Accelerating sustainable mobility and land-use transitions in rapidly growing cities: Identifying common patterns and enabling factors

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Abstract

Urban growth has been increasing rapidly across the globe, in particular in low and middle-income developing countries. As city populations and GDP per capita rise exponentially, cities tend to experience similar challenges related to urban development and transport/mobility.
One of the most problematic issues emerges when urban growth drives car-oriented urban development. This is characterised by a range of unsustainable patterns such as low-density development, urban sprawl, lack of plans and infrastructure to accommodate collective transport and active travel, and significant efforts and investments to meet the demand for private motorised vehicle use. For emergent cities, the risk is that these developments lead to highly inefficient, unhealthy and unsustainable urban systems that are difficult to remedy.
This paper aims to identify recurrent governance and policy factors across sectors, as well as macro factors, that tend to contribute to car-dependent urban mobility systems in rapidly growing cities. It draws on qualitative and quantitative research findings from five under-researched Eastern European and Middle Eastern cities: Tallinn, Bucharest, Skopje, Adana and Amman. Data examining the evolution of urban mobility in these cities were collected as part of the Horizon2020 EU funded project CREATE.
The paper investigates the extent to which car-dependent urban development processes can be avoided in rapidly growing cities, to support transitions towards liveable and sustainable cities. Finally, it provides policy recommendations targeting growing cities with low levels of car- use, in particular in Sub-Saharan Africa. It highlights the importance of acting swiftly to achieve targets such as the Sustainable Development Goals, the New Urban Agenda or the Paris Agreement, by supporting policies fostering efficient, sustainable and inclusive urban mobility and land-use across sectors and levels of governance.

Keywords

Sustainable urban development; Mobility; Transport; Urban planning; Urban transition

1. Background

This paper aims to identify recurrent governance and policy factors across sectors, as well as macro factors, that tend to contribute to car-dependent urban mobility systems in rapidly growing cities. It draws on qualitative and quantitative research findings from five Eastern

European and Middle Eastern cities: Tallinn, Bucharest, Skopje, Adana and Amman. It investigates the extent to which some of these factors are preventable.

1.1 Global context: fast urban growth

Urban growth has been rapidly accelerating in developing economies[1], in particular in low-income, lower middle income and upper middle income countries[2] such as Jordan or Turkey (Babalik-Sutcliffe, 2017; UN/DESA, 2014). In 1950, only 30% of the world's population lived in cities[3] (United Nations, 2018a). In contrast, by 2050 close to 70% of the world population are projected to live in urban areas (UN, 2018).

In a context of rapid urban growth, small size cities are rapidly turning into medium size cities, which in turn are quickly becoming large size cities which are subsequently morphing into megacities (United Nations, 2018b). This change is particularly rapid in low and middle-income countries across the Global South[4] (United Nations, 2018a). The global share of African urban residents is projected to increase from 11.3% in 2010 to 20.2% by 2050 (UN Habitat, 2014). This trend is driven by population increase and by rural-urban migration patterns (UN, 2018). The climate crisis[5] is likely to further accelerate urban migration as rural economies and livelihoods are increasingly affected by extreme climatic and environmental changes that threaten the reliability and availability of natural resources and ecosystem services (Foresight, 2011; Stapleton et al., 2017).

1.2 Achieving sustainable urban growth

Unless urban development processes, in particular in rapidly growing cities, are sustainable, efficient and inclusive, major international targets, such as the United Nations' (UN) Sustainable Development Goals (SDGs), the New Urban Agenda (NUA) and the Paris Agreement on climate change, will not be achieved (Burdett et al., 2018; Parnell, 2016). One of the definitions of sustainability this paper draws on is the "Improvement in the quality of human life within the carrying capacity of supporting ecosystems" (IUCN et al., 1991). In relation to urban development, sustainability occurs when economic, social and environmental conditions lead to improved human activity and well-being without compromising the ability of future generations to experience the same.

Sustainable urban growth or development, as defined by international agreements, is characterised by multiple goals, targets and indicators. Amongst these, SDG 11, that aims to make cities "inclusive, safe, resilient and sustainable", lists a range of objectives, such as safe and affordable housing, participatory planning, climate resilience and climate change mitigation in urban areas. Fostering sustainable urban mobility and the integration between transport and land-use planning is key to ensuring sustainable, efficient and inclusive urban development.

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[1] As defined by the World Economic Situation and Prospects (WESP) (UN/DESA, 2014)
[2] As defined by the World Economic Situation and Prospects (WESP) (UN/DESA, 2014)
[3] Defined by the United Nations as urban settlements with 300,000 inhabitants or more (United Nations, and Department of Economic and Social Affairs, Population Division, 2018)
[4] Here the term Global South refers to developing economies and economies in transition, as defined by the World Economic Situation and Prospects (WESP) (UN/DESA, 2014)

[5] The term climate crisis refers to climate change, or global warming, and the unsustainable depletion of natural resources due to human activities on planet earth.

1.3 Decoupling economic growth with car-use levels

Evidence indicates that as cities become wealthier, car ownership and car-use levels tend to quickly increase, especially in developing countries (Babalik-Sutcliffe, 2017; International Transport Forum, 2012; Pojani, 2011a). Beyond the statistical correlation lies a range of complex political, economic, urban, cultural, social and psychological factors that explain this change (Hirt, 2013; Pojani, 2010; Pojani et al., 2017; Stead et al., 2008).

Automobile dependence in cities has been examined by numerous authors (Newman and Kenworthy, 2015). However, limited literature has explored the underlying patterns, particularly those related to the (lack of) policies, that contribute to accelerate car-dependence in fast-growing cities, especially in Eastern Europe and the Middle East (Stanilov, 2007). This paper aims to contribute to this gap in the literature.

In this paper, car-dependent or car-oriented urban developments are defined as urban development processes, driven by demand and public policies, that rely on, and lead to, high or growing levels of car-use (a car being understood as a private motorised vehicle/automobile). This contrasts with sustainable mobility and place-making processes, often characterised by the use and implementation of alternative sustainable modes of transport/mobility (such as collective transport or active travel) and use of public space (Banister, 2008; Jones, 2014).

This is deeply problematic as car-dependent developments in large urban areas almost invariably lead to a range of negative externalities and side effects, as illustrated in Fig. 1 below. These go against achieving the SDGs and climate agreements and harm the life of millions of urban residents throughout the world.

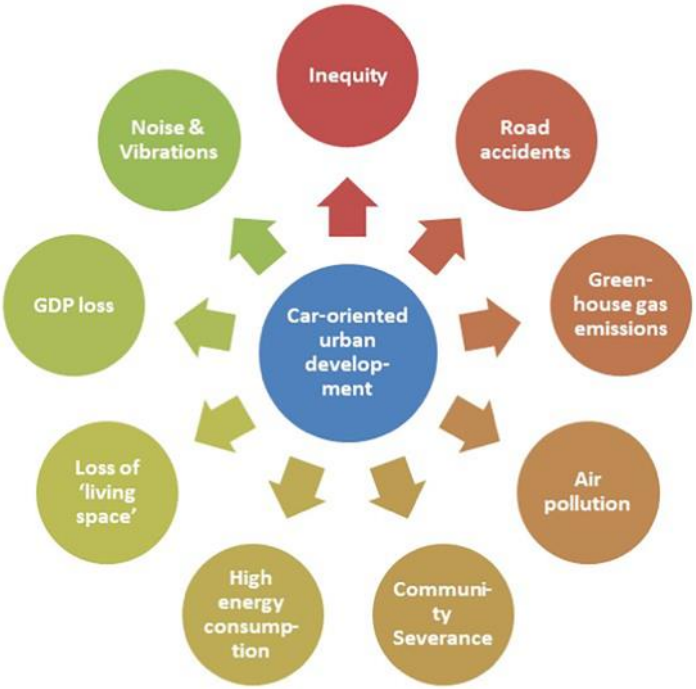

Figure 1 Negative externalities associated with car-oriented urban developments

Fig. 1 above illustrates some of the most problematic issues linked with car-oriented urban developments. These developments contribute to the generation of extremely serious environmental and health issues, including C02 emissions (Hickman and Banister, 2013), air pollution (EEA, 2008), road accidents (WHO, 2018) and sedentary lifestyles with correlated health issues (Bassett et al., 2008; Rojas-Rueda et al., 2011, 2012). Car-dependent urban

