Calculating the potential climate value of Non-Motorised Transport projects in African Cities

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Executive summary

In most African cities, populations are increasing rapidly and the reliance on Non-Motorised Transport (NMT) is high, but dedicated NMT infrastructure remains very limited. Private vehicle use is rising steadily, congesting these cities, poisoning the air and killing NMT users at unacceptably high rates. African cities have a dire need for substantial NMT infrastructure investment, but municipal budgets are constrained and there are many other needs that must be met. Trying to rationalise the allocation of resources in such constrained environments highlights the importance of evidence-based decision-making, to maximise the societal benefit from every municipal investment. Historically, it has been difficult to demonstrate the benefit of NMT, due to the diversity and complexity of its positive impacts, and in many countries that remains true. The ability of NMT to mitigate climate change has remained difficult to measure, in large part due to the lack of appropriate tools. The same was true for the measurement of the health value of NMT before the advent of tools such as HEAT (World Health Organisation, 2014). The climate value of investments and infrastructure in cities is becoming critically important, but to date, has been a woefully neglected and underfunded sector under climate finance programmes.

Determining the climate value of NMT is a relatively new concept and the research is still in a nascent stage. One of the first studies to estimate a climate value of NMT, Massink et al., (2011), calculated that the 3.3% mode share of cycling in Bogotá, Colombia has a climate value of 55,115 avoided tons of CO_2 per year. To attempt a similar climate valuation of NMT projects in African cities, a specific Project Assessment Tool (PAT) was developed. Before applying PAT in a data-scarce, African city, a data-rich, ex-post pilot case was conducted in Bogotá, to validate the tool. NMT projects or scenarios in two African cities, Cape Town, South Africa and Nairobi, Kenya were tested in PAT to determine their potential climate value. To overcome a lack of data necessary to accurately model the changes in mode share resulting corresponding to the scenarios, an opinion poll was disseminated to local experts within the field requesting estimations based on a description of the future scenario being tested. A scenario that was tested across all three cities was a 370km NMT network similar to Bogotá's CicloRuta system. PAT revealed that the climate value of a network like this could be substantial in both Cape Town and Nairobi. Transport planners at the City of Cape Town predict that cycling mode share would increase from 1% to 8%, saving 3.26 million tons of CO_2 over the 15-year life of the project. Experts in Nairobi expect a network like this to be able to not only stem the current decrease in pedestrian mode share but increase it 3% higher to 43%. The avoided trips in cars and minibus taxis could contribute to petrol usage being 7% lower across the city. PAT was also used to evaluate the social benefit-cost ratio of these two scenarios, returning ratios of 16.3 and 12.6 for Cape Town and Nairobi respectively. The climate value of NMT in African cities is considerable and should not be taken for granted. It presents an incredible opportunity for African cities, and the global community, to achieve our collective climate-related goals, and should be integrated into climate finance initiatives in order to spur systemic investment.

1 Introduction

Effective transport systems are vital for people to carry out their everyday tasks, and for providing access to many of the goods and services that constitute a modern society. In turn, each transport mode has associated effects on people's health, the environment and the economy as a whole. The ability to fully appraise these direct and indirect effects is integral to utilising evidence-based policy-making. Impact appraisal and evaluation is especially important for Non-Motorised Transport (NMT) as a significant proportion of the benefit it generates for a society is outside of its function as a provider of access, unlike most other modes. Historically, the techniques for quantifying the benefits of NMT have not been applied as systematically as the simpler appraisal techniques used to assess the costs and benefits of motorised transport infrastructure and projects. However, recent advances in the development of tools that quantify NMT benefits has provided a valuable capability to evaluate transport projects more holistically and more equitably. One of the benefits of NMT that is most abstract to its use is the global impact it has on the environment. The climate value of NMT is seldom considered when appraising local transport projects despite its significant cumulative potential.

Climate change is an increasingly important topic of discussion in African cities as they begin to suffer its effects. From pervasive droughts in urban areas of Southern Africa to flooding in those of Eastern Africa, cities are looking to create transport systems that are more resilient and lower in emissions. NMT is usually a zero-emission form of transport, with considerable societal co-benefits, and deserves to be central to urban planning departments' strategic thinking the world over.

This study involves the use of an NMT Project Assessment Tool (PAT) developed by UN Environment's Share the Road programme, to evaluate the potential climate value of different NMT intervention scenarios in two African cities: Cape Town, South Africa and Nairobi, Kenya. This comparative analysis aims to provide meaningful insight into the potential for NMT to assist African cities, and the global community, in achieving their climate-related goals.

