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Original Article

Potential for Transition to Low-Carbon Urban Road Transport in Developing Countries: Insights from Literature

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Low-Carbon Cities, Urban Road Transport, Transition Pathways, Carbon Emissions, Developing Countries.

ABSTRACT

It is projected that if no actions are taken to cut down the current rate of global warming, global temperatures will rise to irreversible levels between the years 2030 and 2050. Consequently, climate-induced risks to health, livelihoods, food and water supply/security, economic development, and human security will increase. However, although many efforts have been put in the developed nations to enhance sustainability in cities through the development of a Low-carbon transportation system, the situation is different in the developing nations. These countries are, for some reason, reluctant to adopt the concept of Low-carbon cities. For example, in Kenya, despite the evident climate threat associated with rising urban carbon emissions in the country, very little action to curb the emissions is observed both at individual and government levels. This is especially so in the transport sector. Therefore, it is critical that suitable low-carbon transition pathways are identified and adopted in the sector in order to cut down the emission levels. Although the transition to low-carbon transport is faced with a myriad of challenges, transitions bring about an enormousness of environmental and societal benefits through the development of environmentally sustainable systems. Policy instruments are governance tools that can be used to enhance the environmental sustainability of urban transport options. However, climate change targets cannot be realistically attained by a single policy instrument. Instead, research indicates the need for more integrative and strong policy packages that can stimulate low-carbon transitions. In view of this, there is a clear need for the envisioning of sustainable future cities and potential transition pathways towards the realisation of these futures, as it is considered advantageous to various disciplines. This study provides information that can be used to develop an integrated urban transportation system that is environmentally sustainable and which efficiently incorporates all modes of transport; based on the theory of transitional management.

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INTRODUCTION

The scope for government action against climate change tends to be small in the cities compared to the national level; however, cities are considered very significant in the transition to sustainability (Yang and Li, 2013). Low-carbon cities are cities that aim at achieving tremendous economic development while at the same time minimising the associated anthropogenic carbon footprint. According to Yang and Li (2013), the establishment of low-carbon cities is crucial to the attainment of a low-carbon future; therefore, for a city to be considered low-carbon, it has to embrace the concept of low-carbon production and low-carbon consumption.

The term 'low-carbon economy' first emerged in the *Energy white paper* in Britain in 2003 (GOV.UK, 2003); it later drew international interest and was adopted in Japan through the proposal for the construction of a low-carbon society. Consequently, many studies have been and are being conducted to focus on low-carbon cities and are mainly focused on four aspects (Ruiqing, 2010), such as the way families are structured and the amount of energy they use, the types of emissions from cities, the layout of urban areas, and the density of individuals living there. When creating strategies to reduce emissions, it is important to take into account these factors since they are fundamental in assessing the overall carbon footprint of cities.

Several strategies have been applied in the establishment of low-carbon cities, and some of the direct measures include the transformation of the energy system and optimisation of transport and mobility systems in order to minimise carbon emissions (Alonso et al., 2016; Cheshmehzangi et al., 2018). Additionally, according to Simoes et al. (2017), policy measures such as the requirement to shift from the use of private vehicles to public transport and to carpooling and the establishment of carbon markets are also increasingly being embraced. However, Mao et al. (2019) note that there is a diversity of these policies, and therefore there is a need for further sorting to characterise their output values and bring out the overall aim of low-carbon city development.

On the other hand, according to Whiteman et al. (2011), cities also provide suitable opportunities for sustainability enhancement. For example, because the human population is concentrated in relatively small areas (cities), the natural ecosystem required to support the rapidly growing global population is also relatively small which implies that efficiencies would be enhanced in such other sectors as transportation and agriculture, hence a reduction in per capita carbon emissions impact. Therefore, sustainability in cities is an important aspect in the

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stabilisation of global climate and is also a major contributor in addressing other socio-ecological issues like pollution, reduction in biodiversity, and deteriorating human well-being as a result of degrading green spaces, among others (McPhearson et al., 2016).

In view of that, Moriarty and Wang (2014) suggest that there are several possible solutions for cities, just like any country, to cut down their carbon footprint—but propose two possible approaches to carbon footprint reduction. The first one is a technical solution that is achievable through the increased use of non-fossil fuels (renewable energy and nuclear energy). This can also be achieved through improvement in the efficiency of all devices using energy in urban areas (they include improvement in the efficiency of passenger and freight vehicles, lighting, heating, and cooling devices).

Further, other proposed technically oriented approaches include carbon capture and storage, reforestation, and geoengineering which aim at the reduction of global albedo. However, these mechanical solutions may not provide the deeply needed carbon reduction because they are expensive (both in monetary and energy requirements), they are slow, could lead to ocean acidification, and risk facing political opposition (Moriarty and Wang, 2014). The study, therefore, concluded that neither the increase in energy efficiency nor the alternative energy utilisation could contribute to the desirable deep reduction in the utilisation of fossil fuels because for a city to be considered low carbon, then it needs to be low-energy as well. Accordingly, following the observation that technical solutions are incapable of providing the desirable low-carbon cities in the coming few decades, Moriarty and Wang (2014) noted that there is a need for lifestyle changes to ease the carbon footprint.

