with a specially designed electric mini-bus for the *hutong* areas (CCTV News Client, 2023).

Notably, a variation of the *lǎo tóu lè* vehicle, as a three-wheel vehicle, is also used in providing certain public services such as postal delivery, landscaping, and waste management. While these vehicles are still in use following the ban, the vehicles were replaced with versions that comply with standards previously proposed and endorsed by the relevant ministries (CCTV News Client, 2023). Efforts were made by Beijing authorities, i.e. the Municipal Landscaping Bureau and the Municipal Postal Administration, to purchase industry-compliant vehicles, complete the vehicles' registration, and provide driving training to acquire driver licenses for their personnel (CCTV News Client, 2023). Additionally, while not stipulated in online resources, individuals with specific mobility disabilities are also allowed to continue using *lǎo tóu lè* vehicles, with the condition that the vehicles would be powered by fossil fuels. This aspect highlights concerns from policymakers regarding fire hazards from charging the batteries that power the electric version of *lǎo tóu lè* vehicles and e-bikes (Li, 2023).

The discussion on banning or regulating *lǎo tóu lè* vehicles has been divided, which is also visible in the public opinion response both before and after the announcement. In two separate online surveys on the Chinese social media platform, Weibo, the majority of online users supported the ban with 9.463 votes, while 2.214 supported a strengthened supervision of the vehicles, and 337 did not endorse the ban, citing the mobility needs of the elderly (see Appendix 1). Other voices in the field of mobility proposed a series of changes in enforcing production standards, vehicle registration management, drivers' training, insurance systems, and annual inspections of the vehicles (Heng, 2016). As a solution that can beneficially meet the needs of the population and develop the industry, an emphasis is placed on controlling the product supply and preventing illegal products from entering the market (Heng, 2016). Similar restrictions for e-bikes in Shenzhen city also sparked reactions condemning the lack of action taken toward manufacturers and retailers, as per China Daily (2016): "*A ban is the easiest, if not rudest, way of governance*". Collectively, the multiple viewpoints and the different discourse on handling the *lǎo tóu lè* vehicles illustrate a nuanced perception of the regulatory change.

3. Theoretical framework

The research employs two transitions theories to explore the mechanisms and dimensions of shaping the regulatory change of *lǎo tóu lè* vehicles, and its implications toward the livelihoods of the affected population. In addition, and firstly, throughout the research the Critical Realism (CR) theory is applied, given its element of critical inquiry and interdisciplinary compatibility, as such connecting the two theories and seeking to understand the nuanced social and technological phenomena. Secondly, the *socio-technical transition* is used to identify the dynamics between technological change and societal transformation in relation to the position of the *lǎo tóu lè* vehicle. The relevance of this theory is highlighted through its focus on components of innovation, change, and governance, as well as its operability in analyzing large-scale and contextualized small-scale transitions (Nesari et al, 2022).

Thirdly, the model of *human adaptation to transition* is employed to investigate the dimension of livelihoods as a bottom-up response to the socio-technical transition and specifically understand mechanisms of navigating change, stages of change, and short-term and long-term implications (Musamali, 2018). This provides a framework to analyze transitions at an individual level and

uncover needs such as mobility needs, social dynamics, and causal relations. Lastly, the complementarity of the theories is discussed by highlighting how the theories add to each other, with the aim to relay the micro livelihoods dimension to the macro of the socio-technical transition.

3.1. Philosophy of science

Critical Realism (CR) is a post-positivist philosophical perspective, in contrast to the empirical realism of positivists and idealists, offering a nuanced understanding on the nature of reality by asserting that reality exists independent of human perception while also being shaped by it (Bhaskar, 1978). According to Bhaskar (1978), reality consists of three interrelated domains: the empirical, the actual, and the real. The empirical domain refers to the observable phenomena, the actual domain encompasses events and experiences, while the real domain pertains to the underlying structures and mechanisms that generate these phenomena. CR theory posits that while our understanding of reality may be limited by our perceptions and experiences, there are underlying causal mechanisms and structures that operate independently of human observation. Archer (1998) expands CR theory by emphasizing the importance and interplay of social structures and human agency in shaping social reality to add to the understanding of how phenomena emerge and evolve over time. As such, through its emphasis on methodological pluralism and ontological depth, CR offers a robust framework in empirical studies to investigate the complexities of social phenomena and social scientific inquiry, relevant to this research.

3.2. Socio-technical transition

The foundation of understanding socio-technical transitions is grounded in explaining its two components. The *socio-technical* aspect, more specifically referred to as a socio-technical system, refers to recognizing the two-way influences between the systems that are created and the social actors that create those systems (Whitworth, 2008). Their existence represents a joint integration of the social elements that include human actors, organizations, and the technical elements including artifacts of technological components, infrastructure or tools (Whitworth, 2008). Their relation is characterized by interconnectedness as changes in one are reflected in the other in mutual shaping, as societal values may shape the adoption of certain innovations, which in turn can reshape the very same societal values and structures (Whitworth, 2008).

Socio-technical systems are constructed by a combination of rules of regulative, normative, and cognitive nature, which act together to maintain the stability of a system (Nesari et al., 2022). The *transitions* aspect draws from the concept of change as a continuous and gradual process, and from the fields of evolutionary economics, sociology, and theories such as systems theory, governance theory, and system innovations (Geels, 2005; Nesari et al., 2022). Consequently, at its essence a socio-technical transition is defined as a shift from one socio-technical system to another, where a system could represent different key societal domains such as transport, energy, etc. (Geels, 2005).

The socio-technical transition theory developed by Geels (2005), provides a tool of analysis for the dynamics of technological change and social transformation, namely the Multi-Level Perspective (MLP). The MLP highlights interactions between three components that must be identified as a prerequisite for a transition, the landscape, the regime, and niche innovations (Geels, 2005) (see Figure 2). The *landscape* refers to a wider context, such as national or global, that can influence the dynamics in a regime through trends, macroeconomics, ideologies, and/or market opportunity (Geels, 2005). Its relation to the regime acts as pressure that can lead to the regime losing its stability in the face of opportunities for innovation (Hölsgens et al., 2018). The *regime* refers to the set rules, technological forces, and institutions that define the existing socio-technical system, and stabilize the current practices (Geels, 2005). *Niche innovations* refer to somewhat protected spaces, with small networks of actors in which innovation occurs as emerging technology deviant from the dominant regime. The innovations can represent alternatives to the existing regime, and act as catalyzers of the socio-technical transition, leading to new adjustments that become mainstream and dominant, hence replacing the old regime (Geels, 2005). Ultimately, their mainstream adoption can lead to the newly-established regime to influence the landscape, by following development phases of emergence, diffusion, and reconfiguration (Geels, 2005) (see Figure 3). Notably, the socio-technical transition theory is a middle-range theory able to describe both global and local mechanisms; hence allowing for the mobilization of insights from across scales and social science disciplines. As such, the landscape, regime, and niche innovations can be contextualized to a given scale, and positioned accordingly to study the global or national context of a particular region or community (Geels, 2005).

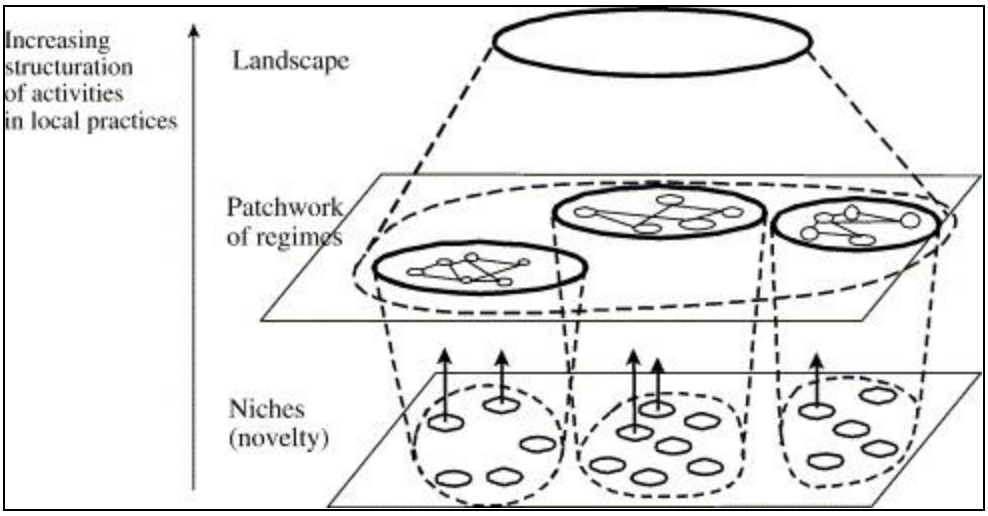

Figure 2: Multiple levels as a nested hierarchy, as per Geels (2005, p. 684)

While transitions theory initially materialized as an explanatory means to socio-technical changes, it also evolved into a policy instrument that can guide the process of achieving desired changes (Wells & Lin, 2015). These are referred to as *transition pathways*, with six potential and different pathways that include both planned and unplanned transitions, according to Geels and Shot (2007); reproduction, transformation, reconfiguration, technological substitution, de-alignment and re-alignment, and sequence of transitions. Due to brevity, this paper will develop two of these pathways as relevant to the research, respectively the transformation path, and de-alignment and realignment. The *transformation* path occurs in the presence of a moderate pressure from the landscape level and of premature niche-innovations. This primes the regime actors to modify, respectively accelerate or reorient trajectories for development of innovation activities (Geels and Shot, 2007). Consequently, new regimes emerge from preexisting ones, meaning the actors within the regime persist, albeit with some alterations (Geels and Shot, 2007). The *de-alignment and re-alignment* path suggests that if regime actors do not believe in change and niche innovations are not sufficiently supported, the existing regime will erode under the pressure of the landscape (Geels and Shot, 2007). The lack of a substitute will lead to other niche innovations to occur, which compete for resources, with one becoming dominant and hence creating re-alignment in establishing a new regime (Geels and Shot, 2007).

