

Changing Perceptions on Healthy Cities and Climate Change through inclusive Street Design

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Abstract

Climate change is an existential threat for human society. Urban settlements account for 75% of the contribution of greenhouse gas emissions (GHGs), with transport and construction being the largest contributors. Africa is urbanising at the highest rate globally (World Bank. (2015) and experts warn that the continent will be hardest hit by climate change if immediate action is not taken.

Studies in Addis Ababa, Kampala and Lagos confirm that toxic air pollution in these fast growing metropolises are related to urbanisation and population growth, turbocharged by construction booms, increased energy use, vehicle emissions and industrialisation (AirQualityNews, 2020). Urban pedestrianisation programmes have led to a reduced number of vehicles parked along streets while encouraging active mobility including walking and cycling. It goes without saying that air quality has improved in such places.

This study took advantage of the 2021 Urban October campaign that focused on the climate crisis in line with the theme of UN-Habitat's campaign ClimateAction4Cities (UNHABITAT, 2021). The research was conducted with the goal of understanding the public perception on climate resilience and the related impacts of an urban pedesitralization intervention. The area of study was Nairobi central business district with particular focus on the environment along and around a downtown street that the city authorities pedestrianised.

Methodologies used in the study included initial secondary research on public perceptions of climate change and successful urban climate friendly interventions. On street engagements were done with stakeholders who were interviewed by means of questionnaires. These included nearby paratransit and motorcycle taxi operators, shop owners and attendants as well as members of the public. Questionnaires captured their views on climate change, sought proposals on climate resilient ideas from them and attempted to get an understanding of the social, environmental and economic impact of the downtown street pedestrianisation project. A transect walk was also conducted taking video recordings and photographs that captured street activity on the pedestrianised street and adjacent streets that have not had any interventions.

The results portrayed a relatively good understanding of the wider impacts of climate change with many people associating it with global warming, changes caused through bad environmental practices, rise in sea levels and extreme weather conditions. Over 80% of the respondents believed that they were affected by climate change and the most popular action to prevent climate change effects was the planting of trees. 88.3% of the respondents were in favour of the interventions done along the street, and evident benefits included more people walking into shops, increased sales, more window shopping, increased occupancy and more confidence by suppliers. 60-81% recorded an improved business environment while 37% had increased their operation

hours. The impact on health was a key outcome and this was noted by 61.3% of the respondents. One respondent's quote was 'I use my inhaler less frequently.'

The study brought out the importance of improved streets as a way of developing healthier cities. The interventions go a long way in improving people's health and reducing GHG emissions within urban areas by encouraging active mobility and also positively impacting on the business environment.

A final study report and research paper were prepared and summarised by means of infographics that were shared with city authorities, urban planners and members of the public for advocacy purposes..

Keywords

Climate Change, Cities, Urban, Streets

1. Introduction

1.1. Urban Life and Climate Change

The transformations brought about by climate change and the continued growth of cities are having an impact on urban climate (Smith P and Henriquez, 2019). Urban activities are major sources of greenhouse gas emissions, thus making cities highly responsible for and susceptible to climate change. It is estimated that cities contribute about 75 percent of global CO₂ emissions. Transport and buildings are among the largest contributors (UNEP, 2017). Adaptation to climate change requires that we make towns and cities more resilient (CABE, 2008).

Climate change refers to long term shifts in global or regional temperature and other weather patterns (UN, 2020). Climate change and its impact is one of the greatest challenges facing humanity in recent times as it has several negative effects on human beings. (EAA, 2021).

2. Understanding Climate Change

2.1. Causes of Climate Change

Climate Change may be due to natural causes or, as has been the case in recent centuries, due to human activities (UN, 2020). The primary activities that have led to this include the burning of fossil fuels like coal, oil and gas. These activities produce 'heat trapping gases' known as 'Greenhouse Gases.'

Greenhouse gases released into the atmosphere from anthropogenic sources such as industries and transport lead to heat being trapped in the atmosphere and consequently the warming of global climate (EPA, 2017). This has resulted in the constant rise of global temperatures since the mid-20th Century (National Geographic, 2019).

Weather patterns have also been gradually changing. Many times people mistake climate for weather. The difference between the two is that weather refers to short term atmospheric conditions while climate is the weather of a specific region averaged over a long period of time (USGS n.d). Through these long term measurements, we are able to know seasonal temperature, rainfall averages, wind patterns among others (National Geographic, 2019).

This is the reason why we refer to climate change as ‘long term shifts.’ The atmospheric changes lead to unexpected weather patterns that make it difficult to plan e.g. farmers cannot predict planting seasons, there are damaging effects like sea level rise, hurricanes, floods, downpours and windstorms. There are also negative and costly effects on cities ranging from basic services, infrastructure, housing, human livelihoods and health (UNEP 2017).

2.2. Effects of Climate Change

Although climate change is a global phenomenon, the effects affect the poor disproportionately (UNEP, 2017). It affects health, food production, housing, safety and work. Among those who have been most affected are those in developing countries, especially rural communities where several cases of ‘climate refugees’ have been recorded (United Nations, 2020). Some communities have been forced to relocate due to sea level rise and salt water intrusion. One reason why poor and rural communities are most affected is due to lack of resources to afford goods and services needed to prevent or recover from the effects of climate change (UNEP, 2017).

While looking at Climate change, one can look at it from the lens of its effects on a specific location or the planet as a whole. As a result, physical factors like local geography and environment in addition to social, political, and economic factors that are rooted in systemic inequalities will have an influence on the effects (Rangwala L, et al, 2018).

Though over time Africa has contributed negligibly to the changing climate (about two to three percent of global emissions are produced by the continent), it stands out disproportionately as the most vulnerable region in the world (UNEP, 2017a).

2.2. The transport sector and Climate Change

The transport sector is significantly responsible for climate change as 23% of all CO₂ emissions are from transport activities (Alhindawi, et al, 2020). Most of the energy used in the transport sector comes from combustion of fossil fuels- a major source of greenhouse. Vehicles also produce fine particulate matter and nitrogen oxides that are major causes of urban air pollution. Many of these second hand cars do not meet the emission standards in their own countries of origin (UNEP, 2021).

Developed countries are slowly phasing out diesel and petrol vehicles. Developing countries, on the other hand, are getting an influx of old vehicles from Europe, Japan, China and the US. These cars emit dangerous fumes that expose people to high levels of air pollution (Olusanya et al, 2020). At times, they are also poorly maintained and not roadworthy, leading to accidents and fatalities. According to Rob de Jong, head of the Sustainable Mobility Unit at the United Nations Environment Programme (UNEP), unless efforts are made to regulate the used car trade, it will not be possible to meet the zero-emission target under the Paris Agreement on climate change (UNEP, 2021).