However, although citizens show concern about energy utilisation and the associated environmental challenges, their behaviours hardly match their concerns. For instance, saving energy might require high behavioural costs (in monetary terms, the effort needed, as well as inconveniences associated), and therefore most people are unlikely to minimise their energy utilisation (Steg, 2008). Therefore, based on the assumption that citizens are adequately motivated to cut energy consumption, then there is a need to provide them with adequate information on feasible energy reduction methods. But as Froehlich et al. (2010) note, for the information to achieve the desirable transformative potential, it must be delivered in a form that can be easily understood, can be trusted, should be presented in an attractive and easy-to-remember way, and should be delivered in time and to the closest proximity to the target audience.

Further, according to Huovila et al. (2022), factors such as lack of precise clarity in the definition of cities, insufficient political and social commitment, limited stakeholder participation, and contradictory aims across different departments within cities hinder their transition to low carbon emission. Similarly, financial risks, cultural values and norms, legal impediments, and a lack of government commitment to attaining established goals or implementing regulations are among the challenges that the road towards carbon neutrality faces in cities.

THEORETICAL LITERATURE

Theory of Transition Management

Considering the existing global climatic changes, the necessity for the transport sector transition to sustainability has been emphasised by many researchers and scientists using different terms such as ‘mobility transition’, ‘transition towards more sustainable transportation system’, and ‘transformative solutions. According to Markard et al. (2012), transitions are a set of procedures that bring about a vital change in socio-technical systems and will normally happen over a long period of time, usually not less than 50 years. However, although they rarely happen, these transitions, when they happen, affect not only the structural systems but also the social contexts such as housing conditions, work, planning and even policy-making.

According to Loorbach et al. (2008), transitions are large-scale revolutions that happen in the society or its significant subsystem and bring about fundamental changes in the structure of social systems. This definition goes along with the definition of Rotmans (1994), who described a

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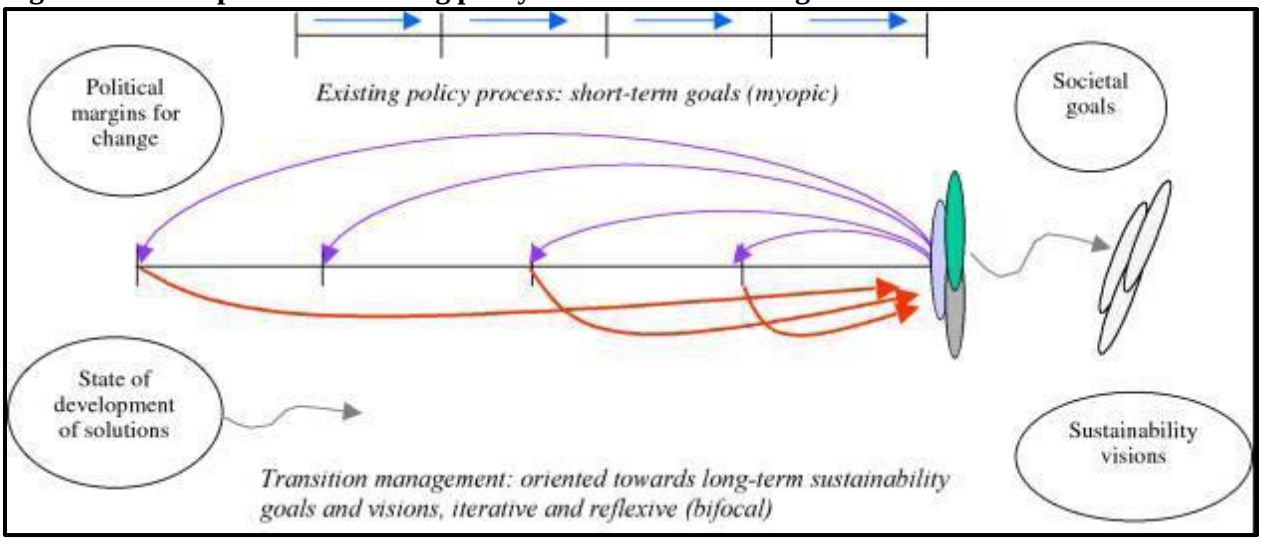
transition as a rapid change of system from a relatively stable state to an irreversible new stable state again. Transitions, as described by Rotmans et al. (2001), are complex changes that occur in a variety of disciplines, including sociocultural, economic, institutional, technological, and ecological. These changes are marked by a mix of quick and gradual changes that reinforce each other over a long period of time, usually lasting for at least a generation. The interfaces between multiple levels of participation, such as governance and landscapes, are another way to conceptualise transitions.

From a sustainability point of view, Kemp and Loorbach (2006) noted that transitions could be considered interesting because they present an enormousness of environmental benefits as well as a wide range of societal benefits through the development of environmentally sustainable systems. However, transitions are also associated with the potential for the opposition because they can bring about a loss of investments due to the breakdown of prevailing systems, institutes, and infrastructure.