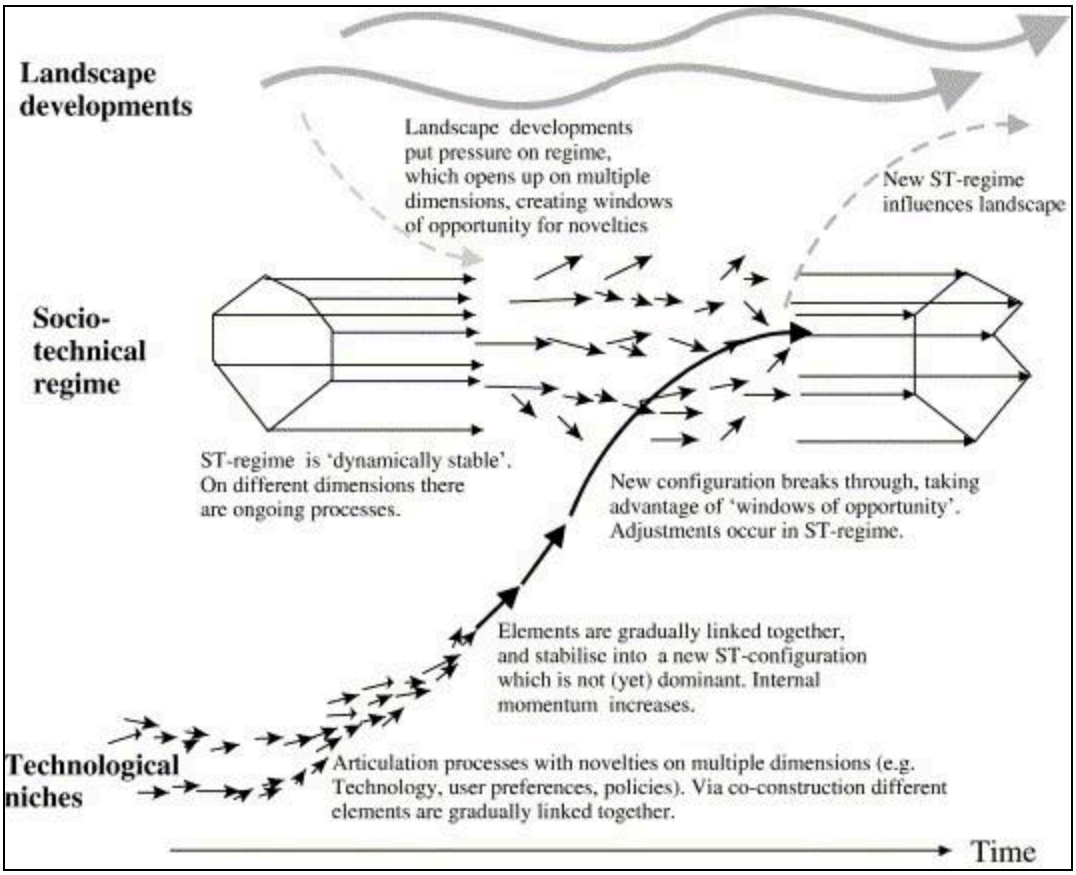

Figure 3: A dynamic multi-level perspective on system innovations, as per Geels (2005, p. 685)

The field of socio-technical transitions currently assumes a central position in guiding sustainability transitions as a means to inform policymakers in following a certain pathway and achieving desired changes of sustainable development (Wells & Lin, 2015). In relation to this, the MLP of socio-technical transitions has been refined, following criticism toward various aspects that include: limited study of agency and autonomy, limited attention to power and cultural meaning, a narrow focus on technological innovation, and imbalance in highlighting social sustainability aspects of inequality, poverty, and working conditions compared to technicalities of environmental sustainability (Transformations to Sustainability, 2019). These criticisms led to a greater emphasis on the role of power relations and shifts between groups, sources of resistance to change, and framing change as appropriate to the cultural setting (Svensson and Nikoleris, 2018). Some pathways also include de-alignment from an existing regime, for example, the regime of extractive industries in which criticisms of unjust transitions led to adopting means of compensation, such as financial, to counter resistance to change and

foster a more just transition (Transformations to Sustainability, 2019). These criticisms have been acknowledged by Geels (2019) while underlying the MLP's openness toward conceptualizing local models, given its middle-range theoretical character.

Lastly, a recurring concern in transitions theory is the limitation of incremental innovation, drawing from ecological modernization theory through its conviction that environmental and sustainability challenges can be solved without transforming the underlying societal structures (Pel, 2020). This concern is highly present in the transportation domain, where innovation efforts of transitions are linked to placing the automobile dependency as a central system to which all other social, infrastructural, and technological derivatives should be transformed (Pel, 2020). While innovations also occur in the system of automobiles, Pel (2020) highlights the power structures of such innovations stemming from the same automobile industry, in its goal of regime continuity, rather than radical transformations from other regimes of reshaping transportation, urban spaces, and mobility management. Such limitations and criticisms are crucial in constructing a comprehensive applicability of socio-technical transition theory and its pathways.

3.3. Human adaptation to transition

An alternative conceptualization of transitions, focused on the position of individuals, is articulated by Schlossberg (1981, p. 5), who defines it as: "*A transition can be said to occur if an event or non-event results in a change in assumptions about oneself and the world and thus require a corresponding change in one's behavior and relationships*". The definition includes the terms of *event* or *non-event*, which refer to the nature of a transition, which are categorized as anticipated, unanticipated, and non-events (Schlossberg, 1981). Anticipated events are expected occurrences in an individual's life that one would naturally expect to experience, while unanticipated ones are unscheduled occurrences typically associated with a sense of loss, and non-events are events that one would expect to occur but did not occur (Schlossberg, 1981). The model draws from crisis theory, which asserts individuals as operating in consistent patterns through habitual mechanisms and problem solving but experiencing discomfort and tension when the regularly employed mechanisms are disrupted (Schlossberg, 1981).

Transitions are complex and multifaceted, varying in their manifestation according to each individuals' personal traits and their surrounding circumstances (Schlossberg, 1981). As such,

Schlossberg aims to describe individual assets in coping with transitions under the dimensions of situation, self, support, and strategy (Schlossberg, 1981). The *situation* refers to the context that initiates the transition, the *self* are personal characteristics that include beliefs, skills, state of health, and socio-economic status. The *support* primarily includes the role of social networks such as family, friends, community as providers of support and resources. Lastly, the *strategy* refers to means of problem-solving in managing challenges, which may include strategies of seeking information, or changing perceptions (Schlossberg, 1981).

The term *adaptation* in relation to *transition* is defined as per Schlossberg (1981, p. 7): "*Adaptation to transition is a process during which an individual moves from being totally preoccupied with the transition to integrating the transition into his or her life*". Factors that affect an adaptation process include role change, such as gaining or losing a role in the social setting, the positive or negative nature of the change, an internal or external source of change, and duration as permanent, temporary, or uncertain; the latter equates to an increased difficulty in adaptation due to the degree of unknown (Schlossberg, 1981). Notably, Schlossberg (1981) places emphasis on recognizing the individual perceptions of what a transition is and when it occurs, based on their own interpretation.

The more recent work of Musamali (2018) draws from several transition authors, including Schlossberg to jointly materialize key components and critically add to a more holistic approach of transitions. As such, providing a transition model namely Kennedy's Integrated Transition (KIT) highlighting two main phases of *deconstruction* and *reconstruction*, under which the stages of disruption, reorganization, integration, and internalization are discussed (Musamali, 2018) (see Figure 4). The connection between the phases begins from an emphasis that transitions begin from a disruption to the status quo, such as routines, roles or relationships. This prompts the necessity for adaptation and restructuring to address the requirements of the change. As a result, the rebuilding process includes activities aimed at integrating and internalizing, which represent blending the restructured assumptions, roles, and relationships into the freshly formed environment shaped by the initial disruption (Musamali, 2018).

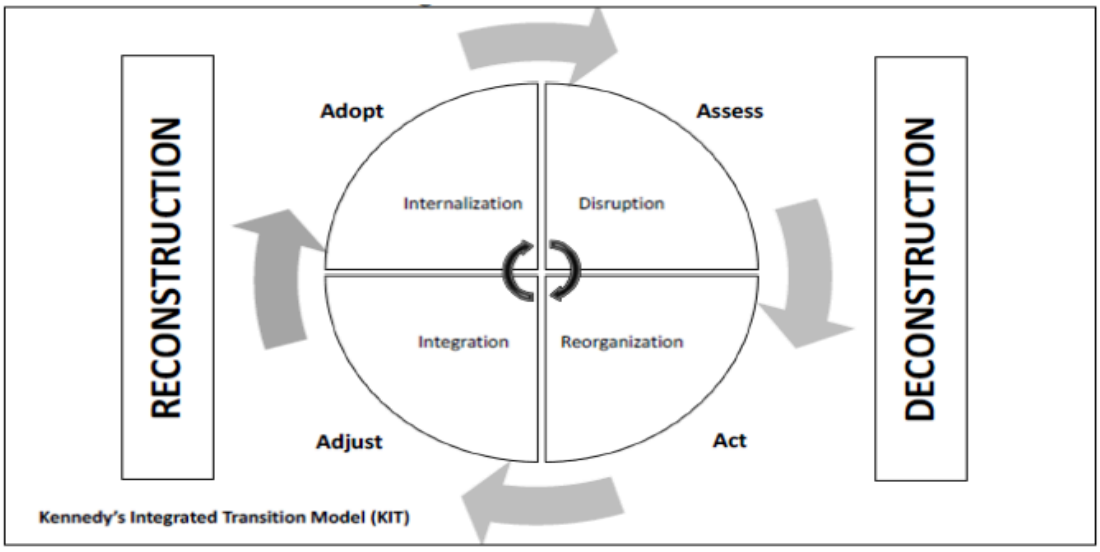

Figure 4: Kennedy's Integrated Transition Model (KIT), as per Musamali (2018, p. 255)

In addition to Schlossberg's (1981) categorization on the nature of events, Musamali (2018) adds a dimension of intensity of disruption which can range from low intensity, to moderate, and high intensity. A *low intensity* disruption causes minimal interruption, and changes for an individual, and so requires marginal adjustments while *moderate intensity* disruptions are characterized as unsettling and influence one's surrounding assumptions and behaviour. Lastly, the *high intensity* disruptions are severe, characterized by a high degree of potential loss and require mobilizing coping mechanisms and social support to facilitate the individual's successful adaptation (Musamali, 2018). As such, the KIT model provides a framework to manage a wide range of transitions at an individual level, with the goal of achieving successful transition outcomes.

The **complementarity** of the two theories materializes across several aspects under the umbrella of transitions. Firstly, the previously mentioned macro and micro level, where the socio-technical theory deals with the *macro* of broader societal, technological, and institutional changes, while the human adaptation theory operates in the *micro* of individual and community experiences. Secondly, the socio-technical describes *structural* mechanisms of policy interventions, industry development, and technological transformations without the added emphasis on individual *agency* and livelihoods, reflected in bottom-up approaches and ground-level ripple effects of the structural dimension. Thirdly, Geels' (2005) theory specifically studies transitions over an extended period of possibly several decades, while the opposite is true for Musamali (2018) in

examining the immediate transition challenges experienced by individuals. In summary, the relationship of the theories is complementary, highlighting the need to bridge the two levels, account for and relay the livelihoods dimension into the socio-technical space, and undertake an interdisciplinary approach based on CR theory to build a more comprehensive, coherent understanding of transition theories.

4. Methodology

The following chapter develops the methodological framework adopted, commencing with a geospatial and temporal description of the study, followed by an examination of research design, data collection methods, and recruitment of interview participants. Finally, the chapter addresses ethical dimensions, encompassing considerations of researcher positionality, data validity, and overarching limitations.

4.1. Area and timeframe

The selection of the relevant site was influenced by my temporary residency in an area of Beijing where such *lǎo tóu lè* vehicles were predominantly present. Specifically, the study covered several such areas, all located within the Dongcheng district of Beijing. This district comprises residential areas referred to as *hutongs* and is generally viewed as a historic area of the city (China Highlights, 2024). As such, the *lǎo tóu lè* vehicles are highly present, given the narrow single-lane streets contrast to the wider roads in newer areas of the city. The total size of the district is close to 40 square kilometers (North South Travel, n.d), and the population is approximately 700.000 residents of Beijing's population of 21 million residents (CEIC, 2022). The streets where the interviews were conducted remain anonymous but are located within the Dongcheng district, primarily in the Beixinqiao and Dongsi subdistricts (see Appendix 2).

The on-site data collection occurred between December 2023 and March 2024. In the early stage, field observations were passively gathered to understand the use of the vehicles, traffic dynamics, and research feasibility. A more intensive collection of field observations began in mid-December 2023, as the implementation of the regulatory change became visible with the occurrence of sites for collecting *lǎo tóu lè* vehicles. The interview outreach was initiated in January and early February 2024, engaging potential participants via multiple channels, as

detailed in the following sections. All semi-structured interviews were conducted from February 24th to April 1st, 2024.