2.3. Climate Resilience in Urban Areas

Resilience is defined as *“the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation”* (IPCC 2014). Building resilience to climate change is complex,

particularly within rapidly growing cities (Rangwala L et al , 2018) as cities create their own unique climates, which we call ‘urban climates’ that are shaped by morphology and materials (Battisi A and Santucci D, 2020).

However, it is also important to remember that resilience develops out of connections between people, not merely physical features or infrastructure (Peinhardt K, 2018).

According to the World Resources Institute (WRI), many cities have put resilience on their agendas, either directly or indirectly. There are a number of ways this has been done, including:

- Developing innovative ways for cities to build resilience.
- Helping cities measure and track community and individual resilience.
- Integrating resilience into city master plans and development plans
- Integrating resilience into sector-specific plans or projects
- Catalysing a paradigm shift for adaptation so that communities and local actors have greater power and resources to build climate resilience.
- Supporting the scaling up of nature-based solutions for adaptation by engaging with governments, funding institutions and practitioners to develop and strengthen commitments, investments and partnerships.

There are also several practical ways that towns and cities can take up and adapt to understand in order to work better. These include understanding water courses , using renewable energy sources and cleaner production techniques to cut emissions. These will also reduce local pollution from industry and transport, thus improving urban air quality and citizen health (UNEP 2017b). At the moment, In many urban spaces environmental conditions are deteriorating and this is affecting the health and quality of life of city dwellers.

2.4 Public Space and Inclusive Non Motorised Transit as a mode of Climate Resilience

Well-designed, flexible public spaces that are softer, greener, more organic and natural will store water and are critical to modifying urban temperatures. Green spaces with a sufficient planting of trees assist in creating an environment with cooler, cleaner air (CABE, 2008). Thus, Public spaces therefore play a key role in strengthening communities in climate-change adaptation (Peinhardt K, 2018).

A study of climate quality in the city of Chillán (Chile) revealed that there are insufficient public spaces to provide acceptable environmental quality for the entire population. The study brought out how high-income areas in peri-urban zones experienced better climate, environment, and air quality (Smith P and Henríquez C, 2019). This is not unique to Chillán but to very many cities worldwide.

Urban green spaces offer critical support for urban life though providing beautiful, healthier places but require investment, just as infrastructure likestreets, railways, drainage and sewers (CABE, 2008). Physical and social resilience meet within public spaces and are therefore a key tool in mitigating climate impacts (Pascal Observatory International, 2019). In order to be able to come to terms with the urban impacts of climate change, public space designers ought to put people at the centre of their work (Pascal Observatory International, 2019) because environmental challenges are also public space challenges. A

good example is the way cities that face air pollution and congestion because of auto-centric design are also unsafe for pedestrians and cyclists (Peinhardt K, 2018). In many African cities walking is the main mode of mobility, with almost 90% using it as their primary means of movement. It is also the most affordable way of accessing basic and important services. However, citizens face safety challenges due to ageing infrastructure, vehicular centric investment and lack of climate-resilient infrastructure that is topped by increased levels of air pollution (Gary H, et al, 2021). There is therefore a need for prioritisation of design of safe non-motorized transport in line with climate needs like dealing with higher temperatures and heavy rainfall (Gary H, et al, 2021).

2.5. Benefits of improved public space and inclusive street design

For any sustainable mobility plan, it is important to have good walking and cycling infrastructure. These also improve the quality of living of citizens. (Penalosa, 2004). More specifically, sustainable development benefits of NMT are:

Factor	Benefit
Environmental	• Air quality improvement • GHG emission reduction • Noise reduction • Non-motorized transport does not emit greenhouse gas emissions, nor local air pollutants nor noise. Every increase in NMT therefore leads to a direct decrease in emissions.
Social	• Congestion reduction • Health benefits due to exercise. For example, cycling for 30 minutes a day reduces the chance of cardiovascular diseases (Solveig et al., 2019). • Gender benefits: cycling can be particularly suitable for the many short trips women in developing countries take • Social equality and poverty reduction: cheap, fast and reliable transport opportunities, and public space development directed towards all segments of society (ICE, 2000) • Safety: increase in bicycle use is often accompanied by a reduction in cycling accidents and an increase in safety in public areas (Vanderbulcke et al., 2009)
Economic	• NMT provides easy, flexible, cheap and fast means of movement • More attractive cities for tourists and residents, particularly if car-free zones are included • Reduced travel times due to improved traffic flow • Energy security due to lower vehicle energy use (UNCTC, nd)

Through the Sustainable Development Goals, there has been a shift and the world is now focused on pursuing sustainability in all spheres of development. Investing in clean transport modes is paramount to achieving sustainable growth, improving access to destinations and services and well-being of the people. One of the strategies for achieving the 2030 Agenda is pursuing low carbon development (Daniela F et al,

2019). The SDGs that are related to this either directly or indirectly include: Goal 4: Quality Education, Goal 8: Decent Work and Economic Growth, Goal 9: Industry, Innovation and Infrastructure, Goal 11: Sustainable Cities and Communities, Goal 12: Sustainable Consumption and Production, Goal 17: Partnerships for the Goals (United Nations, 2022).

2.6 Obstacles towards improved public space and inclusive street design

The UN Climate and Technology Centre and Network, notes that there are some key universal challenges that hinder the development of public space and pedestrian oriented streets in cities. These include:

- Private-vehicle-oriented transport and spatial planning.
- Public perception and status: walking, cycling (and public transport) is perceived as the transportation mode for the poor.
- Safety: pedestrians and particularly cyclists are vulnerable, NMT users have a higher risk of being involved in accidents than car users, particularly in developing countries (IPCC, 2007).
- Lack of convenient public transport.
- Chicken-and-egg problem: *people will not start cycling if there is not cycling infrastructure, planners at times do not build these when they do not see people cycling (UN CTCN)*
- Lack of overall long-term, integrated vision and planning.
- High costs for bicycles, including taxes.

Peinhardt K, (2018) insists that there is an urgent need to move from auto-centric design to place-led development in order for us to take personal action against climate change by having public spaces which we can connect with nature, and perhaps on a more practical level, walk and bike.