developments also contribute to sprawl and an associated increase in energy consumption (Loo, 2018), social exclusion and spatial segregation (Anciaes et al., 2016). These lead to inequality, poor accessibility and affect socio-economic development (Jones and Lucas, 2012). Another side effect of car-oriented developments is an increase in congestion as car-use levels exceed urban spatial capacity (Cervero, 2013; Litman, 2013). This has a negative impact on local economies and indirectly the economy of a country (Schrank et al., 2015).

1.4 Literature review

Whilst these issues have not yet been widely researched in low-income countries, particularly in Middle Eastern and African cities, there have been numerous studies undertaken in various eastern European cities, particularly in Tirana (Pojani, 2011b) and in Sofia (Hirt, 2007). Patterns highlighted and described by numerous authors (Babalik-Sutcliffe, 2017; Hirt, 2013; Kolega, 2018; Pojani, 2010; Pojani et al., 2017; Stead et al., 2008) indicate that in eastern European countries:

- Transport policies have been considerably affected by the political and socio-economic changes engendered by the collapse of the Soviet Union. Until the end of the 1980s, public transport in eastern European countries was frequent and affordable, whilst private vehicles and fuel was expensive. As a result, car-use was limited.
- In the 1990s, the quality and quantity of public transport services started to decrease, whilst in parallel, public authorities invested significantly to improve and expand road infrastructures to respond to the demand for car-use. In addition, restrictions to vehicle imports were lifted and polluting second-hand vehicles flooded the market. As GDP per capita increased, the demand for car ownership and car-use rocketed. Behavioural changes also explained this change, as private motorised vehicles became a symbol of social status and freedom. Subsequently, the reliance on car-use accelerated.
- Concomitantly, population growth swelled in cities due to rural-urban migration, which was especially significant in peri-urban residential areas. This ‘urban ruralization’, as referred to by Hirt (2007), was often driven by car-dependent middle-class households relocating to the outskirts of the city.
- This led to a series of issues, such as congestion, urban sprawl, pollution, gender inequality, and a modal shift from public to private transport, traffic accidents and increased energy consumption.
- Under Communism, urban land was owned and controlled by the state. Cities tended to be denser, more compact and had higher accessibility to basic services (e.g. education & healthcare). On the other hand, since the post-socialist transition, cities experienced rapid urban sprawl. The proliferation of low-density developments is partly explained by the fact that land was privatised and building regulations were relaxed, and by the dependence on car-use.
- Poor transport planning also contributed to car dependency in these cities. Lack of urban plans and transport strategies, combined with a lack of resources to implement plans, are stressed in the literature.

Numerous parallels can be drawn with urban development patterns observed in burgeoning cities in Asia and Africa (Kutzbach, 2009; Rode et al., 2017; Seto and Shepherd, 2009; Watson, 2009). Pieterse and Parnell (2014) refer to the ‘urban transition’ experienced throughout Africa and highlight the various associated challenges. The increase in semi-formal collective transport, which was significant in post-communist cities, has been widespread across African cities (Klopp and Cavoli, 2017, 2019). Similarly, the growth of informal settlement that “sprang up to fill the void in affordable housing for poorer rural migrants” (Babalik-Sutcliffe, 2017, p. 249) was identified in numerous eastern European and Middle Eastern cities and is well documented in the context of Global South cities, including in Sub-Saharan Africa (van Ballegooijen, 2019; Tsenkova, 2009).

1.5 Objectives and outline

Rapidly growing cities still have opportunities to establish alternative urban development pathways following key principles for sustainable, inclusive and efficient urban development (Pojani, 2011a, 2011b). Addressing and preventing car-oriented urban developments is crucial to create liveable and sustainable cities. To do so, a deep understanding of the patterns that lead to car-dependent developments is needed. This paper aims to provide additional evidence to the debate by identifying the factors that have led to car-dependent developments in five eastern European and Middle Eastern cities: Tallinn, Bucharest, Skopje, Adana and Amman. It investigates the extent to which some of these factors are preventable and makes specific policy recommendations targeting decision-makers in fast growing cities, especially across the Global South.

First, the paper outlines the methods used and describes the case study cities. Second, it summarises key findings drawing on a cross-city comparison. Third, it discusses the extent to which car-oriented urban developments are irreversible and the potential for low-income cities to establish alternative developments. Finally, it provides policy recommendations and draws conclusions.

2. Methods

This paper draws on findings from the Horizon2020 EU funded CREATE project that assesses evolutionary processes related to urban mobility in 10, mostly capital, cities across Europe and the Middle East. In the context of this project, qualitative and quantitative data were collected and collated in 5 rapidly growing cities: Adana, Turkey; Amman, Jordan; Bucharest, Romania; Skopje, Republic of North Macedonia; and Tallinn, Republic of Estonia. This data collection was undertaken in collaboration with each local authority. The aim was to assess past, present and future urban mobility challenges and opportunities in each of these cities and to identify common patterns.

The five case study cities were selected following a ‘most different systems design’, a method often used to identify similarities and differences in different cases (Faure, 1994). This research aims to identify potential convergence between the five case study cities in relation to the evolution of urban mobility and urban planning processes.

The five cities have significant cultural, geographical, demographic and climatic differences. Tallinn, Estonia is located in northeast Europe; Bucharest, Romania and Skopje, North Macedonia in southeast Europe; Adana, Turkey and Amman, Jordan in the Middle East (as illustrated in Fig. 2 below).

Figure 2 CREATE cities. Source: http://www.create-mobility.eu/

The city of Amman has over 4 million inhabitants and the city of Adana has over 2 million. Bucharest has over 1.8 million inhabitants whereas Skopje has over 500,000 and Tallinn circa 400,000. The five cities have very different climatic and topographic conditions. Amman, famous for being built on seven hills, is an undulating city with a semi-arid climate. Adana, constructed along the Seyhan River, is mostly flat and has a hot-summer Mediterranean climate with humid summers. Bucharest is mostly flat with moderate elevation in several areas and a humid continental climate. The city of Skopje is built along the Vardar river and has a continental sub-Mediterranean climate. Tallinn is a flat city bordering the sea with a humid continental climate and cold snowy winters. The five cities experience very different socio-cultural and political situations. Four of them (all except Adana) are capital cities, and major political, financial, cultural and educational centres in their country. Estonia, Romania and the Republic of North Macedonia were communist countries until the late 1980s. Estonia and Romania are now part of the European Union (EU) and the Republic of North Macedonia has been a candidate for joining the EU since 2005. Adana is one of largest cities in the Republic of Turkey, located close to the border with Syria, and the capital city of Amman has been welcoming refugees from neighbouring countries for over five decades.