4.2. Research design

The research was conducted through a qualitative approach, allowing for a textured understanding of the subjective experiences to develop an in-depth understanding of the specific context (Bryman, 2012). As the research focuses on a regulatory change, this implies a change in the lived experiences with new aspects, behaviors, or potential challenges arising for those individuals, which can benefit from an exploratory qualitative approach. In addition, the research relies on a multimethod approach to gain different perspectives on the same complex research subject and achieve a triangulation of the data (Bryman, 2012). The multimethod employed involved primary data from field observations, informal conversations, semi-structured interviews with users of *lǎo tóu lè* vehicles, and secondary data from reviews of government documents and strategies, social media platforms, and news outlets. As such, the multiple sources allowed for a triangulation process, which was used to cross-check the data to verify their accuracy.

Under the umbrella of neorealism, a critical realist position is assumed and maintained throughout the research, focusing on constructing reality from the three domains of empirical, actual, and real, as per Alvesson (2017). As such, the empirical that can be observed is aligned with employing field observations, the actual in its broader range is constructed from relevant researchers and literature review, and the real comes primarily from qualitative interviews that can surface other phenomena (Alvesson, 2017). This position aligns with the aim of the study to investigate relations and non-relations, causal effects, and reveal underlying mechanisms while embracing multiple realities.

4.3. Primary data

4.3.1. Field observations

Given my presence in the local area as a resident and a researcher, field observations were initially employed to assess any potential security and safety risks involved in such data collection. This starting point meant initially restricting the observations to simply walking in the

publicly available *hutong* areas and noticing the surroundings while also assessing the impact of my presence; as such, I adopted an incognito degree of self-revelation (DeWalt, 2010). Later on, as I did not encounter any risks, I began writing details of the surroundings and taking pictures of the observed use of the infrastructure and interactions concerning the use of the *lǎo tóu lè* vehicle while following note-taking guidelines from Bernard (2002). This allowed me to observe aspects of parking, traffic participation, charging practices, and the different variants of the different *lǎo tóu lè* vehicles in the natural setting of the local community while not interfering in their organic occurrence, a key aspect in observational research (DeWalt, 2010). Crucially, throughout the entire period of the on-site study, I continued making field observations that added to the notable changes from before, during, and after the regulatory change. This captured the change in traffic participation and the local alternative means of transport that emerged as a response to the *lǎo tóu lè* vehicle ban.

While my presence was visible, it was minimal as locals are regularly exposed to outsiders residing in the same community or visiting the area (China Daily, 2015). In addition, the primary activities of the *lǎo tóu lè* vehicle involved transportation, and as a pedestrian, I ensured not to interfere in deterring their activity. As such, this also presented a limitation, as I could not continuously observe their traffic participation but rather in short sequences in different settings. To accurately recall all field observations, I used my mobile device to take notes and photos, which were later combined, and sorted chronologically.

4.3.2. Semi-structured interviews & sampling

In the process of sampling participants, the purposive typical case sampling method ensured that the chosen cases had relevant experience with the research topic (Bryman, 2012). While purposive snowball sampling was preferred, the method proved inefficient, as respondents did not refer more potential participants. However, given that snowball sampling is primarily recommended in populations where members are difficult to access, this did not pose a challenge given the public-accessible *hutong* areas, familiarized with the presence of foreigners (Bryman, 2012).

Three different scenarios were taken into account for participants: previous owners of *lǎo tóu lè* vehicles required to dispose it, existing owners of *lǎo tóu lè* vehicles able to retain the vehicles

due to physical disabilities, and individuals who had used the vehicle but did not necessarily own one themselves. The latter was included based on field observations of the vehicle used as a taxi service. However, during fieldwork, it became clear that the main category was represented by individuals who had disposed of their vehicles, and vitally, the category of those who retained their vehicles was less open to sharing their experience. The reluctance exhibited by cases of this category may have stemmed from a potential fear of the interview leading to a risk of losing their vehicle. Combined with an overall reduction in ownership of a *lǎo tóu lè* vehicles at the time, the categories became unequally represented (see Appendix 3).

Participants were recruited via social media posts in relevant groups and online forums on Chinese social media, in-person purposive distribution of flyers (see Appendix 4 and 5), and street interactions within the local community. The social media posts were successful only for relevant groups, the distribution of flyers was least successful as individuals were reluctant to scan the QR code listed for contact, and lastly, the street interactions with a mediator proved to be most efficient. Each participant was compensated 50 RMB, except participant no.12, who was a researcher. This compensation was based both on practices employed by other researchers in similar studies in the context of China and was contextually appropriate to the local cultural sensitivity (Hammett et al., 2018).

The aim of the method of semi-structured interviews was to access information related to the lived experiences of the affected individuals and information of a more sensitive nature, which may not be present in official documents, social media platforms, and news outlets (Bryman, 2012*)*. In addition, while the interviews allowed for probing questions on crucial aspects of the research, the open-ended nature of the questions was critical not to bias, steer, or prompt the participants (Bryman, 2012). The interactions were based on interview guides that were designed to establish rapport and employ flexibility in the conversations (see Appendix 6 and 7).

A total of 12 interviews were conducted in different settings: in-person meetings, online video calls, online phone calls, and *hutong* street interactions. Notably, the street interactions had a shorter duration, averaging eight to ten minutes, while the pre-scheduled meet-ups and calls allowed for a more in-depth conversation, averaging twenty to thirty minutes. To mediate the interviews, three mediators were involved on different occasions, and three interviews were

conducted by me directly as the participants could comfortably express themselves in English, a crucial aspect in participants depicting their experiences in a natural, familiar manner (Creswell, 2007). For an accurate recollection of the experiences shared by participants, a mobile device was used as a voice recorder in the least intrusive manner possible, as per Bryman (2012).

4.4. Secondary data

The secondary data for this study was obtained from several categories, including published studies and research, news articles, national strategy documents, international partnerships documents, and secondary statistical data. Their inclusion was based on the added value of complementing the primary data and providing the opportunity for a more in-depth analysis (Bryman, 2015).

Relevant studies and research were used to construct the history and development of the *lǎo tóu lè* vehicle and highlight China's development in urban mobility and road safety (Cherry, 2007; Zhang et al., 2012; WHO, 2015). Notably, Dr. Cherry's work is added to this study as a secondary data source through previously conducted research and a primary source as a participant in a semi-structured interview. A variety of mainly state-operated media was used in understanding the regulatory change, especially from the government perspective, primarily through sources that refer to the government's policy named *Notice on Strengthening the Management of Illegal Electric Three- and Four-Wheeled Vehicles* (CCTV News Client, 2023; Zhesheng, 2024; Li, 2003; CCTV News, 2023b). Lastly, reports from international organizations on China's development strategies and national policies are used for a holistic understanding of policymaking, specifically including several and the more recent *five-year plan* and the *New Energy Vehicle Industrial Development Plan for 2021 to 2035* (Zhao, 2008; Chu, 2021).

A limitation of secondary data is the language barrier in obtaining and using government reports. While this challenge can be overcome through translation tools, the full context can be altered or even lost in the process. As an alternative, reports available in English citing government publications are primarily preferred to ensure an accurate rendering of the information and the presence of key variables (Bryman, 2015).

4.5. Ethical considerations & positionality

A well-designed research positions ethical considerations as central throughout the study, from choosing a site to data collection and analysis (Creswell, 2007). By doing so in this study, I aimed to take a proactive position in anticipating and addressing ethical issues in the respective setting rather than being reactive (Creswell, 2007).

For this study, the context of China with its high level of security and surveillance posed the main challenge in ensuring the anonymity of the participants. While substantial efforts were made to protect participants, the current level of online and offline surveillance made it impossible to fully guarantee anonymity (MIT Technology Review, 2023; US News, 2020). This limitation made it imperative to ensure that participants were well-informed. Based on the ethical guidelines of LUMID and informed by Silverman (2017), I disseminated the information with the mediators to ensure that these standards would be respected, especially in informed consent, voluntary participation, and the ability to withdraw or omit questions. Additionally, while the anonymity of participants was emphasized, three participants preferred to have their names listed as they viewed their role as contributors and displayed a more significant interest in the research (Creswell, 2007). In the case of one individual, I was later made aware that the mediator did not obtain informed consent. Without follow-up contact information, the result was not to use the recording and to discard it, which aligns with otherwise potentially covert practices (Bryman, 2012).

In terms of data collection, some respondents shared opinions beyond the research scope and potentially harmful to themselves. This information was excluded from the transcripts and not accounted for in the analysis to ensure their safety (Bryman, 2012). Furthermore, in transcribing and translating the audio recordings, files were shared only in person via a USB memory stick to decrease the risk of interception. All participants who preferred to not reveal their identity were anonymized and assigned a pseudonym throughout all written mentions, as per Creswell (2007).

My position as a researcher was highly relevant to the research setting. A crucial aspect I identified was that the *field* of study, being the same as the area I resided in, meant I had already been present in the *field* for approximately six months at the start of the research. In this regard, I had already developed preconceptions prior to the research (Creswell, 2007). This was addressed

by adopting reflexivity to examine my judgments, practices and beliefs during the data collection (Creswell, 2007). On specific accounts, I could note how my field observations had been misinterpreted based on my preliminary judgments, later corrected through triangulation in the semi-structured interviews. My relation to the *field* location is also represented by my continuity of residence there following the research. In this regard, I employed guidelines of translocational positionality, referring to the nature of belonging to a range of locations, a given and an acquired national identity, ethnicity, social class, and a national belonging linked to the location of the contextual *field* that I also reside in, and hence a part of (Anthias, 2008).

Additionally, a distinctive characteristic of my position as a researcher in China was my diplomatic status as a Danish diplomat, gained due to my spouse's employment. The implications of this characteristic were two-fold. On the one hand, it offered me enhanced protection against potential risks or repercussions, which may have added to undertaking a more critical position than otherwise allowed. On the other hand, the position of potentially being a person of interest to the local authorities made me more considerate and cautious in how I approached the research. This was reflected in the interview questions as I approached critical questions with caution and in a probing manner, used field observations extensively to assess potential risks before starting the inquiry of interviews, and altered the timeline of interviews to engage governmental institutions only after concluding the interview with the users. The distinctive combination of being a researcher and under a diplomatic status was informed by positionality aspects highlighted by Creswell (2007) to identify the dimensions described above.

4.6. Validity

Ensuring the validity of the research was key throughout the study to support the credibility of the findings. Efforts were made to construct validity in the research instruments and follow strict guidelines for the data collection while capturing the various constructs of participants' experiences. As expected, certain phases proved more challenging in maintaining the same level of validity, such as during the interviews facilitated by a mediator and during the transcribing and translating process (Creswell, 2007). In the case of mediators, despite the initial training, several occurrences of prompting the participants were noted while familiarizing myself with the transcripts. Furthermore, a different mediator who had not been involved in conducting the

interviews was involved in the translating and transcribing process. While this ensured a truthful depiction of the recordings, it also increased the potential for misrepresentations of non-verbal cues, such as pauses, sighs, and tonality, beyond the verbatim transcription (Bryman, 2012). In the analytical process, the transcripts were coded using Insight7, an artificial intelligence-based qualitative research tool, while embedding a deductive approach of pre-set themes in line with the defined theoretical framework and following guidelines of thematic analysis based on Braun and Clarke (2021).

Despite the challenges, by following the research design that employed a triangulation process, potential biased interpretations and understandings were verified against the different sources. Field observations were brought into the questions of interviews, initial interview findings were then added as questions for later interviews, and various aspects from government documents were part of the inquiry of the interviews. This approach was chosen to limit the effect of inaccuracies in gathering data and increase the credibility of the research findings (Bryman, 2012).

4.7. Limitations

Several limitations were recognized throughout the scope of the research, outlined in this section. Firstly, while the regulatory change applies to the entire province of Beijing, including peripheral and rural areas, this study focuses on the urban area of the mentioned *hutong* areas in the Dongcheng district. This is an important distinction, as the use of *lǎo tóu lè* vehicles may differ in other settings and, consequently, the dimensions of transition. Generalization as such is not encouraged, and it is important to emphasize the following distinction, as per Bryman (2012, p.406): "*..the findings of qualitative research are to generalize to theory rather than to populations*". This limitation implies the need for a future study, in the context of rural areas.