3. Public Perceptions on Climate Change and Resilience

A study conducted in 2014 by the Institute for Development Studies (IDS) at the University of Nairobi and the Green Africa Foundation, asked ordinary Kenyans about their views on climate change and more than one third of Kenyans thought drought in their country is more severe. Approximately 25% were of the opinion that there have been drastic weather changes including an increase in hotter weather. A third of the respondents also pointed out that there have been reductions and delays in rainfall (CDKN, 2014).

A similar research had been conducted in 2009 (Otieno S, et al, 2010) by the BBC World Service Trust that focused on 4 main questions:

- What changes have African citizens experienced in their climate and environment over time?
- How do African citizens explain and respond to these changes?
- What do African citizens know and understand about global climate change?
- What knowledge and understanding do African opinion leaders have about climate change and the responses of their country's?

The results of the study pointed out that drought and food scarcity are causing frustration and despair across the country and the most vulnerable victims do not know what to do when things get worse. These include farmers, pastoralists and fishermen.

The report pointed out that Kenyans had noticed changes in weather but many were unfamiliar with the concepts of climate change and global warming. There was thus a need for more information about the causes of climate change and how its long-term impacts will affect their lives as well as translations in local languages. Many Kenyans were noted to be well versed with the problems of deforestation and environmental pollution and there was a strong belief in tree planting (mainly in relation to rain capture). The report had concluded that there was little cross-sector coordination and communication about climate change and that though links between government and Ngos appeared stronger, local community leaders were particularly isolated from decisions made at a national level (Otieno S, et al, 2010).

The report recommended the **provision of information to raise awareness, facilitation of public debate and encouraging accountability.**

The Kenya Climate Innovation Centres reported that Kenya has been in the forefront in developing strategies that will incorporate climate change to the curriculum (KCIC, 2018). They stated that as much as it is important to incorporate climate change into the education system, it has to go beyond teaching but through an education policy curriculum overhaul. This may go a long way in changing perceptions towards climate change in Kenya.

In a separate study done by the Stockholm Environment Institute, it was revealed that there was limited expertise in climate resilience in four case study countries: Ethiopia, Rwanda, Uganda and Zambia. Climate resilience appeared to be a low priority in cities compared to, for example, reducing the economic effects of traffic congestion. In spite of the interest from planners to access technical support on this issue, such as learning how to run vulnerability and risk assessments, financial resources were needed to support this and any resulting measures (Gary H, et al, 2021).

Integrating urban climate resilience in city planning is a challenge in most cities, because of the lack of institutional capacities and effective governance mechanisms to integrate long-term climate risk assessments in urban planning and decision-making (Asian Development Bank. 2014) and as indicated earlier, there do exist negative connotations towards non motorised transport. ,

The Project for Public Spaces (PPS) once asked passers-by what they'd use the street for instead of cars, the majority of people had simple responses: *Streets ought to be safer places to walk, bike, or rollerblade. This was further proof of the desire by people to choose low-carbon modes of transport, if given a safe, accessible place to do so* (Peinhardt K, 2018).

4. Research Methodology

4.1. Study Area

Nairobi has invested in both a proposed CBD non motorised transport network as well as a CityWide Network. The network is expected to ensure that citizens have easy access to different services

within the city as well as access the key employment zones within the city (CBD, Industrial Area, Upper Hill, Westlands etc). When this is executed together with the on-going development of sustainable mass transit systems, environmental, social and economic benefits will be visible, thus extending to climate action.