Based on the ICIS-MERIT model of transition management, transition management for sustainability works towards the orientating of dynamics towards sustainability goals (Kemp & Loorbach, 2006), and a political process is involved in the selection of these goals. To achieve these goals, Kemp & Loorbach (2006) further note that the policies involved are assessed continually and occasionally reviewed in development rounds, and the policies will often differ through the different phases of transition. However, during the initial phases, the main concern of a policy should be to formulate transition goals and sustainability visions which are then assessed again in later phases.

Figure 1: A Comparison of existing policy and transition management



Source: (Kemp & Loorbach, 2006 pg. 7)

Figure 1 above provides a schematic representation of transition management as proposed by (Kemp & Loorbach, 2006). The ICIS-MERIT model of transition management suggests that there are two types of criteria that are applied in the evaluation of policy actions. The first one is the instantaneous input to the policy goals (e.g., in terms of the $MtCO_2e$ reduction and reduction in climate vulnerability through the adoption of measures for climate change adaption). The second one is the policies' contribution to the general process of transition.

This implies that there are two goals of policies in transition management; (i) content goal and (ii) process goal, in which case the policy goals act as the mode for change (Kemp & Loorbach, 2006). Transition management focuses on systems thinking that encompasses different domains, actors, and scales. It is a long-term process with a time frame of at least 25 years and involves both

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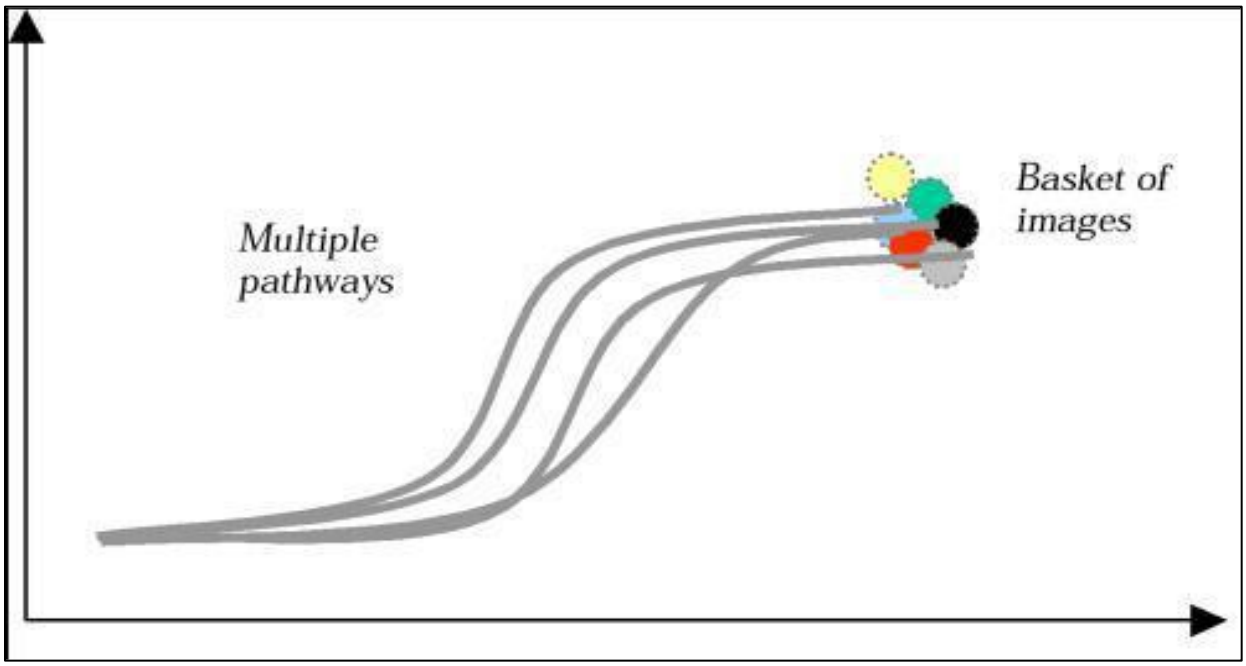
backcasting and forecasting to effectively plan for the future. The approach focuses on learning through experimentation and experience, with a strong emphasis on innovation and the exploration of alternative techniques. In addition, stakeholder involvement is also a crucial aspect of transition management.

Several activities are associated with the transition management process, which to a large extent, depends on the nature of the existing transition problem and the collective nature of transition management on the stakeholders, including Kemp and Loorbach (2006). Therefore, transition management is considered an approach and has to be customised for the particular context or problem at hand. For example, according to Kemp and Loorbach (2006), transition management for sustainability starts with the identification of the problems in the current functional system which are widely acknowledged and need to be responded to and to which no ready-made solution exists. After problem identification, a vision for sustainability is developed in consultation with stakeholders and which forms the guide for the formulation of policies and programs and setting of objectives (both short and long-term).

Figure 2: Transition visions, images, and pathways



Source: (Kemp & Loorbach, 2006 pg. 10)

The sustainability vision, according to Kemp & Loorbach (2006), has to be inspiring, imaginative, and innovative and is then translated into future transition images as shown in figure 2 above.

In an ideal setting, transition images should be chosen democratically, and several (consensual or contradicting) images can be selected. To get to the final transition images, transition paths need to be developed, which can range from one path to as many as possible for one image (Kemp & Loorbach, 2006). In addition, these transition pathways have to include the provisional goals and objectives of transition, the essential breaks in trends, the changes in behaviours and institutions, the uncertainties associated with the pathways, and the barriers and potentials for implementation. Practical experiments are then organised as the final step to explore the identified transition pathways.