Secondly, no access was gained despite efforts to engage with the local government to further inform the governance aspect. In attempting to balance out this limitation, relevant organizations that influence policy-making, researchers, and EV manufacturers were contacted. This resulted in one successful interview with Dr. Cherry, a researcher in the mobility field in China. While this added to the study, it cannot act as a stand-in for the regional government's perspective.

Thirdly, as the interview participants were predominantly male figures, 8 out of 12, the insights are male-dominated and informed primarily from male experiences. This limitation may have also occurred from the cultural setting of men being the primary owners and drivers of automobile vehicles in China (China Daily, 2022). A further presence of intersectionality aspects was noted concerning participants with physical disabilities, 2 out of 12. As such, the study is limited in aspects of intersectionality, feminist perspectives, and the exploration of the multiple social identities of the participants and affected community in depth (Dill and Kohlman, 2012).

Lastly, the effects of the regulatory change may have affected more stakeholder groups and components of urban mobility that have not been included as subjects of study. This includes stakeholders such as manufacturers of *lǎo tóu lè* vehicles, distribution centers, retailers, and components of other means of transport, such as public transport, taxi services, or bike-sharing programs. Engaging with these actors and areas was unfeasible as their inclusion would have required expanding the research scope beyond manageable bounds.

5. Analysis

This section explores the application of the described transition theories to understand the role of the *lǎo tóu lè* vehicle, the livelihoods implications of the regulatory change in Beijing, and explore causal relations to China's development strategies of automobiles and passenger vehicles. The first section employs the application of the MLP framework in understanding the socio-technical transition by delineating the dimensions of landscape, regime, and niche innovations, followed by the role of governance and policy interventions in shaping transition pathways. The second section employs the KIT model to highlight the lived experiences of *lǎo tóu lè* users and their adaptation to the regulatory change as a ripple effect of the socio-technical transition. While the two theories are applied separately, their complementary use aims to study the same phenomena from two dimensions and identify potential discontinuities, between the socio-technical transition as a middle-range theory and human adaptation as a more focalized dimension.

5.1. MLP framework

The MLP framework is used to identify and examine the causal relations between the three dimensions of the nested hierarchy of landscape, regime, and niche innovations, and this section will identify the three as a prerequisite for the analysis of the socio-technical transition (Geels, 2005). The *landscape* is formed by a multitude of forces that act as pressure on the existing regime and includes large-scale societal trends, economic shifts, and environmental factors that enable change and shape a new regime (Geels, 2005). In China, the unprecedented levels of urbanization from the ‘90s to 2000s are mainly rooted in the increased presence of work opportunities in urban areas, which generated a series of pressures on urban mobility and transportation within the main cities. These forces materialized in the shape of growing commuting distances for workers, which increased traffic congestion and deteriorated air quality to substandard conditions (Wells and Lin, 2015; Zheng et al., 2021). The *regime* refers to the existent system, the mainstream and dominant structure, and is expected to change under the pressure of the landscape (Geels, 2005). In this context, the regime is represented by the increased uptake of internal combustion engine vehicles (ICEVs), initially supported as a solution to the growing urban population and used as an economic stimulus (Zhao, 2008). Eventually, the ICEVs led to enhancing the pressures from the landscape by negatively contributing to traffic congestion and air quality. Other means of transport present in the regime, such as bicycles, also came under pressure as they could not accommodate the increased commuting distances, and public transport was still under development (Wells and Lin, 2015; Zheng et al., 2021). The *niche innovations* are characterized as emerging technology with the potential to challenge and disrupt the existing regime's established structures (Geels, 2005). As such, several innovations materialized including motorcycles, e-bikes, *lǎo tóu lè* vehicles, followed by a later emergence of NEVs, including EVs, mini-EVs, and AVs. The three dimensions of landscape, regime, and niche innovations are mapped across the nested hierarchy (see Figure 5).

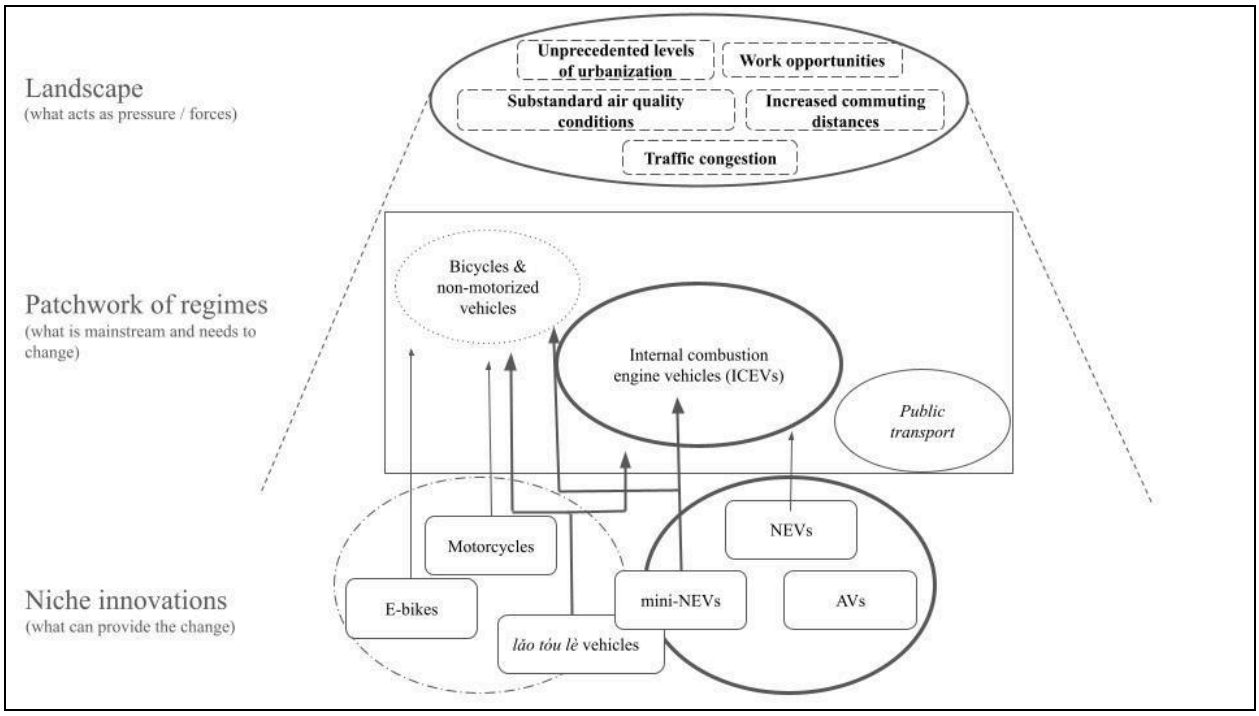

Figure 5: Nested hierarchy mapped of China's automobiles and passenger vehicles socio-technical transition (Simion, 2024)

While according to Nesari et al. (2022), a socio-technical transition is a transition from one system to another, through continuity and technological change, the MLP framework expands on interrogating what innovations emerge, and which ones are protected, nourished and supported by policymakers. In China, automobiles have been the focus of policymakers since the '90s, initially in the form of ICEVs, and during the 2000s through programs aimed to develop the knowledge and technology of NEVs (Zhao, 2008). The need for such programs was initially shaped by energy and environmental pressures experienced by China (Yang et al., 2015). Beyond automobiles, more niche innovations emerged as motorcycles and the *lǎo tóu lè* vehicles. Policymakers were less welcoming to their emergence, and not only were they not protected or supported, but rather the opposite response was noted by banning them, including their later electric versions of e-bikes and EV *lǎo tóu lè* (Zhang et al., 2013).

The lack of support from policymakers did not stop the niche innovations from evolving, as they crucially met the mobility needs of the population in different contexts. Motorcycles and e-bikes evolved from bicycles to address the increased commuting distances and allow users to navigate through and avoid traffic congestion. While initially, motorcycles negatively added to the

deteriorating air quality, their EV adaptation as e-bikes no longer presented this downside. The *lǎo tóu lè* vehicles also evolved to meet similar needs, with the added benefits of transporting multiple people simultaneously and increased stability as a three- or four-wheel vehicles. Multiple variations emerged to address the population's needs, from transporting multiple passengers to transporting goods such as daily groceries, oversized items, and construction materials (see Figure 1). The benefits and role of these niche innovations were also recognized in policymakers' shift to reinstate their use in the late 2000s (Zhang et al., 2013). Initially a niche innovation, e-bikes became an embedded part of the regime as they reached 300 million units in China, almost as many as automobiles, and were included in the MIIT's vehicle catalog (Weinert et al., 2007; Zhang, 2024). However, the *lǎo tóu lè* vehicles did not follow the same development into the regime, as they comparatively reached 10 million units in China (Zhesheng, 2024; Guangming Daily, 2021). The vehicles are excluded from the MIIT's vehicle catalog, which deprives them of any subsidies to facilitate industry development or influence user preferences. Consequently, this removes *lǎo tóu lè* vehicles from development policies aimed at facilitating transitions in the automobile and passenger vehicles industry. Despite these obstacles in its lack of recognition, standardization, and governmental policy protection, the *lǎo tóu lè* vehicles have been able not only to emerge and prevail as niche innovations but also evolve into an EV version. In doing so, the *lǎo tóu lè* vehicle followed the socio-technical transition, and contrary to the automobile industry, it has been able to do so without any facilitation or protection from policymakers.

The recent regulatory change in Beijing, banning the use and manufacturing of the *lǎo tóu lè* vehicle, removes it from the socio-technical transition and its role in the population's needs. The relationship between the regulatory change and NEV policies is present in the alternatives promoted by Chinese policymakers, which include mini-NEVs as passenger vehicles and electric mini-buses as shuttles for the *hutong* areas (Zheng, 2021; Junxi, 2024; CCTV News Client, 2023). The materialization of the ban also comes at a time when NEV policies in China reached a stage of strategic deepening, which also led to a broad cancellation of subsidies for low-mileage vehicles, such as e-bikes, and a standardization of vehicle categories that meet market needs aimed to encourage NEVs' development nationally and globally (Zhou et al., 2020; Wu et al., 2021). This call for standardization was contrary to the variety of designs of *lǎo tóu lè* vehicles, and so given the gray areas of the *lǎo tóu lè* standardization, policymakers chose to ban

rather than regulate and include it in NEV development strategies. The same importance of standardization is also highlighted as a means to ease traffic control, according to Dr. Cherry (2024): *"There's a kind of an order of the road that is the main motivator. Traffic police and others want there to be kind of homogenous traffic that's easy to control. And that basically means cars and transit, right?"*. This contradiction between the presence of *lǎo tóu lè* variations and a desired homogeneous traffic stems from the initial emergence and diffusion of *lǎo tóu lè* vehicles, where in the absence of guiding policies, it was unclear which regime it would replace; the bicycles and non-motorized vehicles, or the ICEVs (see Figure 5). The implications of this contradiction against standardization and homogeneous traffic, are also present in relation to embedding AVs in the socio-technical transition. As AVs rely on training through real-life scenarios testing, harnessing big data, and anticipating traffic conditions, the *lǎo tóu lè* vehicles pose a challenge through their many designs, which evolved away from a standard, when such was not imposed (Kalinowska, 2021). Consequently, the lack of regulation and acknowledgement through defined traffic rules and infrastructure led to a free-will interpretation, making *lǎo tóu lè* vehicles difficult to predict as traffic actors in relation to AVs.