As illustrated in Table 1 below, public and collective transport facilities vary from one city to another. Tallinn, Bucharest and Skopje have a relatively expansive network of publicly operated transport facilities whereas Amman and Adana mostly rely on an extensive network of privately operated buses of various sizes.

Table 1 Source: (Cavoli, 2018).

Public & collective transport facilities in the five case study cities.					
Public & collective transport facilities	**Adana**	**Amman**	**Bucharest**	**Tallinn**	**Skopje**
Publicly operated buses (number of vehicles)	293	200	1,147	412	428
Privately operated	419		Data not available	Data not available	206

buses (number of vehicles)		11,390 (mostly minibuses)			
Privately operated minibuses (number of vehicles)	1,085		Data not available	Data not available	-–
Trolley buses (number of lines)	-–	-–	15	4	-–
Underground (number of lines)	-–	-–	4 (71.14 km double track, 47 stations; 1 line under construction)	-–	-–
Tram/Light rail (number of lines)	1 (13.5 km 13 Stops)	-–	24 (286 km)	4	-–
Total kilometres of bicycle lanes	The city does not have cycle routes for commuters. It has cycle lanes for leisure; 40.5 km in total	-–	Approximately 19.02 and 2.2 km of bicycle lanes under development	273	2 km bicycle lanes (80 km bicycle paths)

Several methods were used to collect and analyse data from the five case study cities. First, quantitative and qualitative data were collated in each city following common themes/indicators from a topic guide (see *Annex A*), such as data about transport demand and vehicle ownership, economic or demographic data. The data provided by each local authority (in the context of the CREATE project) came from official sources, such as European, national or local statistics, or primary data collected by local authorities. Second, one focus group involving circa 15 key stakeholders across sectors and levels of governance was undertaken in each city discussing various transport and urban planning issues (see topic guide in *Annex B*). The participants were carefully chosen as stakeholders representing different key sectors in each city. A range of experts, who all demonstrated a deep understanding of their city's past, present and future transport and urban planning took part in the focus groups. Each focus group lasted 2 h on average and was conducted in the local language (further information available in Cavoli, 2018).

Third, a cross-city comparison was undertaken examining past, present and potential future opportunities and challenges linked with urban mobility and planning in the five case study cities. To cross-analyse findings, a framework matrix was established (see *Annex C*). The matrix is divided into main themes and sub-themes which were systematically cross-analysed to compare and contrast content. Thematic content analysis and coding methods were also applied using computer software NVIVO for qualitative data analysis. For further details about the methods used in the context of the CREATE project are available in Cavoli (2018).

Furthermore, the discussion session draws on work undertaken as part of the GCRF ESRC funded project T-SUM, Transitions to Sustainable Mobility and Land-use in Sub-Saharan African Cities. This project aims to identify the conditions under which pathways to sustainable and inclusive transport and land use development can be accelerated in growing cities in the Global South, taking Maputo and Freetown as case study cities.

2.1 Differences between eastern European cities and Middle Eastern cities

The socio-economic context and institutional frameworks are significantly different between eastern European countries and western European countries (Stead et al., 2008). Similarly, a more refined analysis of the study's data indicates that there are differences between the 'post-communist' eastern European cities of Bucharest, Tallinn and Skopje and Amman and Adana, as summarised in Table 2. Urban growth has been much less rapid in Bucharest, Tallinn and Skopje, and public transport systems are much more developed in these cities. These differences need to be taken into account when formulating specific recommendations addressed to other cities. Structural and socio-economic conditions (e.g. including whether a city is flat and dense or not) are likely to influence the implementation of sustainable urban mobility solutions in different cities (Pojani, 2011a).

Table 2 Regional differences in the five case study cities.

Regional differences in the five case study cities		
Key differences between regions	**Post-communist cities – Tallinn, Bucharest, Skopje**	**Middle Eastern cities – Adana, Amman**
Urban growth and urban sprawl at the metropolitan level	Gradual urban growth at the metropolitan level, at the outskirts of the city	Sudden and substantial growth due to the waves of migrants and refugees
Land-use and density	Due to the privatisation of land post-communism, public authorities have less control over land-use and density	In Turkey, density requirements are established at the national level and strictly enforcedIn Amman public authorities control land-use but there is limited enforcement
Public transport network	Extensive public transport network that was established during communism but failed to be updated post-communism	Private transport operators (often informal) still constitute the backbone of the transport system
EU influence	Heavily influenced by EU policies, in particular Tallinn and Bucharest	Amman is influenced by oil-rich countries investing in highway infrastructures

3. Results

This section highlights some of the most common factors that have contributed to car-dependent developments across the five case study cities. Fig. 3 provides an overview of the majority of the factors. The figure draws on the study's findings. It highlights the key topics that have emerged from the qualitative and quantitative thematic analysis. This section then offers additional details illustrating some of these factors.

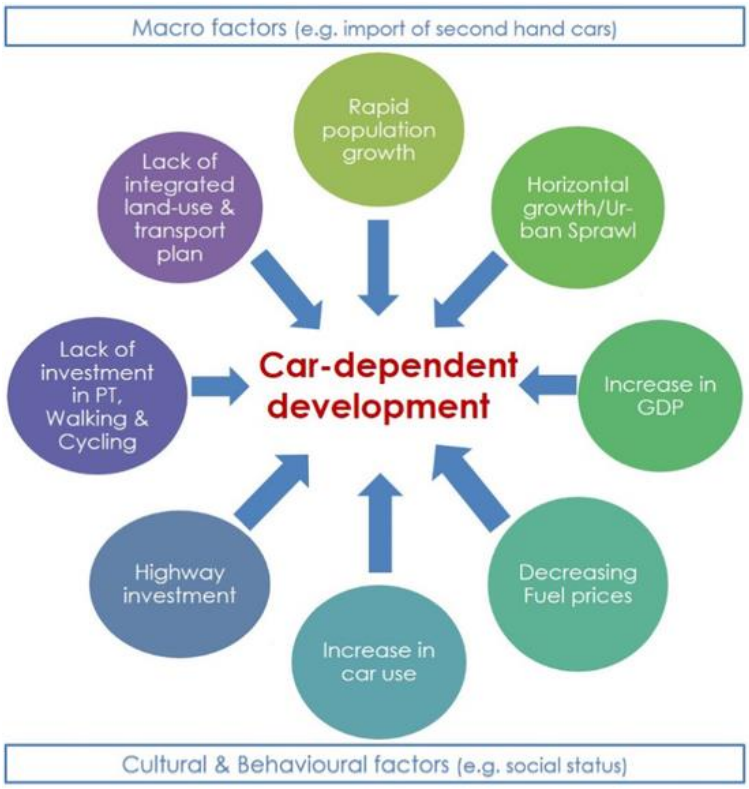

Figure 3 Factors that tend to contribute to car-dependent development processes

The results of this study indicate that some of the most common factors contributing to car-dependent development include (in no particular order): rapid population growth, horizontal growth, an increase in GDP per capita, and a decrease in fuel prices. In addition, certain macro factors, such as the import of cheap second hand cars, coupled with strong cultural and behavioural factors, in particular social status issues, have also contributed to an increase in car-use levels in these cities. Public authorities have tended to respond to this demand for car-use by investing in road infrastructures targeting private motorised vehicles. In parallel, there has been a lack of investment in alternatives to car-use, such as public transport, cycling or walking. Furthermore, various urban planning issues are salient, in particular the lack of integration between transport and land-use (as further described below). The results section of this paper describes some of these issues more deeply.