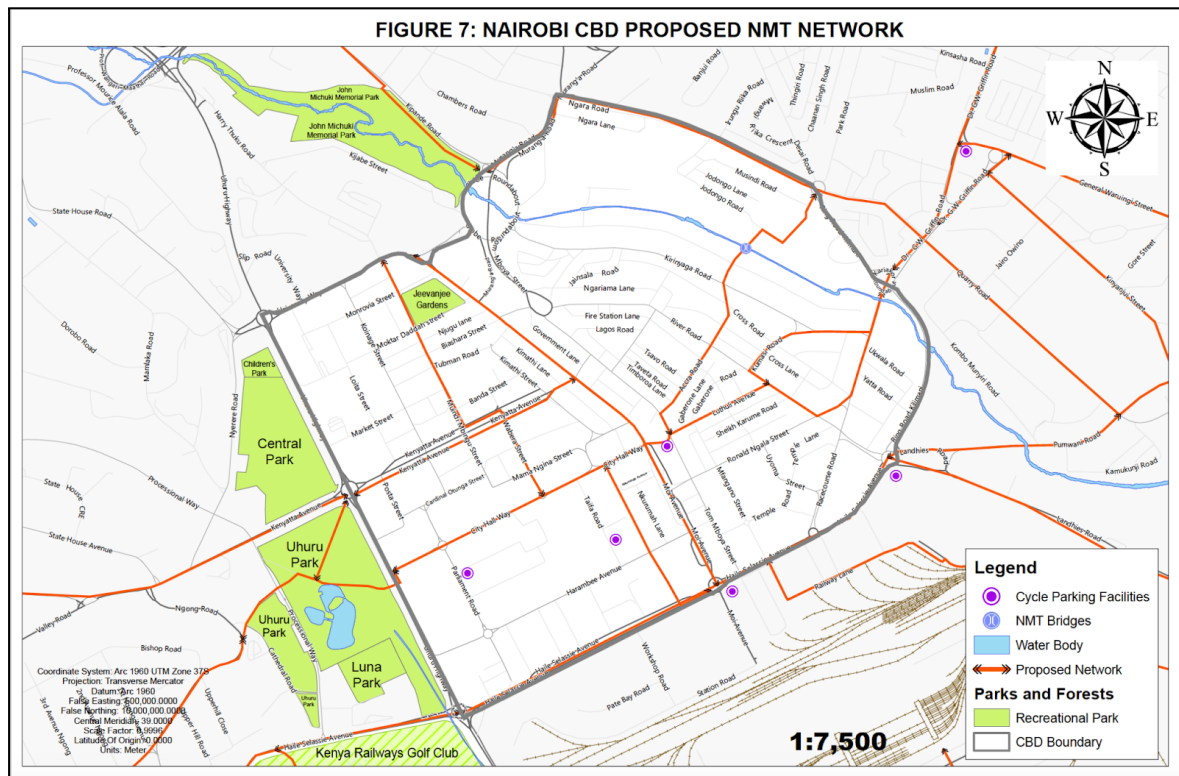


Figure 1: Nairobi CBD Proposed NMT Network

Source: World Bank, 2019

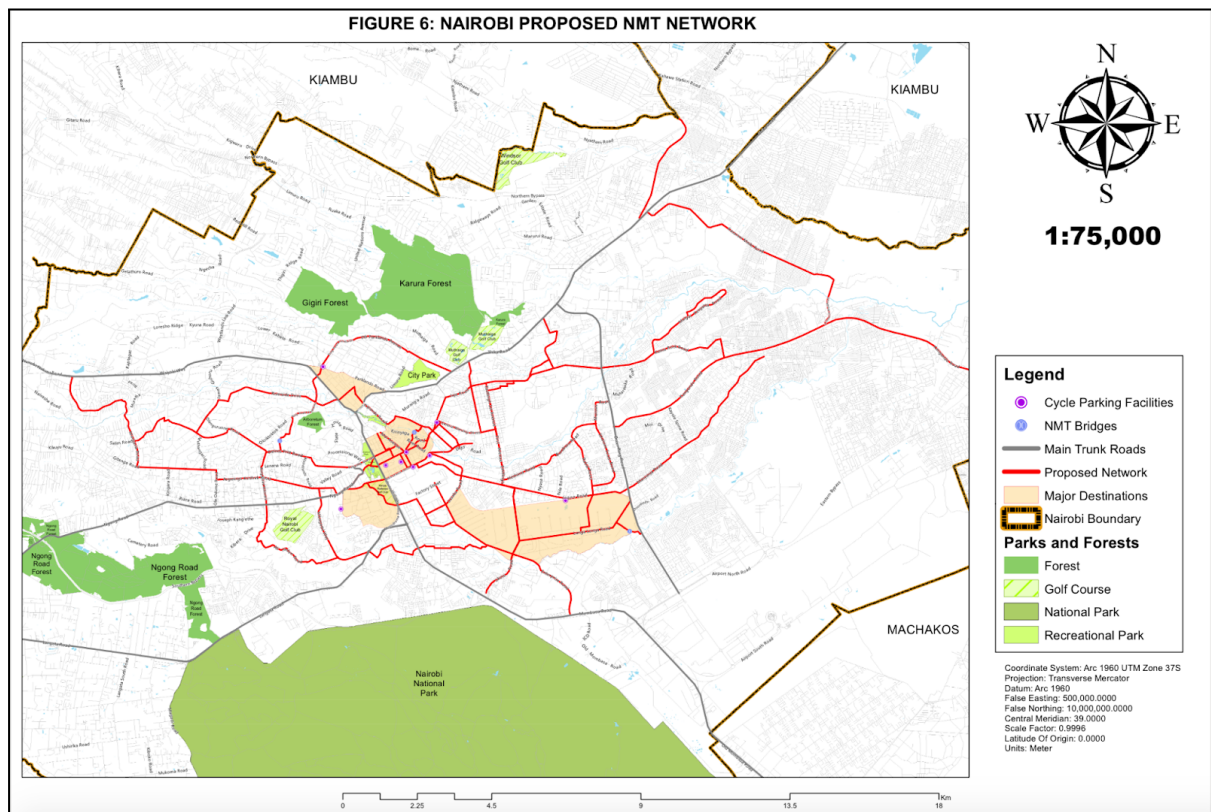


Figure 2: Nairobi Citywide Proposed NMT Network

Source: World Bank, 2019

4.2. Methods used

The study targeted 4 streets. These included Luthuli Avenue, Accra Road (now known as Kenneth Matiba Road), which is one of the proposed streets for pedestrianisation in the Nairobi NMT strategy as well as Munyu Road and River Road, which are adjacent streets.

Questionnaires were distributed among the respondents and a total of 60 respondents were interviewed. Random sampling was used to select the respondents and an effort was put to have a balance between genders and occupations. In a few cases, some respondents were not willing to participate as they were very busy at their shops or businesses because the study was conducted during ordinary working hours and these are very busy streets with thousands of people walking through them everyday.

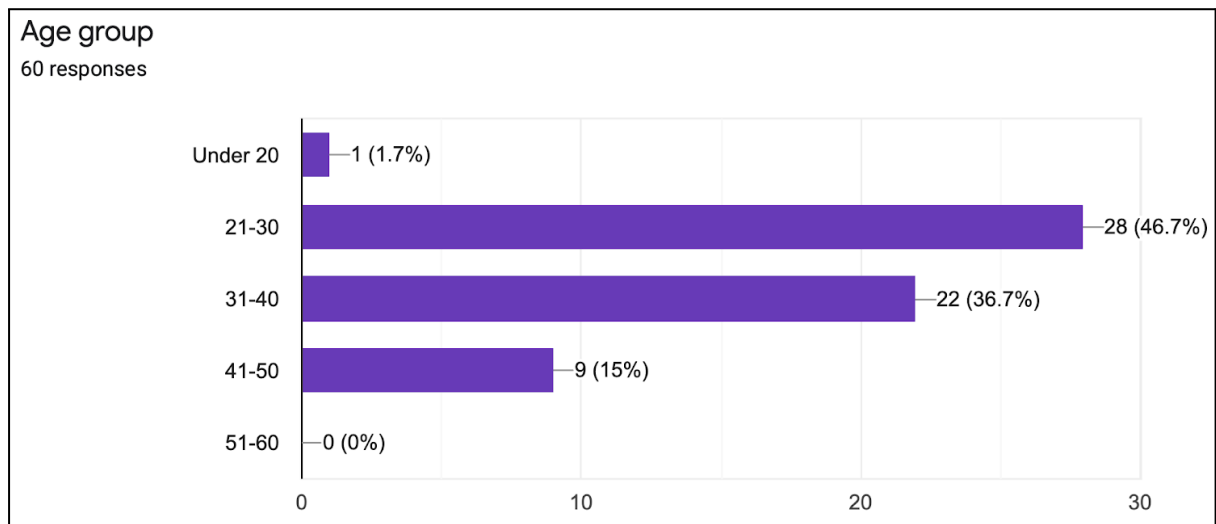
A breakdown of the respondents by street was as follows:

- 57.6% were from Luthuli Avenue,
- 18.6% from Accra Road,
- 20.3% from river road, and
- 2.3% from Munyu lane.

Breakdown by gender:

- 59.3% female,
- 40.7% male.

The majority of respondents were shop attendants (78%) followed by public transport operators (13.6%). Others included fruit vendors, TV set distributors, hawker (PWD), shop owner and watch repairer.