EMPIRICAL LITERATURE

Transport and Climate Change - A Global Perspective

Although there are numerous benefits associated with the existing transport systems globally, the transport sector is also associated with numerous

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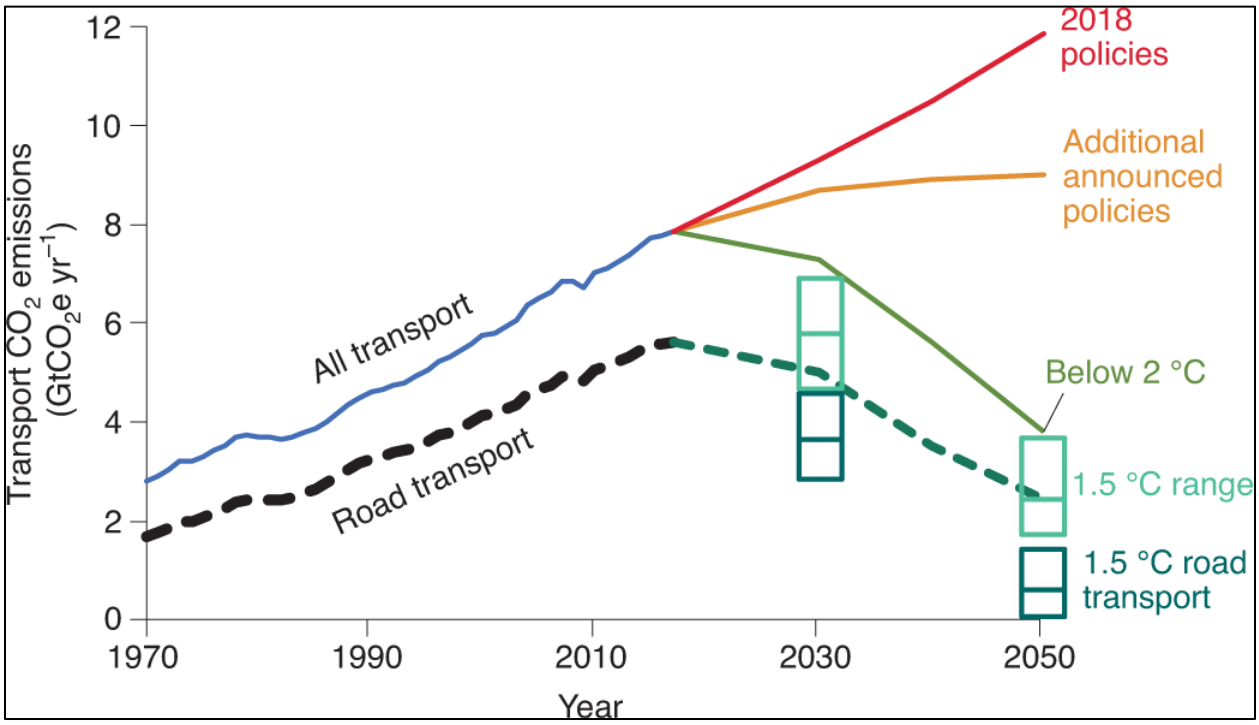
negative societal impacts. For example, it is estimated that the transport sector contributes approximately 23% of total global Greenhouse Gases emissions, 72% of which is from road transport (Masson-Delmotte et al., 2018). Therefore, it is clear that in order to meet the deep-needed decarbonisation goals as set out in the Paris Agreement, both scenarios of 1.5^0C and 2.0^0C require that global GHGs are reduced by 30 – 40 % by the year 2030 and 60 – 80% by 2050, and a net zero emissions subsequently. This goes along with (Bachner et al., 2020), who noted that in order to meet the targets contained in the Paris Agreement on climate (below 2.0^0C), there is a need to keep the net GHGS emissions to at least neutral by the year 2050.

Figure 3: Transport sector (general) and road transport historical and future global GHGs



Source: (Bachner et al., 2020)

Figure 3 above shows the historical and future global GHG emissions from the transport sector (in general) and from road transport under different scenarios, which suggest that transport emissions are expected to continue growing even with the implementation of the currently announced policies.

Transport and Climate Change - A Kenyan Perspective

Kenya's urban population has been rapidly expanding since independence, and it is projected to continue expanding for the coming few decades. For instance, in 2015, Kenya's urban population was 12.4 M and is projected to rise to 41.6 M people in 2050, accounting for at least 42% of the country's entire population (Ministry of Transport, Infrastructure, Housing and Urban Development (MTIHUD), 2020). However, the provision of transport infrastructure and services has not been proportionate to this growth in urban population. Consequently, urban transport in major cities of Kenya (Nairobi, Kisumu, Mombasa, Nakuru, Eldoret) is characterised by a lack of adequate public transport (mainly buses and matatus), growth in the number of cars and cargo transportation vehicles, peak hour traffic congestion, and limited road space leading to competition among the different road users (pedestrians, cyclists, and motorists).