3.1 Rapid urban growth and urban sprawl

In the five case study cities, over the past four or five decades, urban growth has significantly increased. Continuous rural-urban migration flows, coupled with sharp immigration influx in some countries, has led to fast expanding metropolitan areas. Although in some of these cities urban population has increased dramatically (most strikingly in Amman), what the five cities have experienced in common is 'horizontal growth' or urban sprawl, in particular at the outskirt of each city.

In Amman and in Adana, urbanisation rates rose sharply following the start of the Syrian civil war in 2011. This growth was particularly significant in Amman, which went from 2 million inhabitants in 2002 to 4 million in 2015 (see Fig. 4 below). Skopje also experienced sharp population growth in the 1990s and early 2000s due to the influx of refugees during the Yugoslav wars in Slovenia, Croatia, Bosnia and Kosovo. However, in the case of Bucharest and Skopje, population has remained stable or has tended to decrease in the city centre but has continued to rise in the metropolitan area (which is not illustrated in the figure below as

the data obtained was limited to the city). This trend is partly caused by the re-location of inhabitants from the city centre to the city's suburbs and peri-urban areas.

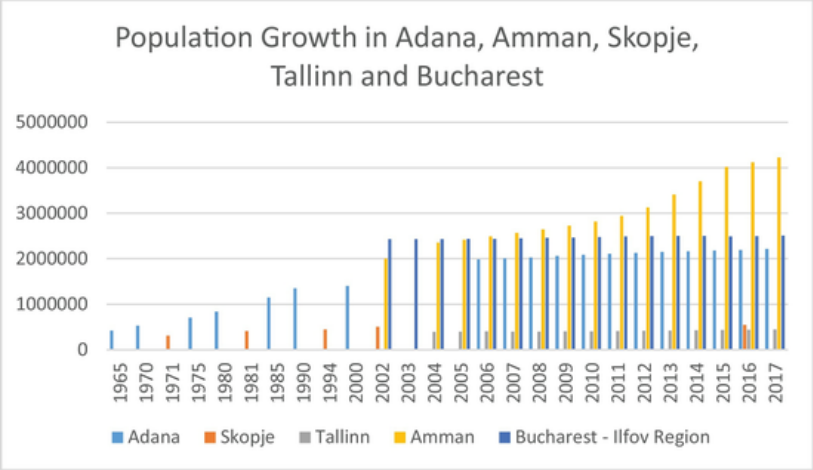

Figure 4 Evolution population in Adana, Amman, Skopje, Tallinn and Bucharest since 1965. Source: Cavoli, 2018. Vertical axis: Population (in millions); Horizontal axis: year.

In the five case study cities, focus group participants made references to 'unmanaged urban growth'. Public authorities in Adana and in Amman have had difficulties responding to the growing demand for housing and transportation since the 2010s; "Naturally the government could not provide for all these people", describes a participant in Adana and numerous "informal settlements started to mushroom around the city". Referring to the sudden growth of population in the late 1990s, participants in Skopje made similar comments, highlighting the fact that public authorities were not "prepared" for this sudden growth in population.

The rapid urban growth experienced in the five case study cities led to an unplanned mushrooming of the cities. Fig. 5 below illustrates the changes in land-use experienced by Adana between 1984 and 2000. Unplanned urban sprawl was highlighted as one of the most problematic issues linked to transport across the five case study cities. "It is when transport problems started", recalls a participant in Adana. This unmanaged urban sprawl increased pressure on transport networks creating daily pendulum flows from the suburbs to the city almost exclusively reliant on car-based movements.

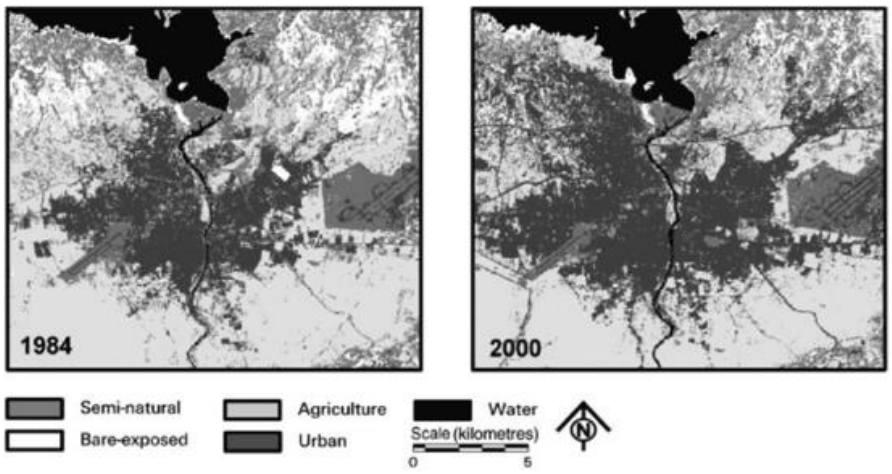

Figure 5 Land use changes in Adana. Classified images showing Land-use Land-cover categories of the study area in 1984 and 2000. Source: Alphan, H. (2003) Land-use change and urbanisation of Adana, Turkey. Land Degradation & Development.

3.2 Common urban planning issues

'Unmanaged urban growth' issues have contributed to, and have been accentuated by, urban planning issues across the five case study cities.
First, general urban plans and local transport plans (or equivalent) have not been recently updated in most of the cities looked at (as highlighted in Table 3 below), despite some significant changes, such as increase in urban population. Second, another issue common across all five case study cities is the lack of co-operation between metropolitan, in some cases regional, and local urban planning authorities. Metropolitan areas in those cities are rapidly expanding but planning decisions and policies remain too fragmented and uncoordinated.

Table 3 Urban and transport plans in Adana, Amman, Bucharest, Skopje and Tallinn

Urban and transport plans in Adana, Amman, Bucharest, Skopje and Tallinn.					
	General urban plan for the city	**Date of adoption**	**Transport plan**	**Date of adoption**	**Urban plans for the metropolitan area**
Tallinn	General spatial plan	2001	Sustainable Urban Mobility plan	On-going	None (but the SUMP will cover the metropolitan area)
Skopje	General urban plan for 2012-2022	2012	Transport Master Plan for Greater Skopje and SUMP	2011	Spatial plan for Skopje's Region 2005-2020 (not adopted)
Bucharest	General Urban Plan	2000Last modified in 2016	Sustainable Urban Mobility plan SUMP 2016-2030 Bucharest-Ilfov Region	2017	2014 Regional Development Plan' for the Bucharest - Ilfov Region. 2014-2020 & SUMP 2016-2030 Bucharest-Ilfov Region
Amman	Urban Plan	2009	Transport Mobility Master Plan	2010	2011 Amman Downtown Plan & Revitalization Strategy
Adana	Urban Plan scale 1/5000	2013	Transport Master Plan	1992	2015 Five-year strategic plan for the Metropolitan area of Adana

In addition, at both the local and the metropolitan level land-use and transport plans and policies are not integrated. This continuous policy issue has led to the development of numerous car-dependent urban areas within cities and in particular in the outskirts. There are no planning rules that make public transport links compulsory for new-built developments within and outside cities. More generally, urban plans are being approved without plans which anticipate the traffic and mobility needs that new developments are likely to generate. "Development comes first" summarises a participant in Amman. In Amman, the "lack of co-ordination between land-use planning and transport planning" has led to the construction of numerous residential areas that lack basic facilities and are almost exclusively reliant on private motorised vehicles. In those areas, the reliance on a car is an 'absolute necessity', "whether people are wealthy or not" even to go and "buy bread". Similarly, in Bucharest several

'dormitory districts' have been built in the outskirts of Bucharest that can only be accessed via private vehicles.