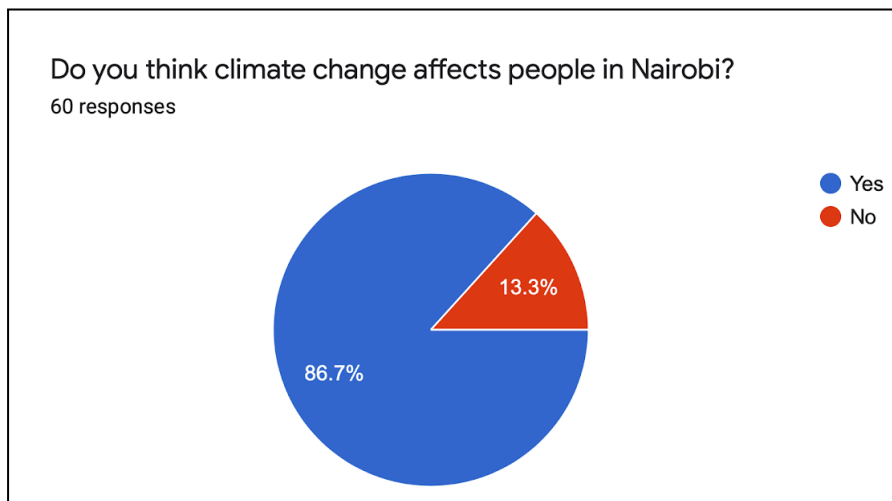


All the respondents approached were adults above the age of 18. Full ethical consent was sought from the respondents and anonymity was guaranteed. Three of the respondents were persons with disabilities.

5. Research Outputs and Outcomes

5.1. Perceptions and knowledge on Climate Change

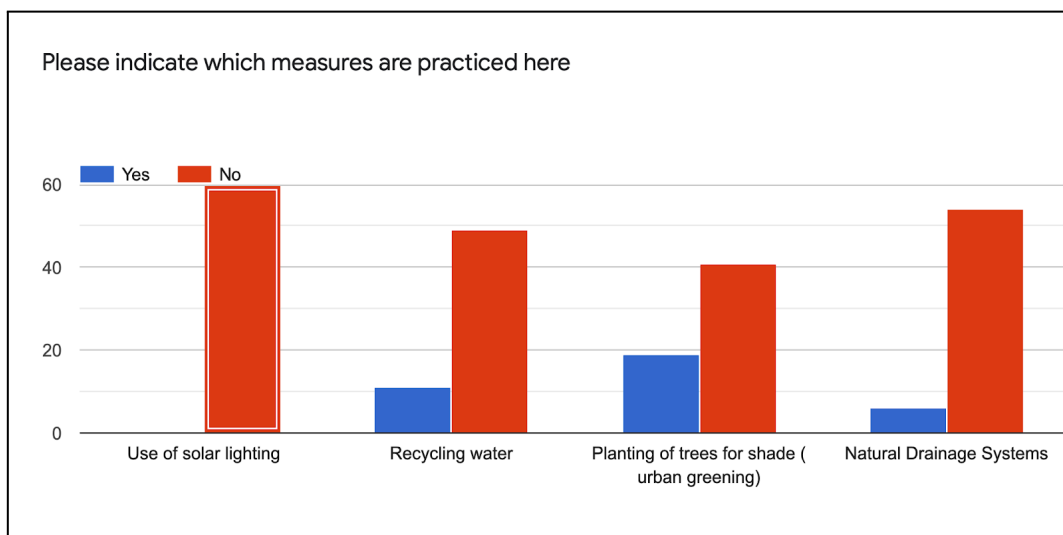
A lot is talked about climate change within professional circles especially research/academia, civil society and the built environment. However, little is known how much awareness there is outside these circles, especially among those who are not directly involved in climate related studies. It remains unknown as to the levels of know-how concerning climate change, the different mitigation measures that can be taken to reduce GHGs at a local and a city level through citizen driven approaches and the short and long term effects.



5.2 Climate friendly measures used by those along the street

As a business district/street that specialises in electronics, it is not surprising that most businesses have their electrical appliances (including lighting) on throughout the day. One can see from the graph that they all source their power from the grid with no utilisation of solar lighting. The 'power density' required along these streets might be too high for current abilities of solar power.

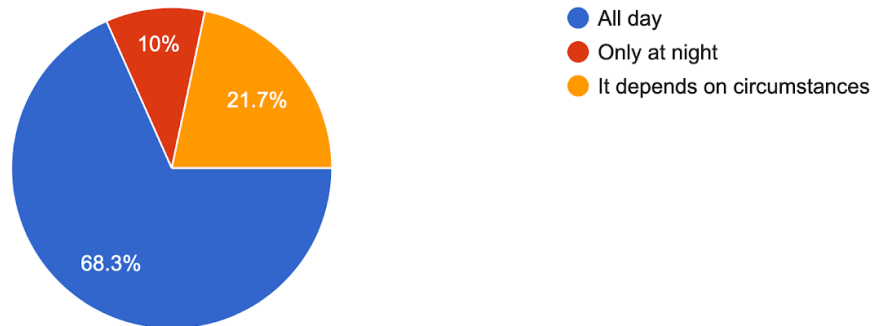
Other practices have been attempted though, including recycling water, planting of trees (these were visible along Luthuli Avenue) and use of natural drainage systems. It was not clear whether the respondent meant using natural drainage systems at site or elsewhere.



Quite notable, as the area has a lot of electronics businesses, the majority (68%) have their lights on all day. Another visible group (21.7%) use electricity depending on circumstances, while 10% have it only at night (possibly for security measures).

How long do you have your lights on in the business place?

60 responses



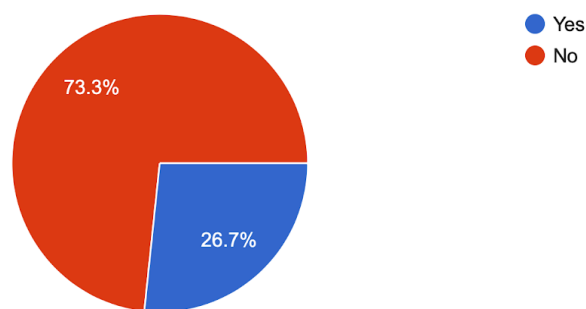
5.3 Air quality and respiratory issues

As noted earlier, the effect of having vehicles right outside shops and businesses does have an influence on air quality. A study done during placemaking week Nairobi 2016, showed that there was a visible change in air quality before, during and after a temporary street closure (Nthusi, V. 2017).