Additionally, due to the heavy traffic congestion in these major cities of Kenya, vehicles move slowly in long queues, and travel waiting times are also considerably long. Similarly, poor physical planning has been attributed to urban sprawl, long

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trips, increased use of private cars and a general rise in urban transportation costs (MTIHUD, 2020). As a result of motorised traffic congestion, transport GHG emissions are noted to increase because more private cars are used instead of public transport, walking, or cycling, a situation that is accelerated by the generally poor condition of public transport vehicles and increased use of motorcycles for public transportation.

Given the inefficiency of urban transport due to the lack of proper infrastructure, transportation costs are generally high and unaffordable to most low-income urban dwellers. These urban dwellers instead opt for NMIMTs (mostly bicycles, walking and motorcycles), which is also characterised by a lack of appropriate infrastructure (MTIHUD, 2020). Considering that urban areas account for 50% of the Country's GDP, the lack of reliable and affordable urban transportation adversely affects workers' efficiencies and productivity, fuel efficiency, the environment, and the general economic situation.

Although Kenya contributes only 0.1% of global GHG emissions per year, the country faces a serious climate threat to its sustainable development goals. The transport sector, which contributes 8.3% of the Country's GDP, is the largest consumer of petroleum products and, consequently, a major contributor to GHG emissions in the country.

According to Kenya's transport sector Climate change annual report of 2018/2019, the transport sector contributed 11.25 $MtCO_2e$, which is equivalent to 12% of the country's total GHG emissions in 2015, and approximately 67% of energy-related CO_2 emissions in the Country (Government of Kenya (GoK), 2019). These emissions, according to the report, were attributed to road transport, aviation, and rail transport, 97% (10.97 $MtCO_2e$) of which came from road transport. The table below shows the contribution to the road transport sector GHG emissions by the various types of vehicles in 2015.

Table 1: Contribution of various types of vehicles to road transport sector emissions in Kenya

Type of cars	% Road transport emissions
Passenger cars	33
Light Commercial Vehicles	11
Heavy Goods Vehicles	40
Coach	5
Motorcycles	10

Following Kenya's ratification of the Paris agreement, which is an intergovernmental agreement on climate change contained in the United Nations Framework Convention on Climate Change (UNFCC), with the objective of keeping global average temperatures below 2^0C and 1.5^0C above pre-industrial levels, the country committed itself to mitigating GHG emissions by 30% in 2030. Consequently, the Country's National Climate Change Action Plan sectoral mitigation target for the transport sector was set at.`3.46$MtCO_2e$ in the year 2030 compared to the business-as-usual scenario, which implies that the sector's annual GHG emissions should not go beyond 17.54 $MtCO_2e$ (GoK, 2019). Consequently, it implies that sectoral emissions should not increase by more than 6.29 $MtCO_2e$ against the 2015 scenario, or annual sectoral emissions growth should not exceed 0.4 $MtCO_2e$ every year on average. However, it was noted that the sector's average yearly emissions increased by 0.6 $MtCO_2e$ between the years 2010 to 2015, which implied that the sector was operating off track with the 2030 emissions target.

The main focus of Kenya's National Climate Action plan for 2018-2022 is to ensure that transport infrastructure is climate-proofed, as well as ensure the development of a sustainable low-carbon transport system. However, the plan identified inefficiencies in operations, immense traffic congestion and excessive consumption of fuel as the leading cause of high GHG emission levels in the country—which can only be addressed through such measures as avoiding or limiting the need to travel, shifting to the most efficient modes of transport, and improved fuel efficiency and vehicle technology. However, despite the increase in

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demand for transport services in Kenya, the transport sector is faced with many challenges, which according to the report on "Integrated National Transport Policy of 2020," need to be addressed both in the medium and long term (MTIHUD, 2020). The report further notes that although these challenges need to be addressed in the context of the country's vision for 2030, many of the challenges will need to be addressed past 2030.

These challenges, as identified in the report, include a lack of a clear vision for the sector, lack of urban transport policy to aid in the formulation of an integrated urban transport system that is balanced and environmentally safe, insufficient research in the transport sector to advise policy formulation and to assess the different intervention plans, lack of an adequate number of professionals in the transport sector, and a lack of proper structure for intermodal coordination which is inclusive of all modes of transport. In addition, they also include poor quality transport services that are characterised by high transport costs and lack of public and private investment, poor land use planning methods to enable protection of transport infrastructure and transport services in the long term, adverse effects of climate change on transport infrastructure, for example, the collapse of bridges and roads, non-adherence to environmental obligations leading to environmental degradation from transportation activities such as GHG emissions, noise pollution among others, lack of fully integrated transport system, and unsuitable modal split which means that the roads are overloaded and thereby require a lot of maintenance and the associated costs

According to MTIHUD (2020), the lack of urban transport policy in Kenya has led to the lack of a clear vision of the necessary transport modes and facilities to be provided and/or encouraged in the urban areas. Further, although Nairobi and Mombasa cities are noted to have in place comprehensive land use and transport development plans, these plans have not been implemented in either of these cities. Consequently, this has encouraged uncontrolled growth in the use of private vehicles, further leading to growth in traffic congestion, especially in Nairobi city, which in effect negatively impacts economic productivity due to loss of productive time, increased fuel consumption, and the resultant GHG emissions. Therefore, the Ministry proposes that in the long term, the country needs to come up with an urban policy which will act as a guide to all towns and cities in the country. This policy should be designed to allow the development of a balanced and integrated urban transport system that is environmentally safe and which incorporates all modes of transport efficiently.