These issues, coupled with a lack of the requirement for density, generate urban sprawl and car-dependency. Low-density areas have been rapidly expanding in the outskirts of cities. In many post-communist countries, ownership reforms did not specify requirements for density. According to a participant in Tallinn it "went too far" and led to unplanned low-density developments. Similarly, in Bucharest, post 1990s, it became possible to build low density buildings and houses. This led to a rapid increase in low-density areas in the outskirts of Bucharest.

3.3 Decrease in fuel prices, increase in GDP per capita & import of second-hand vehicles

Another factor that is likely to have contributed to increased car use is the drop in fuel prices that certain countries have experienced. Overall, fuel costs have been going down since 2010 in Jordan, North Macedonia, Estonia and Romania[6] (see example Estonia, Jordan and North Macedonia in Figs. 6, 7 and 8 below).

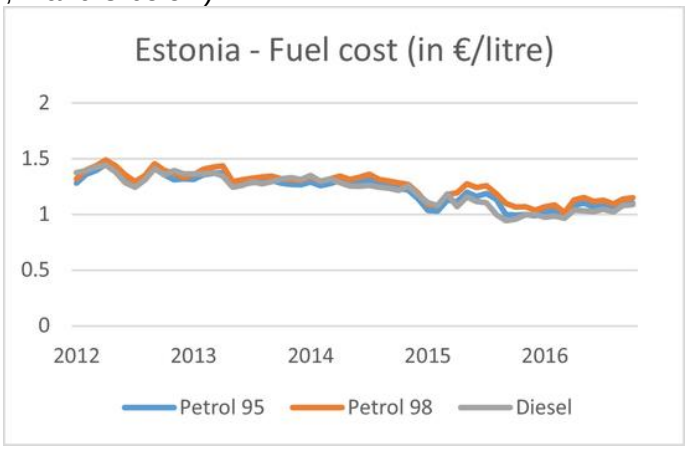

Figure 6 Evolution Fuel Prices in Estonia. Vertical axis: fuel cost in €/litrel; Horizontal axis: year. Source: Liiklusloenduse tulemused 2016. aastal Maanteeamet. https://www.mnt.ee/sites/default/files/content-editors/Failid/Liiklusloendus/2016/aruanne_2016.pdf

[6] Source: Eurostat

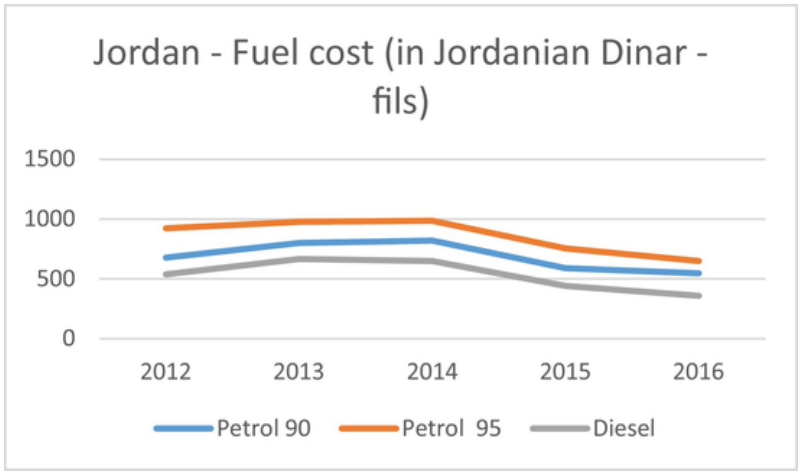

Figure 7 Evolution Fuel Prices in Jordan. Vertical axis: fuel cost in Jordanian Dinar/litrel; Horizontal axis: year. Source: National Statistics Jordan.

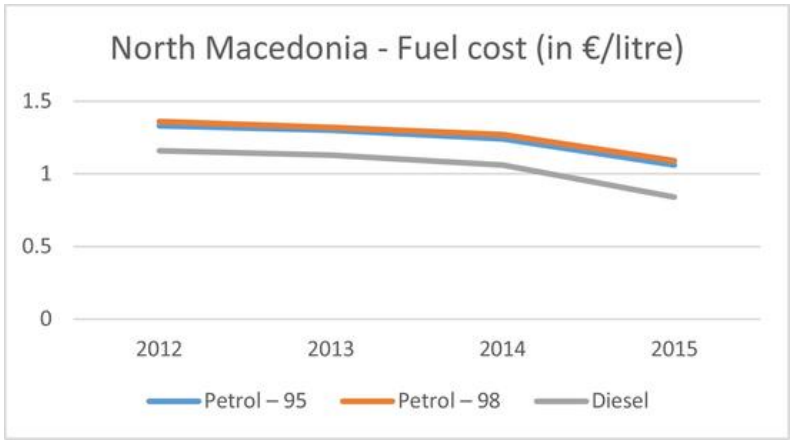

Figure 8 Evolution Fuel Prices in North Macedonia. Vertical axis: fuel cost in North Macedonia Euro/L; Horizontal axis: year. Source: National Statistics North Macedonia.

In parallel with decreasing fuel prices, purchasing and owning a private motorised vehicle has become easier in the five case study cities. The importation of second hand vehicles started immediately after 1989 in all of the eastern European cities. In Tallinn and in Bucharest it became “very easy to buy a car” from the 1990s following the end of the communist era. In Skopje, buying a second-hand vehicle has become particularly affordable since the late 2000s when the national government approved the import of Euro 1 & 2s vehicles from western Europe which were being removed from utilisation. “These vehicles are available at a very low price” and as a consequence “Even students who used to take public transport started buying motor vehicles” describes a participant in Skopje. In addition to increasing car use levels in the city, it also contributed to an increase in pollution levels.

Another common element across cities has been the continuous growth in Gross Domestic Product (GDP) per capita. GDP growth has been particularly strong in the post socialist era in Tallinn, Bucharest and Skopje. Since the 1990s Estonia’s GDP has been gradually increasing making Estonia one of the strongest economies of the new EU member states. Bucharest’s GDP per capita is the highest in Eastern Europe and has been growing steadily since the 1990s; this contributed to Romania’s position as the fastest growing economy in the EU. Since 2001 GDP per capita has also been steadily increasing in Adana and in Amman (see Fig. 9).