Respondents were asked if they have experienced any respiratory problems possibly due to poor air quality and 26.7% responded that they do. This is a relatively large number as it implied that one in every four people in the CBD could be experiencing respiratory related issues due to vehicular fumes, construction and other air pollutants.

Have you had any respiratory problems because of poor air quality e.g. emissions from vehicles?

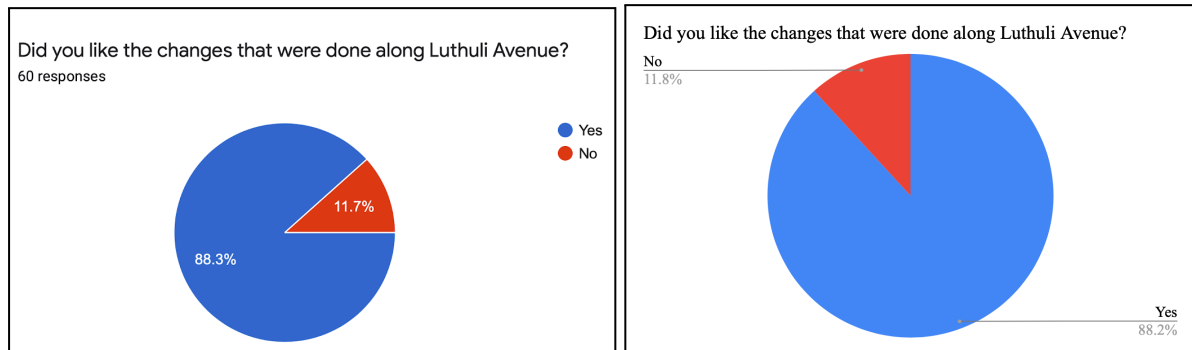
60 responses



5.4 Luthuli Avenue Interventions

Out of all the respondents, 88.3 % were in favour of the interventions done along Luthuli Avenue. A number of those who did not like were public transport operators who stated that their reasons for not liking were because the reduced parking had led to a reduction in their business.

An almost similar result was obtained from the survey of respondents who are specifically along Luthuli Avenue.