For example, access to Non-Motorised Intermediate means of Transport (NMIMTs) (which includes the use of bicycles, tricycles, walking, animal transport and hand-carts) in both urban and rural areas is still held back by many constraints, one of them being the lack of suitable infrastructure. This, according to the Integrated National transport policy report can be attributed to the fact the NMITs have not been integrated into the national transport policy. In urban areas, the provision of NMIMTs would mean the provision of pedestrian sidewalks and pavements, parking bays, bridges, and separate lanes. Therefore, to deal with these challenges, the country will need to work on a new strategic direction.

Policy Instruments as Methods of Governance

Policy instruments are methods of governance that entail the use of government resources or the deliberate limitation of these resources to attain certain policy objectives. According to Hood (2002), policy instruments are the tools used for governance, the mechanisms and methods used in the implementation of public policies. However, whereas it is considered necessary to address climate policy design as it concerns specific regions, countries or cities, most information in the literature mainly concentrates on the developed nations (mainly Europe and Northern America)—indicating a clear need for more research to provide an understanding of climate policy design in the developing nations (Axsen et al., 2020).

According to Ardila-Gomez and Ortegon-Sanchez (2016), financial instruments can be used to enhance performance in different aspects of an urban transport system, among them being the improvement of the environmental sustainability of urban transport options. Some of the proposed instruments include the use of public transport

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subsidies, parking charges, road pricing, congestion charges, fuel taxes/surcharges, and vehicle taxation. However, as Ardila-Gomez & Ortegon-Sanchez, (2016) further note, financial instruments are normally faced with implementation challenges due to factors such as financial stability, transport sustainability, and other associated risks.

For example, as explained by Ardila-Gomez & Ortegon-Sanchez (2016) and Sakamoto and Belka (2010), public transport subsidies are dependent on the availability of funds and are commonly obtained through taxation or national government allocation to specified programs of the local govemment. The subsidies can, therefore, change over time depending on economic cycles, changing political situations and priority changes. However, subsidies on public transport tend to be highly embraced both politically and at the general public level (Sakamoto & Belka, 2010). Although high taxes may be involved in order to sustain the subsidies, they tend to be ignored if the associated benefits are clear and significant.

Similarly, according to Huovila et al. (2022), the applicability of voluntary instruments to enhance sustainability in urban road transport would require the government to provide an enabling environment for the transition to carbon neutrality in cities. This includes encouraging the use of and increasing the number of trips by more sustainable transport means (such as the use of public transport), enhancing accessibility to cities without using cars by investing in city structures, and advancement of car fleets managed by the cities to use low and zero-emission vehicles. Further, Huovila et al. (2022) note that the provision of mass transit options that are carbon neutral, availing of alternative fuels that are sustainable, and encouraging the continuous renewal of the vehicle population would contribute significantly to the voluntary choice of sustainable options. Also, other government initiatives include availing of vehicle charging infrastructure, increasing the coverage of the network for public transport, supporting a constant city bike system, shifting to electric vehicles and bikes, and encouraging smart mobility choices such as the use of shared electric vehicles.

However, as noted by Dugan et al. (2022), many previous studies on the assessment of low-carbon policies have mainly concentrated on the evaluation of single policy tools/measures. For example, Zhang et al. (2018) investigated a policy package comprising only three policy measures (carbon pricing, modal shifts and energy efficiency) and took a global perspective to investigate how the transport sector can contribute to global climate change mitigation. Although the study findings came up with very promising GHG emissions reduction potentials, they may not be representative of specific agents or regions. Consequently, researchers have identified the need for the investigation and development of policy packages that are balanced in order to tackle the many challenges that policymakers are facing during implementation (Axsen et al., 2020; Dugan et al., 2022).

Similarly, Axsen et al. (2020) and Bhardwaj et al. (2020) further note that no single policy instrument is adequate to realistically attain climate change targets. Instead, the researchers suggest that there is a need for more integrative and strong policy packages in order to stimulate a low-carbon transition. Although other definitions may exist in the literature on the definition of policy mix/policy package, this study adopts the definition by Axsen et al. (2020), who referred to it as the existence of manifold policies that are implemented at the same time, in the same region/country, and aiming at the same objective in a society

Policy Packaging

It is unlikely that a single policy instrument would be enough for a real achievement of climate targets. Instead, researchers suggest that an integration of a range of strong policies is necessary to stimulate a low-carbon transition and may include the combination of taxes, subsidies, regulations, infrastructural developments, and other pricing mechanisms (Rogge et al., 2017; Bhardwaj et al., 2020). According to Givoni et al. (2010), the policy packaging concept was developed several decades ago with regard to various transport research projects in the European Union. Because the policy-making process is normally associated with conflicts of interest, the concept of policy packaging was adopted in these projects because it was considered useful in dealing with such conflicts. There are four basic components of a policy

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package, according to Givoni et al. (2010), all of which should be considered but may not always be included in a package. These components are primary measures, effectiveness measures, acceptability measures, and feasibility measures

Therefore, a policy package can be defined as "a combination of individual policy measures aimed at addressing one or more policy goals" (Givoni et al., 2010, pg. 53). They are established in order to enhance the effectiveness of the individual policy measures, reduce the likelihood of negative occurrences, and/or enable the acceptability and implementation of these measures. According to Tuominen et al. (2014), policy packaging has especially been employed at national levels and integrating the backcasting approach in countries like Sweden and the United Kingdom. This is especially so because policy packaging is considered useful in supporting the development of highly effective and efficient interventions.