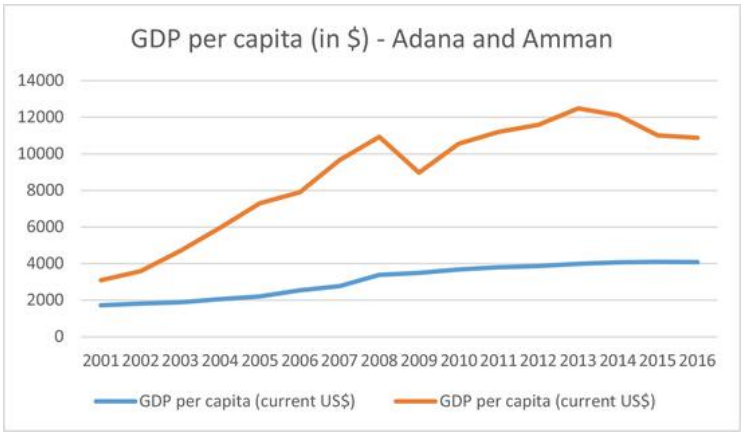

Figure 9 Evolution of GDP per capita in Adana and Amman 2001–2016 period. Source: National Statistics Turkey; National Statistics Jordan

3.4 Increase in car-use levels & investments accommodating the demand for car use

All the factors mentioned above contributed to an increase in car use and car ownership in the five case study cities (as illustrated in Figs. 10). In Bucharest, estimates suggest that circa 55% of Bucharest's population own a private vehicle; since 2005 the increase has been particularly significant in Ilfov County, at the outskirt of Bucharest City. In Skopje, the increase was less significant. The number of vehicles registered rose from 119531 in 2007 to 174793 in 2015. In Tallinn, the city went from 72676 vehicles registered in 2007 to 118468 in 2014. Behavioural changes also contributed to this trend. It was very prevalent in post-communist countries where owning a private vehicle has been perceived as a sign of newly found freedom since the 1990s. The increase in car use and car ownership was also influenced by successful mass marketing techniques used by major car companies. In Adana, a participant highlights the fact that car manufacturers have been "very successful in promoting cars" in the city. In Amman, automobile manufacturers even advertise their product by comparing "a happy person in a car with a sad person in a bus" recalls a participant. In all five cities, owning and using a car is perceived as a sign of higher social status.

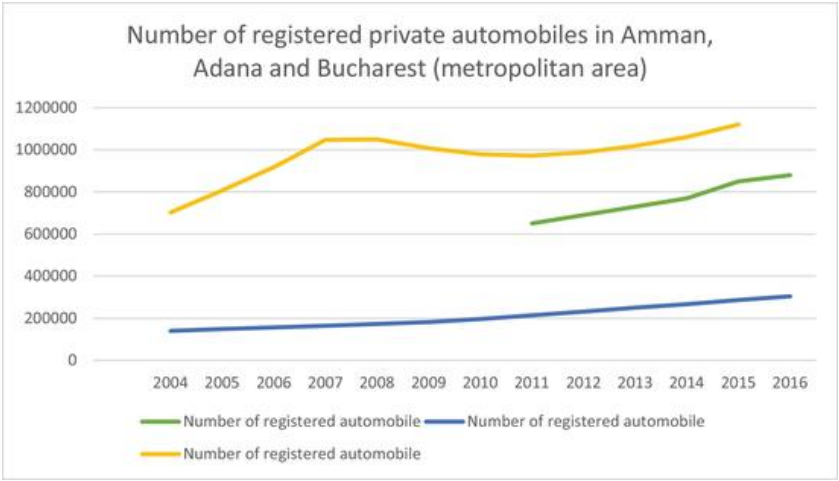

Figure 10 Number of registered private automobiles in Amman, Adana and Bucharest (metropolitan area). Vertical axis: number of private vehicles registered in Adana; Horizontal axis: year. Source: Turkish Institute of Statistics Number of private vehicles register

A common characteristic across the five case study cities is that until recently, public policies and investments have mainly focused on accommodating the growing demand for car use in cities. For the past three decades, a very high percentage of the cities' resources and investments dedicated to transport have been used to build highways and parking facilities,

primarily for car use. A participant from Skopje highlights that as a result 'Skopje has now become "a paradise for motor vehicles" and "a city for fast motorways". In Amman, a participant notes that public authorities are building a "vast road network and are providing free public parking space" for car users. By doing so "the government is subsidising private transport", highlights a Jordanian participant. Similarly, "In Bucharest all parking is free" points out a participant. In many instances, foreign investments such as investments coming from Gulf countries in Jordan or EU structural funds in European countries have incentivised road building. "Transport planning is more driven by these things than by an assessment of what the city needs" highlights a participant in Amman.

Meanwhile, and in comparison, there has been a significant lack of investment in public transport across the five case study cities over the past three decades. In Amman, until recently almost no public subsidy was available for public and collective transport and to date it remains limited compared to the resources spent on highway investment. "Public transport has declined slightly whilst the population has increased dramatically" and the quality of public transport service 'is worsening', stresses a participant in Amman. In Jordan's capital city, "The car is a necessity, because there is no public transport" or "the existing public transport is very poor", summarise participants. The cities of Tallinn, Bucharest and Skopje have been relying on the public transport network mostly inherited from the communist era. Since then, apart from some exceptions, those networks have not been sufficiently expanded or upgraded despite the increase in urban population. The lack of quality and capacity of public transport is one of the factors that leads people to rely on their private vehicles to commute.

Data indicate that in Tallinn, Skopje and Bucharest modal share has shifted towards more car use and less public transport use (see Figs. 11, 12, and Table 4) since the 1990s. Current estimated modal share for car use is close to, or above, 40% in Tallinn, Skopje, Bucharest and Amman and could even be close to 50% if the use of taxis is included.

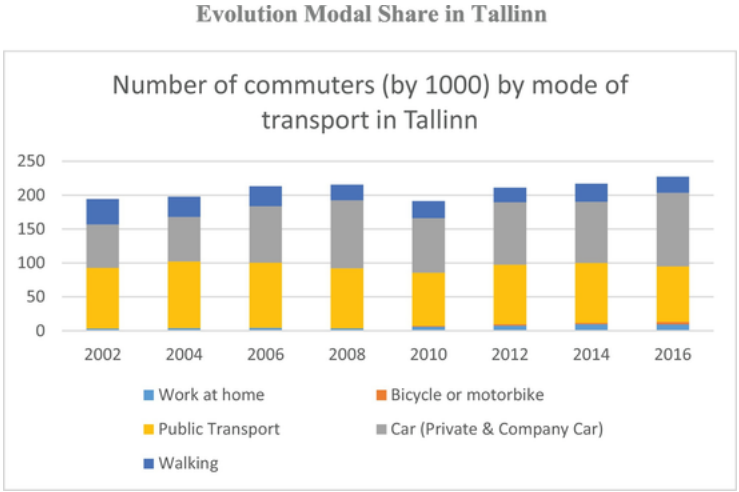

Figure 11 Number of commuters (by 1000) by mode of transport in Tallinn. Source: Statistics Estonia; Labour Force Survey, testimony-based.

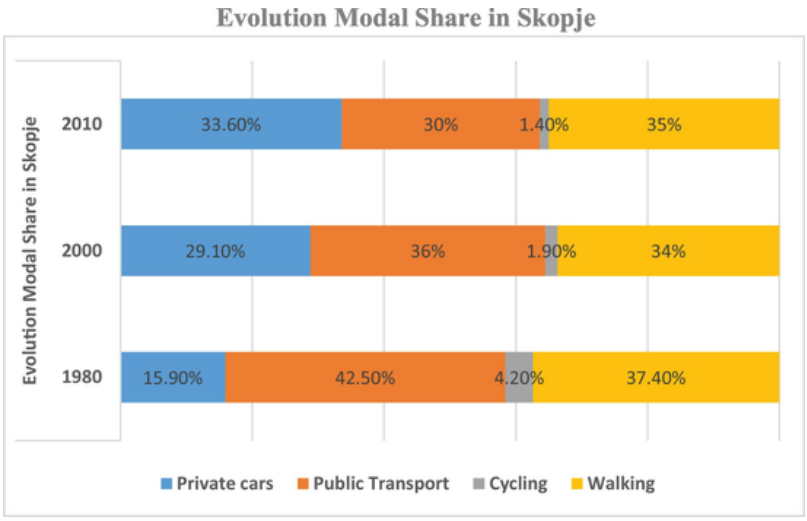

Figure 12 Evolution of Modal Share in Skopje. Source: Traffic studies for transport system in Skopje and Study for Develop-ment of public transport system in Skopje until 2000.