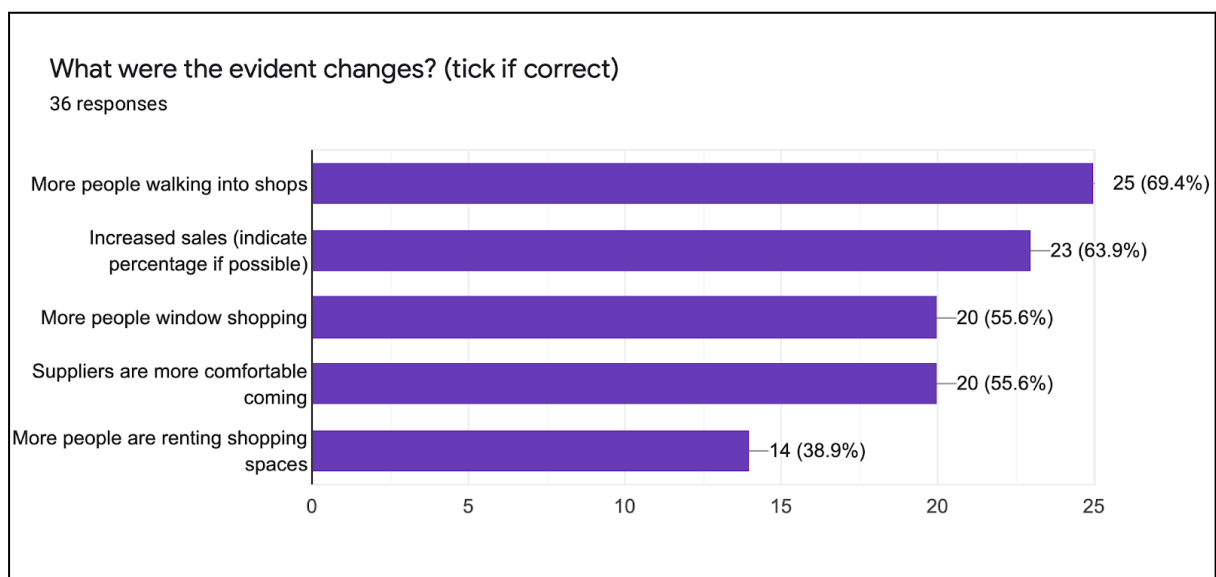


All respondents

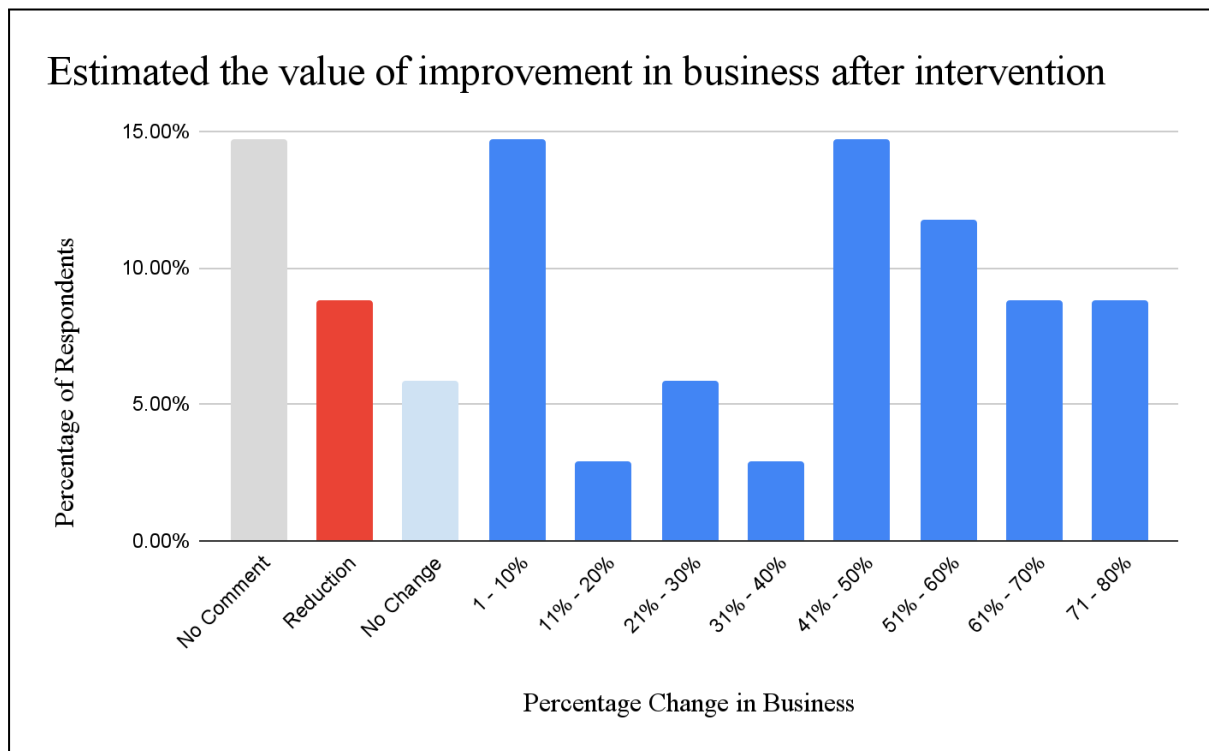
Those along Luthuli Avenue

5.5 Impacts of climate friendly interventions along the street

Respondents were asked whether some of the listed items relating to their businesses had been experienced along the street. A Large number responded in the affirmative as indicated below:



This was very positive and proved the previous fact that has been discussed several times that clients walk into businesses and having on-street parking does not guarantee sales. Increased sales of up to 63% during covid also amounts to increased revenue though VAT while an increase in retail space also directly leads to more employment.



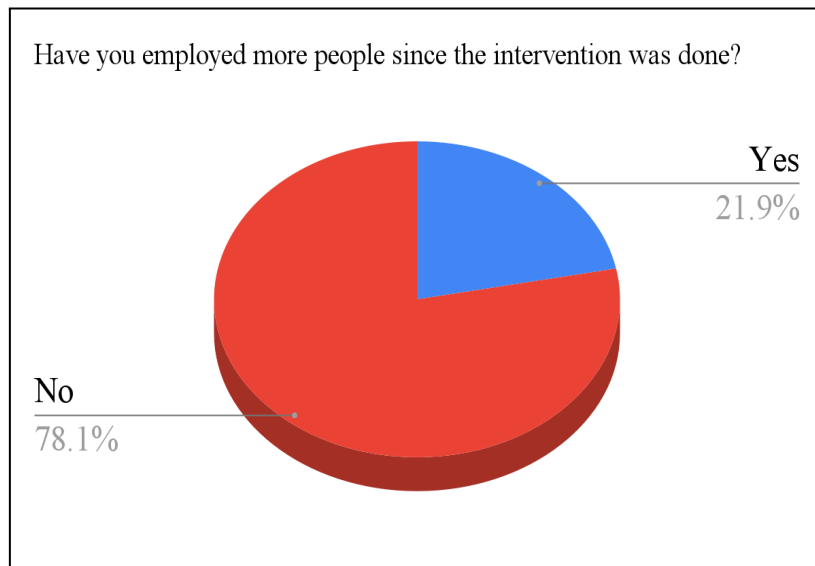
Of those who had an increase in business, one cluster reported an increase from 1-10%, but there was also a larger cluster that reported an increase from 41-60%. Amidst the current covid pandemic, this was very encouraging.

One business person pointed out that *'There hasn't been any improvement this year at all but before that there was an increase by 10%.'* This could possibly be related to the ongoing economic situation with increasing inflation and the effects of the Covid-19 pandemic.

A transport worker also noted that the area is *'Relatively better. Less chaotic /minimal fights since the stage was relocated.'*

Some of those who reported a negative slump noted that *business is low since the flow of clients/people is low* while another from the transport sector stated that *Not having parking spaces has had a negative effect on my business.*

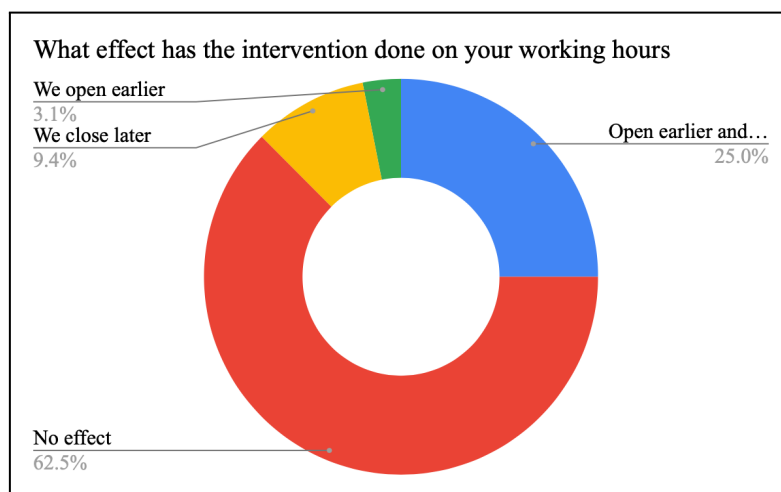
Additionally, 21.9 % (aprox 30%) of the respondents pointed out that they had employed more people since the intervention was done.



5.6 Impact of the climate friendly intervention on working hours

A number have also been able to change their working hours and open earlier, close later or both. This is primarily due to increased security within the area, an improvement recognized by 85% of the respondents. Personal safety is critical for human beings to carry out their day to day activities and for their general well being, this should be pointed out as one of the most important effects of the intervention.

21.9% of the respondents also pointed out that they had seen a slight increase in employment among the businesses in the area (in many cases within their businesses).

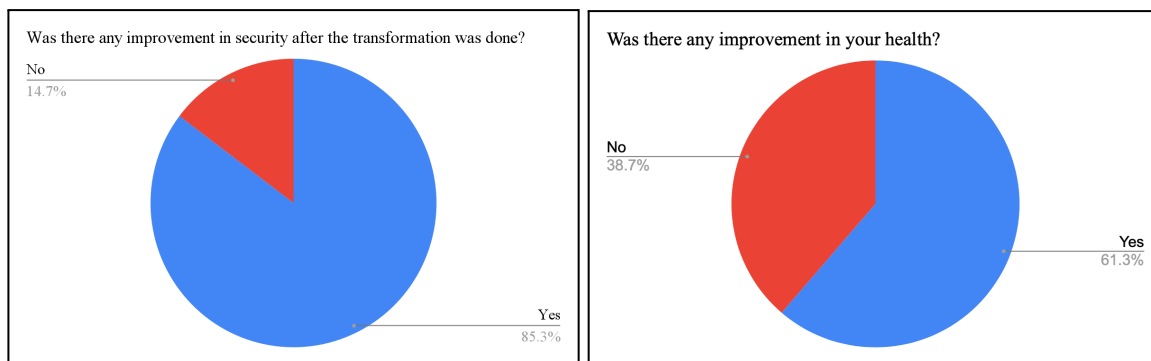


5.7 Health impacts of the climate friendly intervention

The health impact of the intervention should also not be ruled out. As pointed out earlier, air quality and respiratory challenges are a major issue in urban areas. 61% of the respondents stated that there had been an improvement in their health since the intervention. Noise pollution is also a major urban issue