According to Axsen et al. (2020), a complex understanding of policy interactions is required in order to design an effective and integrated policy mix. In this case, an integrated policy mix is considered consistent and clear on policy goals as well as consistent across specific policies. For example, May et al. (2006) note that the presence of two or more policies is considered a more societal benefit than the entirety of benefits that would be obtained from individual policies. This is especially so because the policies, when implemented together, complement each other.

Back Casting, Visioning and Scenario Building

Transition to urban sustainability has become a crucial policy agenda regarding the possibilities for transitioning from the current trends in order to prevent cities from sticking to the existing unsustainable pathways (Hodson et al., 2017; Frantzeskaki et al., 2018). Within this context, many relevant disciplines (including sustainability) have since the late 1990s discussed the advantages of envisioning sustainable future cities and envisaged potential transition pathways towards the realisation of these futures. Such interests in scenario building, according to Aoki et al. (2020), cover a wide range of subjects, including sustainable development and climate change and backcasting is particularly considered very promising in scenario building.

Many scenario studies have been conducted globally since the 1950s. According to Ayres (1984), the scenario methodology was first established in the 1950s for the federal government of the United States at the Rand Corporation in the prediction of nuclear wars and was later adopted by Shell company as a tool for Business in the 1970s. A scenario was first defined in the mid-sixties by Kahn and Wiener (1967), who defined scenarios as "hypothetical sequences of events for the purpose of focusing attention on causal processes and decision points." Later in the sixties, many companies, like Shell Oil, who were experiencing a lot of challenges with traditional methods of prediction, started to adopt the Kahn-Wiener principle to conduct scenario studies. In doing so, Shell aimed at making plans without the concern of predicting developments that were considered unpredictable then.

In scenario development, Van der Heijden (1996) notes that the first step is the identification of the predetermined and undetermined components. In this case, the predetermined components remain the same in all scenarios, while the undetermined components can be described differently depending on the potential developmental futures, thereby resulting in different images of the future. The term scenario has been defined in many ways in literature, but according to Becker et al., 1982 cited in (Wee & Geurs, 2004), the term has been customarily defined in the Netherlands as the description of the present state (or a part of it), the potential and desired future states in society and the sequence of events between the present and future states.

According to Dreborg (1996), backcasting is largely accepted as a useful method to investigate how set targets can be realised in a case where the existing structures act as an impediment to the desired changes. The technique is considered advantageous because it encourages scenario developers to pay attention to the desired future scenarios, which might be more advanced than the current scenarios (Camilleri et al., 2021). Consequently, backcasting, therefore, allows the evasion of overdependence on the existing paths and allows for future societal

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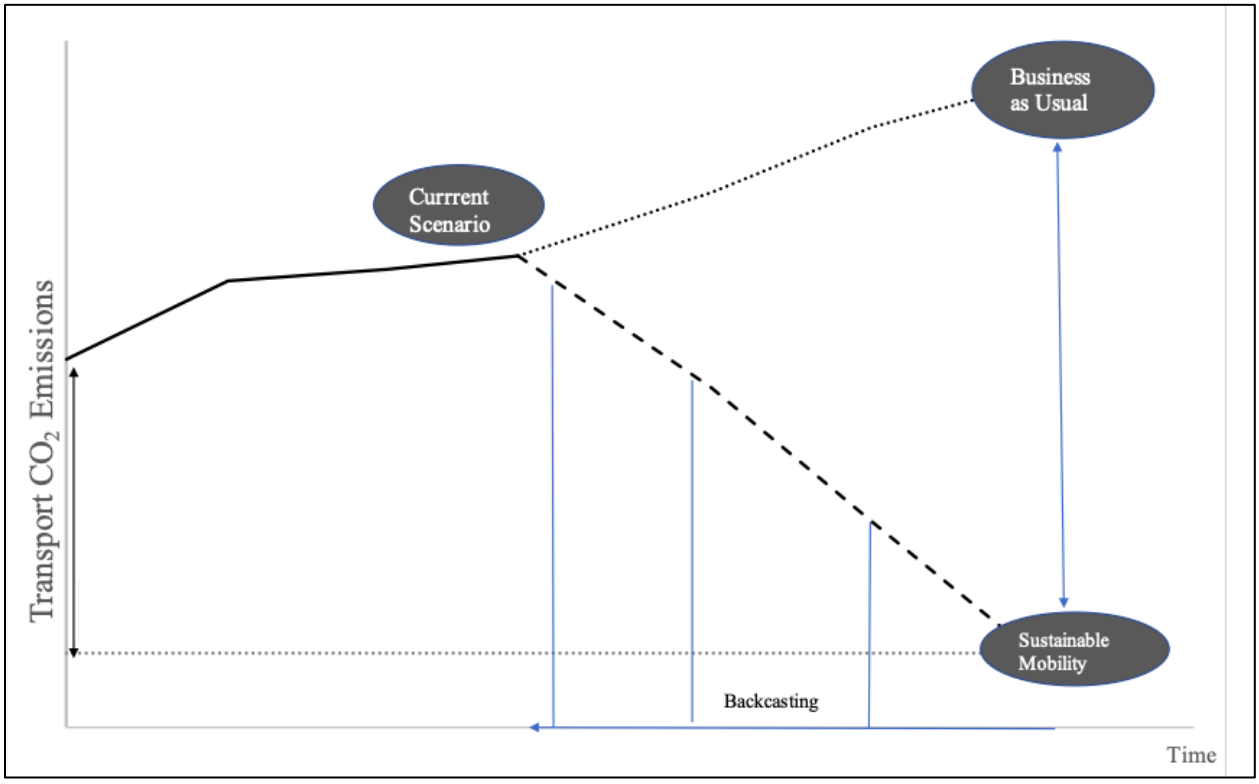
development and transition from the existing trends. Camilleri et al. (2021) further note that backcasting works on the basic idea that the Business-as-usual pathway is not sustainable and that the existing policy measures are inadequate to meet the transport sector targets on climate change. Backcasting, therefore, proposes a technique that starts with the identification of desired futures and is then followed by the development of the various pathways that can aid in the achievement of the set targets, as described in figure 4 below (Hickman & Banister, 2014)