Table 4 Estimated evolution modal share in Bucharest

Estimated evolution modal share in Bucharest.			
	Car driver and car passengers	**Active travel (walking & cycling)**	**Public transport**
2015 (SUMP data)	36%	31%	27%
2007 (Urban Transport Master Plan – Bucharest, 2008)	23%	22%	48%
1999 (The Comprehensive Urban Transport Study of Bucharest city and the metropolitan area, 2000, chapter 4.6 Modal split)	28%	No data	52%

4. Discussion

"*Rising wealth is not necessarily associated with uncontrollable increases in automobile dependence*" (Kenworthy and Laube, 1996, p. 141)

This section investigates the extent to which some of the factors that lead to car-dependent urban developments in rapidly growing cities (see Fig. 3) are preventable, and whether the policy learnings from these case studies are applicable to other rapidly growing cities. This section aims at drawing relevant lessons targeting governments, in particular local authorities in Global South cities.

Examining the study's findings from a policy-making point of view, it appears that the factors leading to car-oriented developments could fall under different categories (as illustrated in Table 5). On the one hand: powerful macro factors that drive social, behavioural or technological changes and are usually beyond the remit of local authorities. On the other hand, factors that mostly result from, or are directly influenced by national authorities' action. Last but not least, factors that are directly or indirectly driven by, managed, or/and directly influenced by local authorities themselves.

Table 5 Categories of factors that lead to car-dependent urban developments in rapidly growing cities and the extent to which local authorities can influence/manage them.

Categories of factors that lead to car-dependent urban developments in rapidly growing cities and the extent to which local authorities can influence/manage them.		
Extent to which local authorities can influence/manage factors that lead to car-dependent urban developments		
Factors affecting local authorities	**Specific example**	**Level of policy influence/control (local authority)**
1- Macro factors	• GDP per capita • population growth/demographic changes • cultural or behavioural factors (e.g. social status)	Limited
2- National policies	• decreasing fuel prices • import of second-hand vehicles	Moderate
3- Local policies	• highway investment • lack of investment in active travel • lack of dedicated transport plans • lack of density requirements • urban sprawl	Strong

The first category includes macro factors such as GDP per capita, population growth and cultural or behavioural factors (e.g. social status). Whilst each of these factors is complex and would require an in-depth analysis in itself, this study suggests that from a governance point of view, in particular at the local level, these factors are extremely difficult to control or manage for public authorities. For instance, although population growth at the local level could be influenced by local authorities (e.g. by fostering family planning programmes), municipalities are mostly reactive to demographic changes, in particular rural-urban migration flows.

The second category includes factors such as decreasing fuel prices or import of second-hand vehicles. The decisions leading to these factors tend to emanate from the national level, often from non-transport departments. For instance, policy decisions linked with fuel prices often come from government departments responsible for the economy.

Factors that are directly or indirectly managed or influenced by local authorities include highway investment or lack of investment in active travel. Common mistakes made by governments include accommodating the demand for car-use by providing increased facilities instead of managing the demand by investing in alternatives to car-use and increasing accessibility. Another issue linked with land-use and urban sprawl is the fact that local authorities at the metropolitan level tend to have disjointed policies. One of the most common mistakes made by local authorities is the lack of action at the early stage of motorisation. Once car-use becomes the dominant mode of transport, it becomes extremely difficult for local authorities to reverse policies. As stressed by Stead et al. (2008): 'Most administrations seem to have to experience the problems first-hand, and experience them to a critical degree, before taking action.' (2008, p. 64).

These findings are particularly insightful in the context of rapidly growing cities across the global south, in particular Sub-Saharan African cities. Although transport policy instruments & policies might not be transferable to countries or cities in a different phase of economic development (Stead et al., 2008) or with a different socio-economic context, relevant lessons can be drawn and shared with low-income cities.

The hypothesis of the study is that the inefficient processes described in this paper can be avoided or 'leapfrogged' by public authorities in rapidly growing cities. Local authorities and other key stakeholders can take policy actions to prevent/address numerous automobile-dependent urban developments. Factors that fall under the second, and in particular the third category, can usually be managed by local authorities. In addition to following sustainable urban mobility principles frequently highlighted in the literature (GIZ, 2020), and building capacity, public authorities should focus on the following points:

- Apply cross-sectoral collaboration and system thinking. Collaboration across policy sectors - e.g. transport, urban planning and health – and across levels of governance –e.g. collaboration between the national and local level is necessary to address some of the issues mentioned in this paper (Cavoli, 2018; Cavoli et al., 2015; Jones, 2012). Similarly 'system thinking', connecting the various elements and policies that constitute the urban form, is a key element to improve urban policies.
- Focus on prioritising active travel and collective transport modes when building highway or road facilities - if investment in road facilities is deemed essential (e.g. by prioritising bus or cycle lanes).
- Harmonise planning decisions at the metropolitan level, ideally by creating an independent metropolitan agency responsible for transport and land-use
- Focus on vision-led planning instead of reacting to short-term demand.

It is important to highlight that further work needs to be undertaken to understand the extent to which low-income cities, particularly in ODA countries[7], have the capacity, institutional and financial, to put in place the necessary measures to prevent unsustainable urban development patterns. Enforcement and implementation issues are mainstream in low or middle income cities. There is a need to further understand the recurrent barriers/obstacles that prevent cities from taking preventive action.

5. Conclusions

Rapidly growing cities face common issues that tend to lead to car-dependent developments. In a context of fast urban growth, preventing car-oriented urban development is crucial to achieve SDGs and climate agreements. Evidence indicates that it is not only possible to decouple economic growth with car-use but that it is highly desirable to achieve prosperity, efficiency, inclusivity and physical and mental well-being (amongst other benefits) in cities. This paper sets out to identify the recurrent factors that contribute to car-dependent developments across different cities and the extent to which some of these factors are preventable.

[7] Countries eligible to receive official development assistance (ODA) as defined by the OECD in 2018 (source: http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/DAC_List_ODA_Recipients2018to2020_flows_En.pdf)

Qualitative and quantitative data analysis undertaken indicates that similar patterns and issues have occurred in the five different cities studied. Despite their different geographical, demographic, climatic, socio-cultural and political contexts and histories, these five cities have experienced rapid growth in urban population, urban sprawl, sustained increase in GDP per capita and an overall decrease in fuel prices (except in Adana). One noticeable difference is that in the three post-communist cities, urban growth has been less rapid than in the Middle Eastern cities, in particular in the city centre. Furthermore, the three eastern European cities have an extensive public transport system that sets them apart. However, since the 1990s, access to private motorised vehicles has become easier in the five cities, and is positively associated with social status. Car- use and ownership levels have increased significantly, and the five cities suffer from chronic congestion. Public authorities have prioritised planning for vehicles, and investments in alternatives to car- use have been lacking. A common issue strongly highlighted is the lack of transport and urban planning, in particular at the metropolitan level. These factors are characteristic of a policy stage where the dominant policy-mindset focuses on planning for car-use. The results of this study corroborate with findings from similar studies in Eastern European countries and some Middle Eastern countries.

The paper concludes that car-dependent urban development processes are hopefully reversible providing authorities across sectors and levels of governance put in place adequate measures at an early stage of private motorisation. Necessary measures include applying cross-sectorial collaboration and system thinking; focusing on prioritising active travel and collective transport modes when building road infrastructure, harmonising planning decisions at the metropolitan level, and focusing on vision-led planning.