The safety concerns and free-will interpretation of traffic rules of *lǎo tóu lè* vehicle users, such as the right of way or traffic signals, also remarked in field observations, have been noted as reasons for the ban, which consequently led to its removal from the socio-technical transition. While such safety concerns are valid, they are also possibly unfairly attributed to the *lǎo tóu lè* vehicles by describing their traffic participation as unsafe, rather than examining their vulnerability concerning other traffic participants, for example automobiles. The fatalities registered in accidents involving the *lǎo tóu lè* vehicles fail to cite which vehicle is at fault during a collision, especially considering the overall negative contribution of automobiles to road fatalities in China (Zhang et al., 2012; Wang et al., 2010). The distinction between 'unsafe' and 'vulnerable' must be redefined in the discourse of presenting the *lǎo tóu lè* ban as necessary and, more importantly, as the solution to reducing road fatalities. Applying the same discourse can be detrimental in the future, where the increased presence of automobiles will endanger the safety of the more vulnerable groups such as users of e-bikes, bicycles, and pedestrians (WHO, 2015). Upholding this discourse from the position of policymakers positions the regulatory change as an extension and continuation of the initial protective policies aimed to nurture the adoption of

automobiles and their assumed central role in China's socio-technical transition as either ICEVs or EVs.

The action of removing *lǎo tóu lè* vehicles from the socio-technical transition did not equate to the disappearance of the populations' needs. Following the regulatory change, alternatives such as manually-powered tricycles became more present in the *hutong* areas, especially as a means to transport goods. While such vehicles existed before the ban, field observations show several such vehicles in new conditions, implying a recent purchase (see Appendix 8). The same alternative and recent purchase was seen in the vehicle owned by P6, who acquired it as a replacement for the previously owned *lǎo tóu lè vehicle*. Additionally, some variations of the manually powered tricycles shapeshifted to add closed containers for transporting goods, and others became motorized to facilitate the transport of heavier loads (see Appendix 9). Such responses do not align with the expectations and alternatives proposed by policymakers, which may primarily be rooted in equating *lǎo tóu lè* vehicles to passenger vehicles and not accounting for their role in transporting both passengers and goods. Consequently, their appearance indicates an emergence of new niche innovations that can continue to meet the population's needs and highlights the importance of recognizing the value they provide rather than banning their use.

5.2. Transition pathways

The difference in the position of policymakers toward the different niche innovations highlights a shift from the explanatory means of transition theories to a policy instrument that can steer the process of achieving desired changes (Wells & Lin, 2015). It also shows a shift from market-driven niche innovations to policy-driven ones, with the latter characterized by a stronger symbiotic relationship with the existent regime rather than a competitive relationship aiming to replace it. As such, a *transformation* pathway characterizes the socio-technical transition of China's automobile and passenger vehicles industry, where the actors of the existent regime, namely the automobile industry, modify or reorient trajectories for the development of innovations, which materialized in the emergence of NEVs, mini-NEVs, and AVs as replacements for ICEVs. As the new regime grows based on a multitude of adjustments of the old regime, including government policies supporting the existing regime and actors, the emergent innovations add to, rather than disrupt the underlying architecture of the existing

regime (Geels and Shot, 2007). The lack of disruption and the reinforcing influence of the same regime actors are visible in China's continuous challenge to address traffic congestion and poor air quality conditions, where policy responses have mostly provided short-term mitigations, which quickly became overrun by the reinforcing landscape pressures (Zheng et al., 2021). Furthermore, the mentioned challenges and effects observed from adopting a *transformation* pathway also align with the sustainable development approach of ecological modernization, where sustainability challenges are defined as solvable without the transformation of underlying structures (Pel, 2020). This alignment highlights a reinforcement of the same mechanisms, actors, and power structures that constructed the existing regime. Consequently, the transition can only lead to recreating the same challenges under a new version of the same socio-technical regime, as observed in the continued challenges of China's urban mobility.

A different pathway of *de-alignment and re-alignment* is analyzed as an alternative, where the existing regime is eroded and replaced due to landscape pressures, with the emergence of a multitude of niche innovations that compete for resources and ultimately establish a new regime (Geels and Shot, 2007). The pathway is characterized by 'avalanche changes', which emerge from societal shifts such as the rapid urbanization China experienced during the '90s and its knock-off effects of increased commute distances and traffic congestion. These changes created opportunities for multiple niche innovations to emerge and diffuse, such as ICEVs, motorcycles, *lǎo tóu lè* vehicles, EVs, and mini-EVs. Additionally, the government's role in this pathway is to facilitate technological breakthroughs and create opportunities (Geels and Shot, 2007). In this context, such a role would materialize in creating the enabling infrastructure of roads, public transport, designated bike and e-bike lanes, subsidy programs, and vehicle regulation. Consequently, it would cultivate the emergence of multiple niche innovations and allow for their diffusion at different scales, where different innovations would serve different segments of the population. As such, the *lǎo tóu lè* vehicles and their role in primarily serving the elderly showcase the need for a more heterogeneous approach, which can be cultivated through the government's role (Ling et al., 2019). Consequently, new dynamics between the social and technological dimensions, capable of replacing the existent regime through more radical transformations, would emerge and ultimately reshape the socio-technological system of automobiles and passenger vehicles (Pel, 2020). In summary, China's socio-technical transition

could benefit from redefining the government's role in transitions and welcoming a higher degree of receptivity for private means of transport beyond automobiles.

5.3. Human adaptation

This section will follow the human adaptation to transition theory to analyze the data primarily obtained through field observations and semi-structured interviews. The KIT model is employed, with its two main phases of *deconstruction* and *reconstruction*, and their corresponding activities of disruption, reorganization, integration, and internalization, which are developed below, based on Musamali (2018) and Schlosberg (1981). The section aims to highlight the implications of the socio-technical transition to livelihoods and define transitions at the ground level of individuals.

5.3.1. Disruption

The first activity, the *disruption,* is prompted by an act that challenges or changes the status quo of individuals (Musamali, 2018). The disruption in the case of this study is defined as the regulatory change banning the use of *lǎo tóu lè* vehicles. Its nature is categorized as an unanticipated event, given that an individual would not naturally expect such a change to occur in the development of their life (Schlossberg, 1981). Several aspects can add to a better understanding of this categorization, such as similar events that set a precedent in one's life, leading to categorizing it as an anticipated event. However, while several precedents were set during the 2000s policymaker's shift between accepting or opposing the use of *lǎo tóu lè* vehicle and similar means of transport, their occurrence was sporadic rather than systematic (Zhang et al., 2013; Zheng et al., 2021). This pattern of inconsistency in prior policymaking removes the element of predictability regarding such changes, ultimately characterizing the disruption as an unanticipated event.

The nature of the disruption must also be accompanied by a level of intensity, regarding how disruptive or unsettling the influence was on the individual's livelihood. As such, the participants described the disruption of either low or moderate intensity, with distinctive perceptions relating to several factors, including socio-economic status, proximity to family, and state of health. Participants with a higher socio-economic status, which consequently could access other individual means of transport such as an automobile, perceived the change as lower disruption,

as per P1 (2024): "*..if [...] we couldn't live without this, then people will definitely be mad at the government. But now there is a solution and there is money*". For participants with lower socio-economic status, the opposite applied, as they did not possess the financial means to purchase an alternative personal vehicle. However, other factors such as a poorer state of health affected even the higher socio-economic status participants in their ability to maneuver a large vehicle, and their proximity to family showcased that the replacement vehicle could not fully meet their previously met needs, hence still causing a moderate disruption to their livelihoods, as per P11 (2024): *""Because we own a car, so we changed another way. I let their father pick the kids up [..] I don't dare to drive. That is why I bought the lǎo tóu lè vehicle"*. These differences in the participants' perception of the disruption are crucial to acknowledge, as their interpretation of disruption adds to the dimension of successfully navigating the transition process to a successful adaptation (Scholssberg, 1981). As such, the study notes that participants described the disruption experienced across the low to moderate-intensity spectrum.

Disruption is also characterized as a period of assessment concerning what activities and pre-established processes would be subject to change, recognizing the need for change in those aspects and ultimately constructing new expectations of their future outlook (Musamali, 2018). As a prerequisite for conducting such an assessment, being promptly informed about the disruptive change is crucial. While the literature review highlights that the regulatory change was made public at the start of 2021, and multiple communication channels were employed to inform the relevant population, the participants expressed a different, shorter timeline, directly affecting their ability to assess and prepare for the disruption. The earliest recollection is expressed by P7 (2024), who took note of the change from the news channels: "*there is just a posted news in around 2022, and they gave us an interim period, and it will be completely banned until the end of December 2023*". Others became aware of the change later on, once the compensation scheme was made available and authorities informed each *lǎo tóu lè* user in a door-to-door approach, as stated by P1 (2024): "*One day I just took my lǎo tóu lè to go somewhere to meet my friends. Then I saw there is a pink paper behind my lǎo tóu lè*". For some participants, the assessment period was even more crucial as P3 (2024) recounts having purchased a new *lǎo tóu lè* vehicle at the beginning of 2023, without having had the information of the regulatory change, which led to a more difficult transition process due to the lack of a timely assessment period. The assessment period was also affected by the participants' beliefs that the regulatory change would be

arbitrarily enforced and allow some of them to continue making use of their vehicle, based on previous, similar regulations introduced or mentioned toward two- and three-wheel vehicles, recounted by P1 (2024) as: "*I heard about that policy around June (2023), after I just came back from Ulaanbaatar (Inner Mongolia). And I thought that policy is not very strict and we can always use lǎo tóu lè after that.*" Consequently, based on the lack of clarity and timing, the somewhat limited assessment period was reflected in the interview findings, as participants did not express preparations in response to the upcoming disruption but acted once the disruption entered a stage where the regulatory change was visibly present. In turn, the assessment period of deconstructing assumptions and creating new assumptions of their future outlook was shortened or not even present, which prompted participants not to foresee the disruption's ripple effects beyond the aspect of their mobility. Those aspects became visible in the later stages of the transition, continued below.

5.3.2. Reorganization

The second activity, *reorganization,* aimed to minimize distress, facilitate the transition to the new situation, and is characterized as a period of taking action to address the imminent change (Musamali, 2018). During this period, participants took action by using the compensation scheme to return their vehicles, asked for support from their local government, and explored potential alternative transport. The role of the *lǎo tóu lè* vehicle became more apparent in the needs it met as participants recount activities for which they explore alternatives, such as transporting children to and from school, navigating short routes where public transport would be less efficient, making use of healthcare services such as hospital or dentist appointments. P11 (2024) emphasized the need to find a suitable alternative for transporting the children to school and taking action in inquiring for support from the local government on how to reorganize best and meet this need. However, the inquiry was met with a lack of better alternatives, as stated by P11 (2024): "*And I actually called some government departments and asked whether there were any other ways to transport my kids. But they didn't provide any better ways*". Based on Schlossberg (1981), the participant employed, or attempted to employ two dimensions of coping with transitions, which are the *strategy* which in this case refers to seeking information to manage the problem-solving and *support* by accessing resources available in the community.

However, despite the participant's efforts, the transition governance showed that the alternatives proposed could not meet the users' needs to the same extent as the *lǎo tóu lè* vehicle.

Most participants returned their *lǎo tóu lè* vehicles in exchange for financial compensation, which some deemed fair, while others found so unsatisfactory that they refused to return the vehicle. The compensation range obtained was between 200 - 2.000 RMB, depending on the vehicle's state and how early the users returned their vehicles, with the earliest returns compensated most. P1 (2024) recounts finding comfort in the financial compensation, as the initial price for acquiring the *lǎo tóu lè* vehicle was similar to the compensation after having used the vehicle for several years: *"So then we accept it with a very complex emotion. I would describe it like this: the happiness of eating the cake (laughing about the bakery), and the sorrow of losing"*. It is important to note that financial compensation was given in the form of money and food coupons for supermarkets and bakery chains.