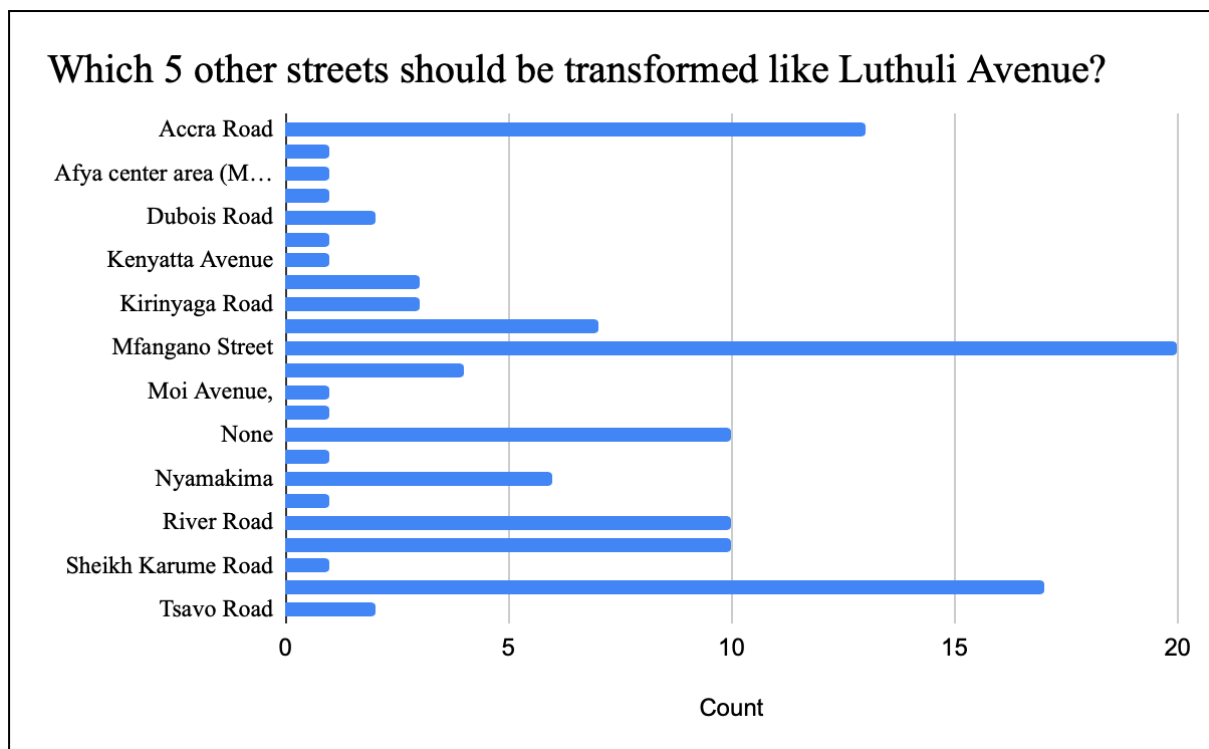
that leads to several health challenges including increased stress, sleeping disorders and concentration problems. When asked to specify details on their health improvements, some of the reasons were as shown below:

*Lesser exposure to emissions; Road accessibility is better especially for ambulances. (General improvement); Less emissions; Less air pollution; Little to no exposure to emissions; No more air pollution from the vehicles; Clean air; Reduced noise pollution; More clean air in circulation; Less annoying hooting engine revving by matatus; Reduced emissions from PSVs led to less sneezing; **Less asthmatic attacks. I use my inhaler less frequently**; Less noise; cleaner breathing air; Less noise and smoke from matatus; Less pollution from matatus; hence cleaner breathing air; Less smoke emissions and noise pollution.*



5.8 Suggestions on further interventions and other streets

Suggestions on other streets that should be transformed like Luthuli Avenue



Respondents were asked some other issues and concerns that were not handled in the questionnaire:

These may form areas for further consideration during other interventions as well as further research and dialogue. Most of these points were mentioned multiple times.

- Vehicle parking spaces should be "bold" to avoid parking on pavements
- Uncontrolled rogue motor cyclists
- Congestion of public transport on Mfangano Street
- No proper shades for bodaboda operators.
- Some dustbins have been removed over time.
- Increased boda boda operators in the pedestrianised Luthuli avenue
- Loading and off-loading zones should be provided for the shop. It is located on one side which make off - loading difficult.
- Benches should be removed. There are many idlers.
- Clean should be done before working/opening hours to reduce the dust inhaled therein.
- Other Issues and concerns
- Booking stations for long distance vehicles park in front of our premises blocking visibility (Munyu lane)
- Noise pollution from other vendors (River Road)
- Congestion on River Road

6. Conclusions

Experts have stated that there is a need to control global temperature rise to no more than 1.5°C. This will enable us to maintain a livable climate. Unfortunately, we are not moving in that direction and with the current trends, it is predicted that global temperatures will rise to as much as 4.4°C by the end of the century. (UN, 2018).

There is a need to have more awareness on the relation between climate change and non-motorized transport infrastructure. In order to do this, it will be necessary to enhance the technical capacity of transport planners and engineers. Fortunately, in Kenya, this has started, primarily in Nairobi, Mombasa and Kisumu (Gary H, et al, 2021).

In spite of the complexity of Climate change, there are simple solutions, as listed above that can make a great effort to improve lives and handle some of the impacts. This is best done on our streets, putting people first and engaging directly with the environment to make communities resilient (Peinhardt K, 2018).

Investing in low-carbon transport options like walking and cycling help us reduce local air pollution, congestion while improving road safety and offering low-income and vulnerable transport users an affordable means of moving around. On top of it all, it mitigates climate change by providing low-carbon alternatives to motorised transport. Mass transit options like electric buses also need to be given some consideration as affordable, low-carbon and climate-resilient (Gary H, et al, 2021).

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