Declaration of Competing Interest

None.

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Appendix A Questionnaire city profile

City Profile Questionnaire
Stage 1 cities
CREATE

- Introduction

The topic guide below has been compiled to provide the CREATE project basic data about your city. We would like you to complete the questionnaire below by collecting/gathering information about your city. The data should be official public data as far as possible. However, we understand that at times it might be difficult to find the relevant data within your organisation. Even though we would recommend that you not provide unofficial data, if you do provide unofficial data (for example online data from Wikipedia) please make an explicit reference in the document.

- Your city's administrative structure
    - Could you please define the boundary of your city's administration?
    - When we talk about transport in your city, which territory are we talking about? (e.g. city centre, metropolitan area, other?)
    - Could you provide surface of land use area (km2) data, an indicative map, and/or any other useful indicators.

- Demography
    - How many inhabitants does your city have?
    - Do you have historic data about the total number of inhabitants in your city (throughout the past decade or two)?
    - Do you have predicted population growth?

- Transport institutions
    - Which entities are responsible for transport policies and operations in your city? (e.g. which department within your local authority? Any national entities? Any private transport operators?)

- Transport demand and car ownership
    - What is the modal share/split (% of trips per average workday) in your city?
    - Do you have historic data recording the evolution of modal share?

    - Could you provide information about the development of the number of private cars (car ownership levels) and the number of driving licences per inhabitants (city-wide)
    - Do you have predictions related to future transport demand in your city?

- Economy
    - Could you provide data about the development of GDP (Gross Domestic Product) per capita in your city (over the years)?
    - Could you provide current and historic data about the development of annual average fuel prices (diesel and petrol) distinguished between net values and taxes [€ per litre]

- Local transport plan
    - Does your city have a local transport plan and/or business plan or any other equivalent policy-making document? If so, do you have an English version?
- Additional data
    - Do you have additional data which would be relevant to establish an initial city profile?

Thank you very much for your collaboration. We would be grateful if you could complete and complement the questionnaire in the coming weeks. We need as much information as possible before the mid-term review report to be submitted to the EU Commission at the end of the year. Early next year we will ask you to gather further qualitative and quantitative information about urban transport and transport policy in your city.

Appendix B. Topic guide focus group

Stage 1 cities CREATE
Topic Guide Focus Group

- Understanding the past

- 1. How has urban transport evolved over the past 10 to 15 years? (for example, linked to societal and cultural changes, mobility demand, demographics…)
    - a. How about land use?
- 2. How have urban transport policies evolved over the past 10 to 15 years?
    - a. How about land use and planning policies?
    - b. To what extent have those changes been affected by policies or legislation at the national or supranational level (for example changes at the EU level)?

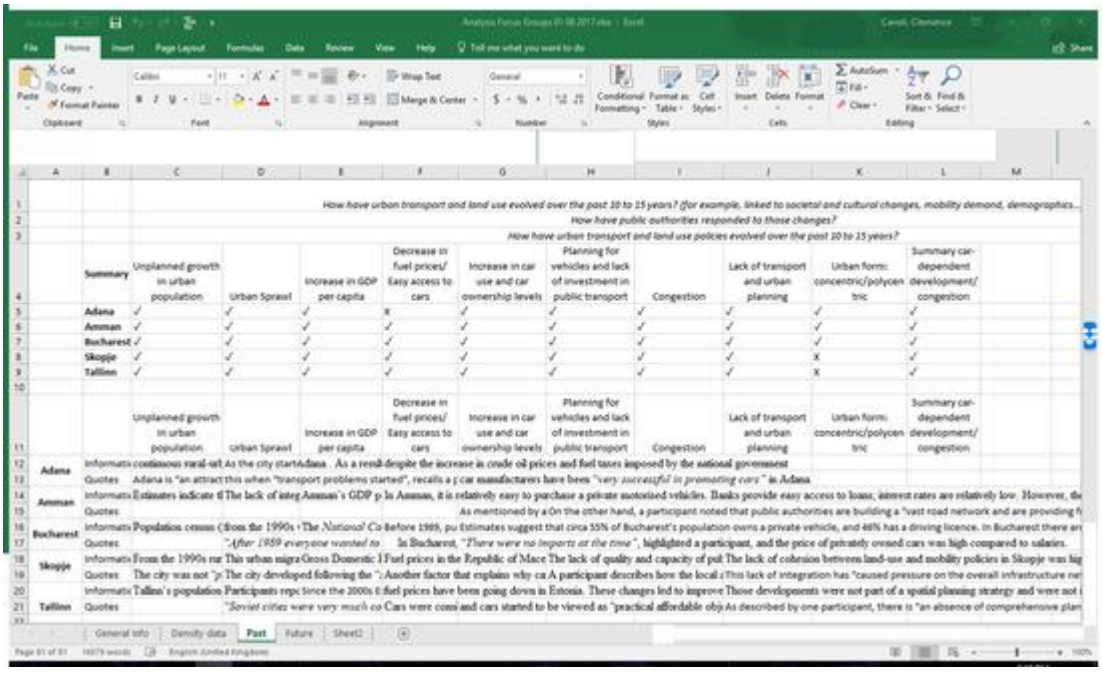
- Defining the present

- 1. What are the biggest challenges for urban transport and mobility in your city?
    - a. What are biggest challenges at a policy level?
    - b. What are the biggest political challenges?
- 2. What are the current policy priorities for urban transport in the city?
    - a. What are the challenges in delivering those priorities?
- 3. What influences transport policies in the city? (for example, regional, national or supranational influences or demands coming from local citizens such as lobby groups or the press, or competition with other cities…)
- 4. Where do you get your guidelines from (for instance to design roundabouts)?
- 5. Which funding agencies do you approach if you want to get funding?

- Shaping the future

- 1. What are the future challenges the city is likely to face in the coming years (for example, demographic changes…)
    - a. And the future opportunities?
- 2. What is the overall strategy for future urban transport policy in the city?
- 3. To what extent can technological developments help solve urban transport problems in your city?
- 4. Which innovative policies could accelerate sustainable mobility in your city?

Appendix C Screen shots & templates framework matrix



How have urban transport and land use evolved over the past 10 to 15 years? (for example, linked to societal and cultural changes,										
How have public authorities responded to those changes?										
How have urban transport and land use policies evolved over the past 10 to 15 years?										
Summary table	Unplanned growth in urban population	Urban Sprawl	Increase in GDP per capita	Decrease in fuel prices/ Easy access to cars	Increase in car use and car ownership levels	Planning for vehicles and lack of investment in public transport	Congestion	Lack of transport and urban planning	Urban form: concentric/polycentric	Summary car-dependent development/congestion
Adana	✓	✓	✓	X	✓	✓	✓	✓	✓	✓
Amman	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bucharest	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skopje	✓	✓	✓	✓	✓	✓	✓	✓	X	✓
Tallinn	✓	✓	✓	✓	✓	✓	✓	✓	X	✓

		Unplanned growth in urban population	Urban Sprawl	Increase in GDP per capita	Decrease in fuel prices/ Easy access to cars	Increase in car use and car ownership levels	Planning for vehicles and lack of investment in public transport	Congestion	Lack of transport and urban planning	Urban form: concentric/polycentric	Summary car-dependent development/congestion
Adana	Information										
	Quotes										
Amman	Information										
	Quotes										
Bucharest	Information										
	Quotes										
Skopje	Information										
	Quotes										
Tallinn	Information										
	Quotes										

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