In contrast, P3 (2024) acquired the vehicle for 5.000 RMB and was offered 1.000 RMB as compensation, which prompted the participant to refuse returning the vehicle due to the prospect of financial loss. Consequently, the participant continues to own the vehicle without using it and stores it in an underground garage to avoid scrutiny from local authorities. This action is still part of the reorganization activity, aiming to minimize the impact of the disruptive event, which in this case refers to minimizing the financial loss, as such, taking a different form than the expected responses intended by the regulatory change. Based on field observations and following the collection points set up across the city, the far majority of *lǎo tóu lè* vehicles were indeed returned by the end of the transition period, visible in both the lack of traffic participation of *lǎo tóu lè* vehicles and the several collection points where users discarded their vehicles during late December 2023 (see Appendix 11). Following this stage of reorganization, where new constraints are set and visibly present, the KIT model continues with the second stage, the *reconstruction.*

5.3.3. Integration

The third activity, the beginning of the reconstruction stage, *integration*, represents the merging of new and old experiences and is characterized as a period of adjustment concerning the newly created setting (Musamali, 2018). The act of adjustment highlights changes in new routines

formed, gained, as well as lost roles and relationships in the given social setting, such as family or close community (Scholssberg, 1981). As such, all participants refer to a range of changes in their activities, or daily experiences from commuting to work to leisure activities, primarily characterized by a loss of independence. Both P3 and P11 refer to new routines established, primarily by mobilizing support resources from the space of the family, with adults supporting their parents in undertaking travels previously carried out independently and P3 (2024): "*I don't go out anymore. I just walk around. Sometimes my daughter takes me in a bicycle"*. Such routine changes represent both gained and lost roles, especially in the form of caretaking where adults take a more active role in the wellbeing of their elderly parents, and similarly fathers in relation to their children's daily activities, as recounted by P7 (2024): "*Originally, the old people can see a doctor by themselves. But now, you have to ask for a leave to take your father to the doctor*". As shown, these changes may also be characterized as an additional burden that extends beyond the users of *lǎo tóu lè* vehicles and to their immediate families as a response to the loss of independence among *lǎo tóu lè* users.

The importance of Schlossberg's (1981) characteristics of *support* and *strategy* is perhaps even more visible in participants who exhibited a lower ability to compensate for the loss through mobilizing resources within their immediate family and community. Some participants have directly decreased their frequency of visits to family and friends and rely on their spouses' better health conditions to handle daily necessities such as purchasing goods and groceries (P10, 2024). While these participants previously had the same level of poor health conditions, they could at least accompany their spouse to complete daily necessities and participate in social settings (P9, 2024). This indicates a loss in relationships to family, friends and community primarily for the more elderly with the added presence of health conditions impairing their mobility. While field observations confirm that individuals with disabilities are allowed to continue using *lǎo tóu lè* ICE vehicles, the financial burden of transitioning to an ICE vehicle is a direct barrier for some of the users, as the compensation scheme for returning a vehicle does not meet the financial level needed to purchase a new *lǎo tóu lè* ICE vehicle.

Continuing the phase of reconstruction, beyond the role of the *lǎo tóu lè* in activities of transporting children or the elderly, the field observations and interviews uncover and add to the literature on the importance of *lǎo tóu lè* vehicles in transporting goods, primarily over short

distances in the local community of the *hutong* areas; an aspect less recognized by the local government. Participants P5, P9, and P10 used services provided by *lǎo tóu lè* users to transport and exchange gas tanks that power their cooking stoves, as the *hutong* neighborhoods are typically not connected to a centralized gas installation. Given the weight of the gas tanks and the absence of *lǎo tóu lè* vehicles, exchanging the gas tanks has doubled in price as manually-powered tricycles are used as an alternative service, requiring more time and effort. This relatively small change has created a financial burden for the participants as the price difference is significant to their income, and their physical wellbeing does not allow them to perform the task themselves. Other individuals in the community have been observed making use of their bicycles to transport such gas tanks, posing a safety question in doing so, given the limited stability of the bicycle to transport goods (see Appendix 10). The integration of such responses as alternatives to the *lǎo tóu lè* vehicles indicates individuals' ability to adapt to the conditions, integrate alternatives to old experiences, and underlines the importance of the *lǎo tóu lè* as a means of transporting goods.

5.3.4. Internalization

The fourth activity, and final in the reconstruction stage, *internalization,* refers to a sense of stability created following the transition, where an equilibrium is restored, and routines, behaviors, and relationships are adopted in their new form (Musamali, 2018). The sense of stability for some participants appears as the ability to construct new routines that rely on other means of transport, lean on peers for assistance, or accept certain experiences as no longer achievable. P1 recalls the *lǎo tóu lè* as more than a vehicle, present in facilitating daily tasks but also creating family traditions such as exploring the neighborhood together, elderly and young, or respecting Chinese traditions of preparing cabbage (*'bai cai'*) for the winter time, given its ability to transport sizeable goods. As such, the internalization activity allows the individuals to reconcile with the sense of loss, as stated by P1 (2024): "*So this year we just cut off this activity. It's a pity for me, because for me it's like some happiness disappeared because of the disappearance of the vehicle*". Other participants may not have reached or accepted the internalization activity, given that P3 chose to maintain possession of the *lǎo tóu lè* vehicle, which suggests an incomplete process of adaptation to the transition.

Important aspects of the adaptation process include providing a clear understanding of a change, including the reasons for which it occurs, and determining if the change is temporary, permanent, or uncertain (Schlosberg, 1981). Both interview participants and informal conversations reveal a degree of uncertainty and a sense of hope for the *lǎo tóu lè* vehicles return in a well-regulated, licensed, and legal form, which also aligns with previous policy recommendations that suggest regulation instead of banning (Cherry, 2007). The uncertainty of the change is also visible in the literature review, highlighting the continuously changing position of policymakers toward two- and three-wheel vehicles, which may act as a reinforcing sense of hope and unknown for *lǎo tóu lè* users (Zheng et al., 2021; Weinert et al., 2007). This aspect may have also added to the incomplete adaptation process noticed in the case of P3, given their choice to retain the vehicle, which implies a belief of reintroducing the use of the *lǎo tóu lè* vehicle in the future. Furthermore, while the argumentation of the change presented from the government was consistently citing concerns of traffic safety, many participants did not understand this reasoning. When discussing traffic incidents, several participants did not view the *lǎo tóu lè* as inherently more unsafe than other type of vehicles, as per P7 (2024): "*You think about it, cars, trains, planes, which one don't encounter accidents? So is the lǎo tóu lè. Most of the time they can't cause accidents. Old people couldn't drive that fast.*" The incorporation of the safety dimension, also as a perceived safety, reveals that users of *lǎo tóu lè* vehicles exhibit a heightened sense of safety when utilizing such vehicles compared other means of transport, for example e-bikes. This aspect contributed significantly to the initial adoption of *lǎo tóu lè* vehicles (Ling et al., 2019).

The section highlights the multifaceted nature of the transition process triggered by the regulatory change banning *lǎo tóu lè* vehicles. Participants experienced varying degrees of complexity in adapting to the new mobility landscape; some could navigate the transition with relative ease, while others faced significant challenges in accessing alternative means of transport and maintaining their daily routines and social connections.

6. Discussion and results

The findings of applying the transition theories in relation to the *lǎo tóu lè* vehicles and the recent regulatory change in Beijing highlight several insights into the socio-technical transition of China's automobile industry and its implications for the affected population. The two theories

used highlight the different dimensions of analysis, the macro level of technological transitions, and the micro level of individuals and their responses. The aim of using the two theories as complementary, is to inform and draw attention to how socio-technical transitions materialize as disruptions to livelihoods, which should be proactively considered in the transition process to adequately support the affected population. Ultimately, this can lead to reshaping the transition by redefining the transition pathways and desired changes, by accounting for the population's needs. As such, the use of the theoretical model in combination with the findings results in expanding the socio-technical transition theory by adding the dimension of livelihoods. The following section describes the observed effects concerning *lǎo tóu lè* vehicles and its users, through the proposed theoretical model, and offers recommendations to policy response as part of China's automobile and passenger vehicles socio-technical transition.

Firstly, in highlighting the lived experiences of *lǎo tóu lè* vehicle users, the study suggests that previously met mobility needs have been affected to the extent which limit the population's ability to fulfill daily tasks and decrease their ability to self-provide for their necessities. The elderly users are more directly affected, as they lack socio-economic resources to adapt to the transition, bear different degrees of disabilities or reduced mobility, and consequently rely more on family and community resources. The alternatives proposed by policymakers raise questions of practicality and economic viability, as the affected population mainly uses the *lǎo tóu lè* vehicles for short-distance travels, and they are far more affordable than alternative private means of transport (Ling et al., 2019). Despite the compensation scheme made available, users have a considerable financial gap to acquire a vehicle to meet the needs previously fulfilled by the *lǎo tóu lè* vehicles. Such discrepancies are specifically observed for individuals with disabilities, who, despite being allowed to continue using a *lǎo tóu lè* vehicle, cannot bear the financial burden of transitioning from an EV to an ICE *lǎo tóu lè* vehicle, as required by new regulations. Consequently, the study suggests a compensation scheme that directly equates to the financial burden created by the regulatory change to facilitate the purchase of ICE *lǎo tóu lè* vehicles or mini-NEVs and ensure their presence in the socio-technical transition.

Secondly, the ban on *lǎo tóu lè* vehicles underscores the potential advantages of adopting a regulatory framework as an alternative approach, as ultimately, the vehicles reappear in a different form, such as non-motorized tricycles and further adaptations with cargo capabilities

and motorized versions. Their long-standing role in meeting the population's needs, affordability, and suitability in navigating narrow roads of *hutong* areas are undeniable assets for the communities. Historically, previous ban efforts have also proven impractical (Zheng et al., 2021; Weinert et al., 2007). As such, this study suggests an alternative of extending the proven ability of authorities to enforce and adopt regulations, as shown by the Municipal Landscaping Bureau and the Municipal Postal Administration, in becoming industry-compliant (CCTV News Client, 2023). Furthermore, by extending the regulations industry-wide, the affected population could rely on safe vehicles, traffic congestion may decrease, and the industry of two- and three-wheel vehicles could be included in the socio-technical transition.

Thirdly, the socio-technical transition and its operationalization as a policy instrument has led to an arbitrary implementation of support from policymakers prioritizing some niche innovations over others. This approach contradicts the mechanisms of socio-technical transitions as it no longer allows for multiple innovations to compete and succeed in establishing a new regime. Instead, this has shifted toward equating policymaking support with ascending the given innovation into the existing regime, which embraces ecological modernization theory and removes the possibility of more radical but also naturally emerging pathways. Ultimately, the early-vested interest of policymakers derived from a transformation pathway extends to assuming a protectionist position of the automobile industry and implementing policies that remove regime-destabilizing innovations, such as banning *lǎo tóu lè* vehicles. Consequently, this study suggests the need for a shift away from such operationalization of socio-technical transitions and for policymakers to move toward facilitating and enabling technological breakthroughs, which can lead to more successful transitions. Alternatively, the landscape pressures that initially triggered the need for a transition, such as substandard air quality conditions, traffic congestion, and increased commuting distances, will continue to exert their presence in the 'newly' established regime, thus reducing the benefits of the transition.