Figure 4: Backcasting technique as proposed by (Hickman & Banister, 2014)



According to Camilleri et al. (2021), the backcasting technique operates iteratively and is comprised of several phases, which can vary in number from one study to another. For example, several previous studies have employed three phases comprising of the initial visioning stage, identification of policy packages and policy pathways that could lead to the achievement of the desired futures, and finally, policy packages appraisal for effectiveness and potential for implementation (Banister & Hickman, 2013 and Julio A. Soria-Lara & David Banister, 2018). However, other studies have suggested the use of methodologies comprising more phases, in which case the initial stage is the establishment of strategic objectives while the final stage involves the monitoring of the general evolutionary process used (Quist & Vergragt, 2006; Hodson et al., 2017).

However, although back casting has been widely applied in both academic and non-academic practical studies, two limitations have been identified with the technique. The first limitation is the fact that backcasting studies have mostly been done with professionals and relevant stakeholders only, which means that the involvement of laypeople in the process has not been greatly studied (Kishita et al., 2016) and (McLellan et al., 2017). However, McLellan et al. (2017) and Frantzeskaki et al. (2018) note that putting into consideration that the processes of transitions to sustainable cities involve direct or indirect resolutions formulated by varied stakeholders, then the involvement of lay people (non-experts and non-professionals) is considered crucial in the backcasting process. Another limitation is that participatory backcasting scenarios have not been effectively implemented practically and therefore have not achieved as much

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impact as the already established policies. This, according to Kishita et al. (2016) and Soria-Lara & Banister (2017), can partly be attributed to the fact that it has been challenging to integrate such participatory backcasting scenario building into already established policy processes.

Similarly, other studies such as Tuominen et al. (2014), Soria-Lara & Banister (2017) & Camilleri et al. (2021) emphasised the need for the involvement of the public body (lay people) in the visioning process. For example, Soria-Lara and Banister (2017) emphasised on inclusion of members of the public of different ages and from different social backgrounds. The study, therefore, paid more attention to the involvement of 14 – 16-year-olds in the visioning because they are considered "more open and imaginative".

CONCLUSION

In summary, if no action is taken to slow the current rate of global warming, global temperatures are expected to reach irreversible levels by the year 2050. A significant portion of global warming can be attributed to road transport in cities due to high traffic, high population density, and the resultant urban heat island. This is especially so because as cities population rises, so does the number of motor vehicles due to the increased demand for transportation of people and goods. However, in most developing nations, the transport infrastructure is poorly developed and does not have the capacity to support the increased demand for transport and the growing number of motor vehicles. This leads to more cars on the roads, causing more emissions and further contributing to global warming. As such, cities in developing nations need to work on an integrated urban transportation system that is environmentally sustainable and which efficiently incorporates all modes of transport.

Based on the theory of transitional management, it is possible to sustainably transform cities in developing nations towards greener, more efficient, and more equitable forms of transportation. In Kenya, the transport network in cities faces several challenges, which include the lack of a clear vision and lack of an urban transport policy to aid in the formulation of a sustainable integrated urban transport system. To address these issues, the government of Kenya should create a comprehensive urban transport policy and plan to create an efficient and effective urban transportation system. In addition, the article identified a literature gap on the lack of transport sustainability visioning—more so in developing countries—with an emphasis on the need for the involvement of the public body in the visioning exercise. This involvement is needed to ensure that the visioning process reflects and takes into account the needs and concerns of all stakeholders, including those of the public.

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