Lastly, the operationalization role of the socio-technical transition has also shifted the process of emergence, diffusion, and reconfiguration toward a process in which the best-fitted niche innovation prevails over the others, across multiple regimes, contradictory to the proposed relations by Geels (2005). As such, the roles fulfilled and the value created by the competing innovations become disregarded or unaccounted for. Consequently, once a niche innovation

trumps the others, the needs previously met by the now ‘inferior’ innovations will ultimately no longer be met, nor met to the same extent. This aspect is visible in the disparity between the alternatives proposed by policymakers to meet the needs of users of *lǎo tóu lè* vehicles, where the role of the vehicle in, for example, transporting goods was unaccounted for and hence unaddressed. Consequently, this study suggests a need to better take into account the presence of multiple niche innovations, account for their roles, and ultimately allow for their diffusion rather than attempt to replace them with the prevailing innovations.

7. Conclusion

This study aimed to explore the regulatory change in Beijing, banning the use of *lǎo tóu lè* vehicles. It focused on understanding the mechanisms of transition and adaptation employed by the affected individuals and offering an explanatory component in connection to development strategies as part of China’s socio-technical transition. The study uncovered several key insights presented above, with implications that can hopefully serve as recommendations for policymaking and ultimately lead to a more inclusive and constructive response. Lastly, this study aims to add to research on urban mobility, the automobile and passenger vehicle industry, socio-technical transitions, and individual adaptation to transitions. Ultimately, it aspires to inform local and national actors in China to acknowledge the needs of the affected population and provide further responses to protect their livelihoods.

Several areas of further studies are encouraged, firstly in formulating an alternative response to the ban of *lǎo tóu lè* vehicles there is a need to gather insights toward an effective strategy of regulating the vehicles and including services needed to stimulate the participation of the affected population. Secondly, as the study uncovered transition changes that go beyond the directly affected users of the *lǎo tóu lè* vehicles, it is encouraged to further study the reach and implications of the given changes in the broader context of families, local communities and extended social circles, to explore further ground implications of the socio-technical transition. Thirdly, the study primarily concentrated on the socio-technical transition of the automobile and passenger vehicles industry, engaging the stakeholder groups of users and policymakers. It is encouraged to add to this limited scope by including manufacturers of *lǎo tóu lè* vehicles, distribution centers, and merchants together with components of public transport.

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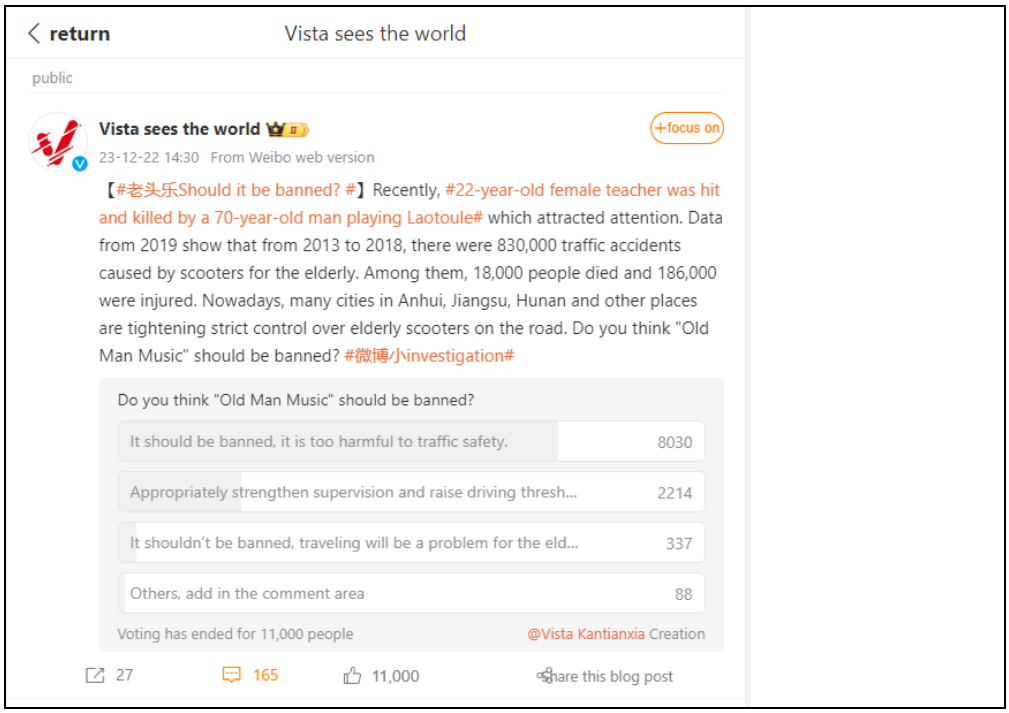
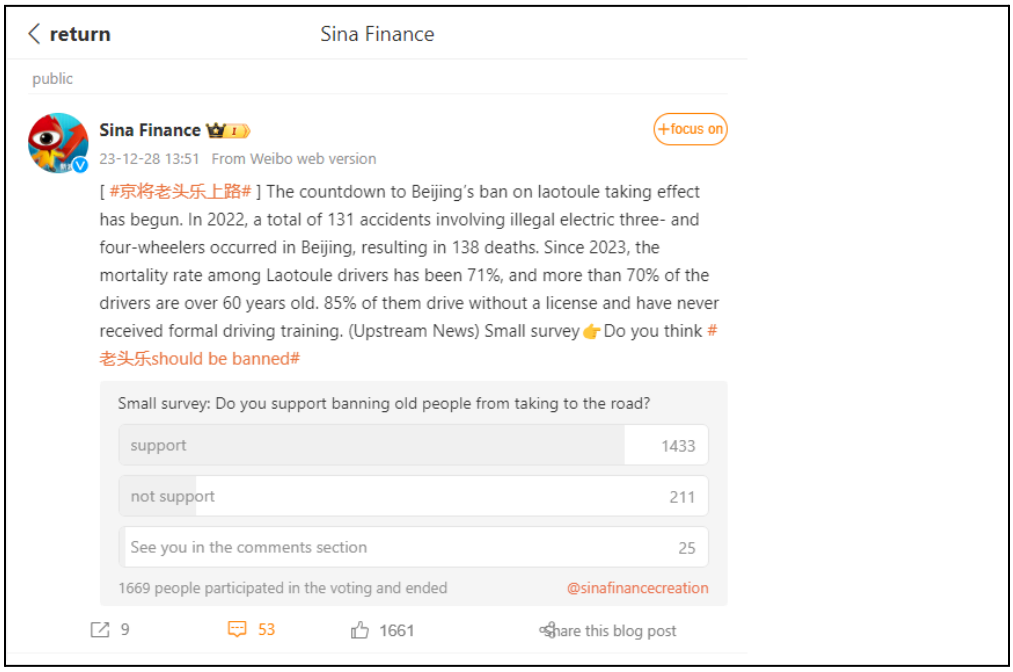
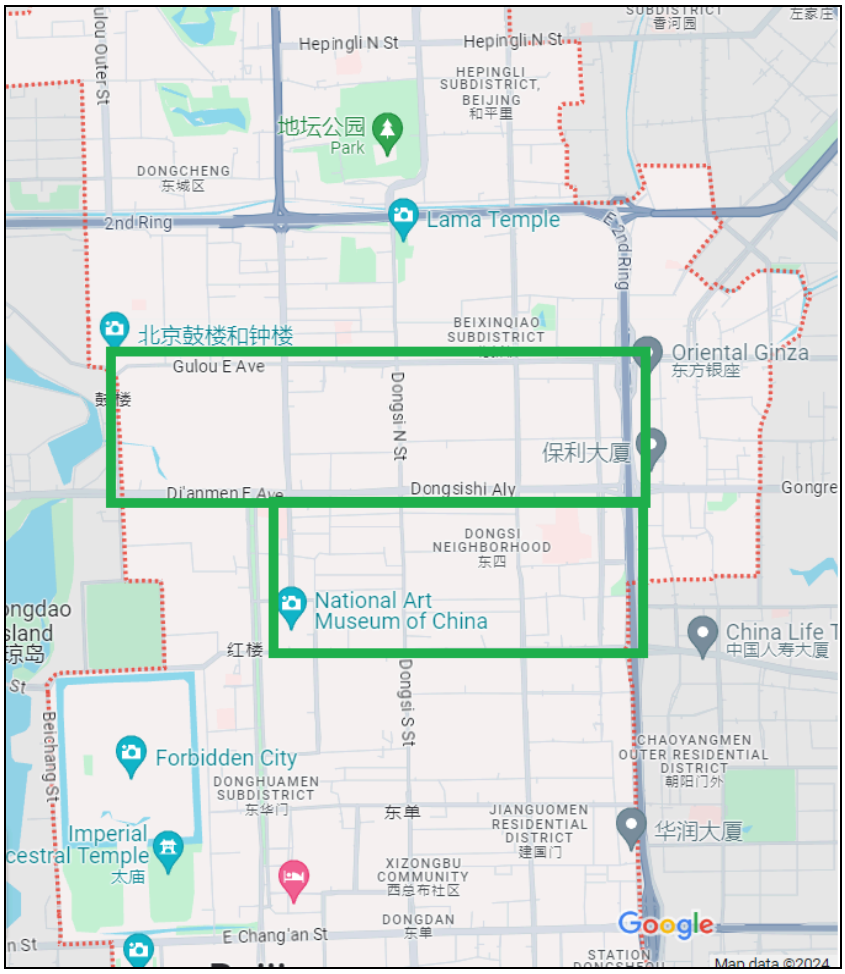
9. Appendix

Appendix 1 - Weibo social media surveys of user's perspective toward *lǎo tóu lè* vehicles





Appendix 2 - Google Maps delineation of hutong areas covered during data collection



Appendix 3 - Interview respondents

Number	Name	Assigned pseudonym	Sex	Category	Occupation	Interview language	Interview date (2024)	Interview location
1	李芳瑜 (Fangyu Li)	P1	Female	Previous owner	Student	English	24th of February	In-person meeting
2	赵一诺 (Zhao Yinuo)	P2	Male	User	Student	English	8th of March	In-person meeting
3	N/A	P3	Female	Previous owner	Retired	Chinese	13th of March	Street interaction
4	N/A	P4	Male	User	Retired	Chinese	13th of March	Street interaction
5	N/A	P5	Female	User	Retired	Chinese	13th of March	Street interaction
6	N/A	P6	Male	Previous owner	Retired	Chinese	13th of March	Street interaction
7	N/A	P7	Male	User	Retired	Chinese	14th of March	Street interaction
8	N/A	P8	Male	Existing owner	Retired	Chinese	14th of March	Street interaction
9	N/A	P9	Male	Previous owner	Retired	Chinese	20th of March	Street interaction
10	N/A	P10	Male	Previous owner	Retired	Chinese	20th of March	Street interaction
11	N/A	P11	Female	Previous owner	Housewife	Chinese	15th of March	Online phonecall
12	Dr. Chris Cherry	P12	Male	Researcher	Researcher	English	1st of April	Online videocall

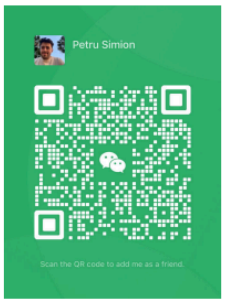
Appendix 4 - Flyer used for recruiting participants (EN)

Do you own, or have you owned, a *lǎo tóu lè* vehicle / tricycle? Share your experience and you will be paid 50.

My name is Petru Simion (西米) and I am a student researcher from an international university. I am interested in the initiative to ban the use of *lǎo tóu lè* vehicle / tricycles in Beijing from 1 January 2024 onwards. I am interested in talking to citizens who still own such vehicles or who owned them before the law was implemented. I would like to hear about your experiences and ask a few questions about how this initiative has affected you.

If you are an owner, former owner or know someone who is, please add my WeChat account (Delasator_) and contact me directly.

We can arrange a meeting (in Chinese) that will last about 30-40 minutes. Each participant will be paid 50 RMB. Thank you!



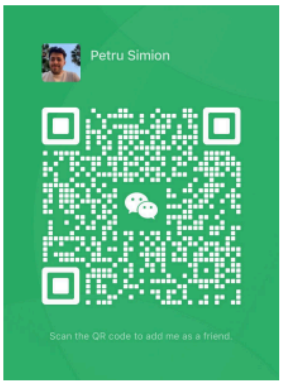
Appendix 5 - Flyer used for recruiting participants (CN)

您是否拥有或曾经拥有过一辆 老头乐/三轮车？分享你的经历，你将得到50 元的报酬。

我叫 Petru Simion (西米) 我是一名来自国际大学的学生研究员。我对 2024 年 1 月 1 日起北京禁止使用老头乐 /三轮车的倡议很感兴趣。我有兴趣与仍拥有此类车辆或在法律实施前拥有此类车辆的市民进行交流。我想听听您的经历，并就这一举措对您的影响提几个问题。

如果您是老头乐的所有者、前任所有者或认识相关人士，请添加我的微信 账号 (Delasator_)并直接与我联系。

我们可以安排见面交流（中文），大约持续 30-40 分钟。每位参与者将获得 50元的报酬. 谢谢!



Appendix 6 - Interview guide with previous/existing owners and users (EN, CN)

Audience: Previous owners of vehicles

Before the law change

EN

1. What was the purpose of using your vehicle? Try to think of some specific days and describe the main activities you would use your vehicle for.
2. How frequently did you use your vehicle?
3. What were the advantages about owning and using this vehicle?
4. What were some of the disadvantages?
5. Did other people in your household also use your vehicle, or did you use it together with someone else?
6. Do you have a driving license? If yes, when did you get your driving license?
7. Did you suffer any crashes or injuries from using the vehicle?

CN

1. 您使用老年代步车的目的是什么？试着想一想具体的日子，并描述一下您使用车辆的主要活动。
2. 您使用车辆的频率是多少？
3. 拥有和使用这辆车有什么好处？
4. 有哪些缺点？
5. 您家中的其他人是否也使用您的车辆，或者您是否与其他人一起使用？
6. 您有驾驶执照吗？如果有，您是何时获得驾驶执照的？
7. 您在使用车辆时是否发生过碰撞或受伤？

During the change

EN

1. How did you feel when you found out that the vehicles would be limited?
2. What is your knowledge about this ban/prohibition?
    a. *Potential follow-ups:*
        i. Why do you believe the vehicles were limited?
3. How did you prepare for the change?
4. What did you do with your vehicle?
    a. *Potential follow-ups:*
        i. What was the procedure of disposing of your vehicle?
        ii. How did you find out about this procedure?
        iii. How did you feel about the financial compensation for the vehicle?
5. What was the support you received from the local government on making this change?
    a. *Potential follow-ups:*

i. Do you know about how the local government is supporting new means of travel for people like yourself?
ii. What do you think of the school buses made available, as a replacement?

CN

1. 当您得知车辆将受到限制时，您有何感想？
2. 您对这一禁令/禁止有何了解？
    a. 可能的后续问题：
        i. 您认为为什么要限制车辆？
3. 您是如何应对这一变化的？
4. 您如何处理您的车辆？
    a. 可能的追问题*:*
        i. 处理车辆的程序是什么？
        ii. 您是如何知道这一程序的？
        iii. 您对车辆的经济补偿有何感想？
5. 当地政府对您做出这一改变给予了哪些支持
    a. 可能的后续问题：
        i. 您知道当地政府如何支持像您这样的人使用新的出行方式吗？
        ii. 您对用校车作为替代有何看法？

<u>After the change</u>

EN

1. How have activities in your life changed since you no longer have the vehicle?
    a. Potential follow-ups:
        i. How are you able to perform the same activities as before?
        ii. How have your routines changed?
        iii. Is there anything you can no longer do or you miss doing?
        iv. Did you suffer any financial loss?
2. What transportation means do you use instead of your vehicle?
3. Do you own or use any other types of vehicles (*car, bike, others*)?
    a. Potential follow-ups:
        i. Do you intend to buy one?
4. How has your relation and contact with friends or family changed?
    a. Potential follow-ups:
        i. Do you meet the same people as much as you used to?
        ii. Do you have grandchildren? If yes, how often do you get to see them? Do you get to see them as often as before?
5. How is your state of health, and physical wellbeing in relation to traveling?
    a. Potential follow-up:
        i. Do you have any physical disabilities that impede your mobility?

6. How do you feel about the change now? To what extent are you satisfied with your new way of life?

CN

1. 不再拥有该车辆后，您生活中的活动发生了哪些变化？
    a. 可能的后续问题：
        i. 您还能进行与以前相同的活动吗？
        ii. 您的作息时间有什么变化？
        iii. 有什么事情您不能再做或您怀念做的吗？
        iv. 您是否遭受了经济损失？
2. 除了老年代步车，您还使用什么交通工具？
3. 您是否拥有或使用任何其他类型的交通工具（汽车、自行车或其他）？
    a. 可能的后续问题：
        i. 您打算买车吗？
4. 您与朋友或家人的关系和联系发生了哪些变化？
    a. 可能的追问题：
        i. 您是否像以前一样经常与同样的人见面？
        ii. 您有孙辈吗？如果有，您多久能见到他们？您能像以前一样经常见到他们吗？
5. 与出行相关的健康和身体状况如何？
    a. 可能的后续问题：
        i. 您是否有任何妨碍行动的身体残疾？
6. 您对现在的变化感觉如何？您对新生活方式的满意程度如何？

<u>Demographics:</u>

EN

1. What is your age?
2. What is your job?
3. What is the monthly income of your household (CN¥)?
    a. Less than 5.000
    b. 5.000 to 10.000
    c. 10.000 to 15.000
    d. 15.000 to 20.000
    e. More than 20.000
4. Is there anything else you would like to tell us about the limiting of these vehicles?

CN

1. 您的年龄？
2. 您的职业？
3. 您的家庭月收入是多少？(CN¥)

a. 低于 5.000
b. 5.000 至 10.000
c. 10.000 至 15.000
d. 15.000 至 20.000
e. 超过 20.000

4. 关于老年代步车的限制，您还有什么要告诉我们的吗?

Existing owners of vehicles

Additional questions:

EN

1. How were you able to keep your vehicle?
2. What was the procedure?
3. How did you find out about this procedure?
4. Are there any changes in how you use your vehicle?
    a. *Potential follow-ups:*
        i. Any specific activities that have changed?
        ii. Do you use the same routes as before?
5. How did your friends or close community react to you still being able to use this vehicle?
6. Do you know other people who also kept their vehicle?

CN

1. 您是如何保留车辆的？
2. 程序是什么？
3. 您是如何知道这一程序的？
4. 您使用车辆的方式有什么变化吗？
    a. 可能的后续问题*:*
        i. 有什么具体活动发生了变化？
        ii. 您出行的路线仍和以前一样吗？
5. 您的朋友或邻近社区对您仍然可以使用这辆车有什么反应？
6. 您是否认识其他也保留了自己车辆的人？

Appendix 7 - Interview guide with researcher (EN)

Theme 1: *Area of work /role*

1. What is your current position/title?
2. What field/area of interest do you work with?
3. What is your connection to the field of international development in China?
4. What are some more specific projects that you are/were involved in in relation to China?
5. Have you participated in projects that also influenced policies?
    a. If yes, please share details.

Theme 2: *China's NEV (new-energy vehicles)*

1. What is your knowledge of China's strategies to develop NEVs?
2. How would you describe the field of Electric Vehicle (EV) adoption in China?
3. How would you describe the field of urban mobility in China?
4. What are some of the current and future challenges in these fields?

Theme 3: *lǎotóulè (*老头乐*)*

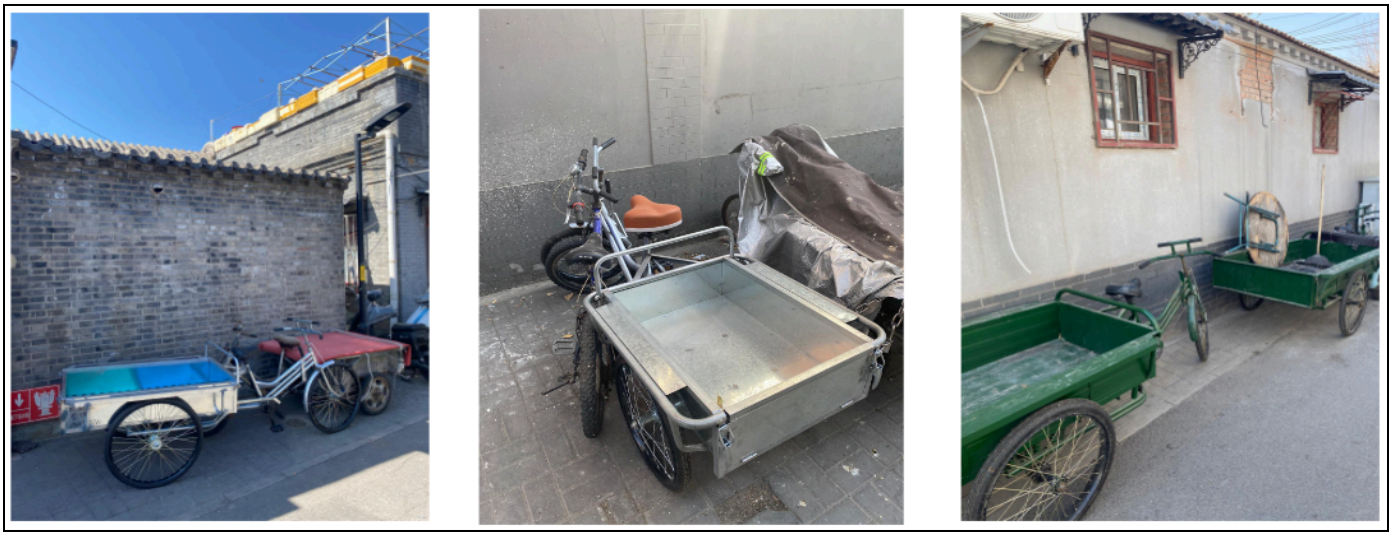
1. What is your knowledge of the *lǎotóulè* type of vehicles in China?
2. What do you see as some of the advantages they offer?
3. What are some of the disadvantages?
4. How do you believe some of these disadvantages could be changed or improved?

Theme 4: *lǎotóulè regulation*

1. What is your knowledge of the recent ban on the *lǎotóulè* in Beijing?
    a. What is your knowledge of the use *of lǎotóulè* in other provinces?
2. What do you believe is the reason for the regulation change?
3. How does this regulation change compare or link to some of your research on the use and role of the *lǎotóulè*?
4. What approaches could have potentially been adopted in comparison to banning the use of such a vehicle?
5. Given the somewhat lengthy history of the *lǎotóulè,* why do you believe the regulation change came at this point?
6. What relations would you identify between the regulation of *lǎotóulè* vehicles and China's development of NEV?

Appendix 8 - *lǎo tóu lè* vehicles in *hutong* areas, following the regulatory change

8.1 Manually-powered *lǎo tóu lè* vehicles, in new conditions (transport of goods)



8.2 Manually-powered *lǎo tóu lè* vehicles, in new conditions (transport of goods and passengers)

Appendix 9 - Manually-powered *lǎo tóu lè* vehicle with closed container (transport of goods)

Appendix 10 - Elderly man transporting a gas tank by bicycle

Appendix 11 - Example of collection point of *lǎo tóu lè* vehicles, situated on the main road adjacent to one of *hutong* areas covered in the research