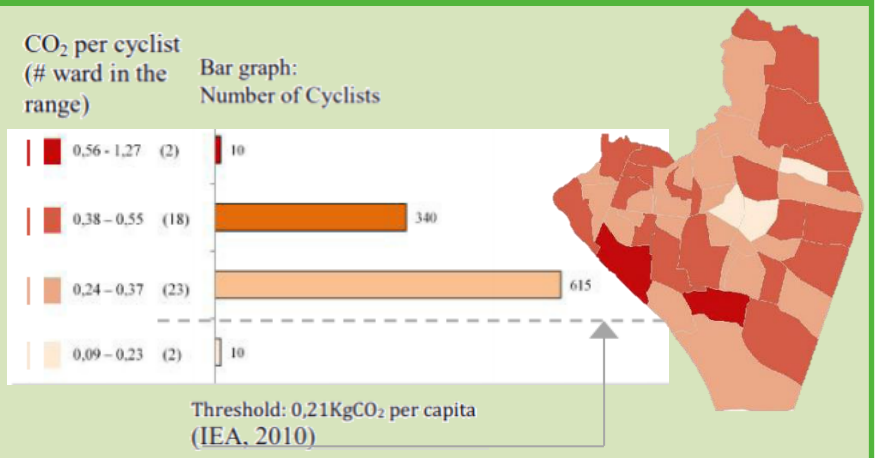
The availability of data is often a constraint to equitably valuing interventions in the urban space. However, this inability to accurately appraise impacts should not restrict decision-makers from discussing or considering these effects. The level of uncertainty related to the valuation of NMT benefits in data-scarce environments is high, but tools like PAT can begin to hint at the magnitude of societal gain that could be created when NMT is invested in. This publication aims to start a conversation around the climate value of transport projects in African cities, a conversation that is becoming more important as each day passes. African cities have the opportunity to embrace their high levels of NMT use and leapfrog the car-dependent cities to achieve environmentally sustainable mobility systems.

2 Climate value of NMT around the world

Determining the climate value of NMT is a relatively new concept and the research is still in a nascent stage. This study follows the approach pioneered by one of the first studies to estimate a climate value for NMT, Massink et al., (2011), which uses the fact that cycling is a zero-emission transport mode to estimate the CO_2 that would have been created had it not been an option. The opportunity cost of the avoided CO_2 emissions is calculated by substituting the cycling trips with those of the most likely alternative mode (Massink et al., 2011). This accumulation of avoided emissions is based on current modal splits, cycling's inter-modal competition and CO_2 emissions factors. Under the assumption that these avoided emissions are transferable for carbon tax credits, Massink et al. (2011) suggest that a monetary value can be placed on the environmental benefits of cycling. In a case study of Bogotá, Colombia, the 3.3% mode share of cycling is calculated to have a climate value of 55,115 avoided tons of CO_2 per year and an economic value of between 1 and 7 million US dollars' worth of carbon credits (Massink et al., 2011). In recognition of the climate value of NMT projects, the UNFCCC published a new methodology in 2018 for monitoring and calculating emissions reductions from cycling infrastructure interventions.

Box 1: Examples of climate value studies related to NMT use around the world

The Unguja Island of Zanzibar had a cycling mode share of 41% in 2009. The climate value of this cycling in the wards of Stone Town was estimated to be 1062.4 tonnes of CO2 per annum, which corresponds to between US$ 7 076 and US$ 20 994, if it were traded on the carbon markets (Mendiate, 2016).



One person switching five journeys of under 2km a week from the car to walking would reduce their carbon footprint by 86kg a year, which is 1.39 times the weight of the average person on earth (Potter 2004).

Barcelona's public bike share system, Bicing, was estimated to reduce annual carbon dioxide emissions by 9 062 tonnes per annum in 2011 (Rojas-Rueda, de Nazelle, Tainio & Nieuwenhuijsen, 2011).

In a five-year period, Dutch people avoided 1.41 million tonnes of CO2 each year through cycling. This saving is equivalent to 54.4 million trees being planted each year (Chen, 2012).

3 Estimating the climate value of NMT

Non-motorised transport research is a vital issue, especially in the current dialogues on sustainability and climate change. However, the availability of NMT related data is still very limited in most African cities. In order to calculate the climate value—and the value of other benefits—of NMT projects in African cities, UN Environment's Share the Road programme commissioned the development of the NMT Project Assessment Tool (PAT). It was developed in order for stakeholders and decision-makers to be better informed regarding the potential improvements that NMT projects can have in a low- or middle-income city context. PAT is a spreadsheet-based, open source tool that evaluates the primary costs and benefits associated with walking and cycling projects.

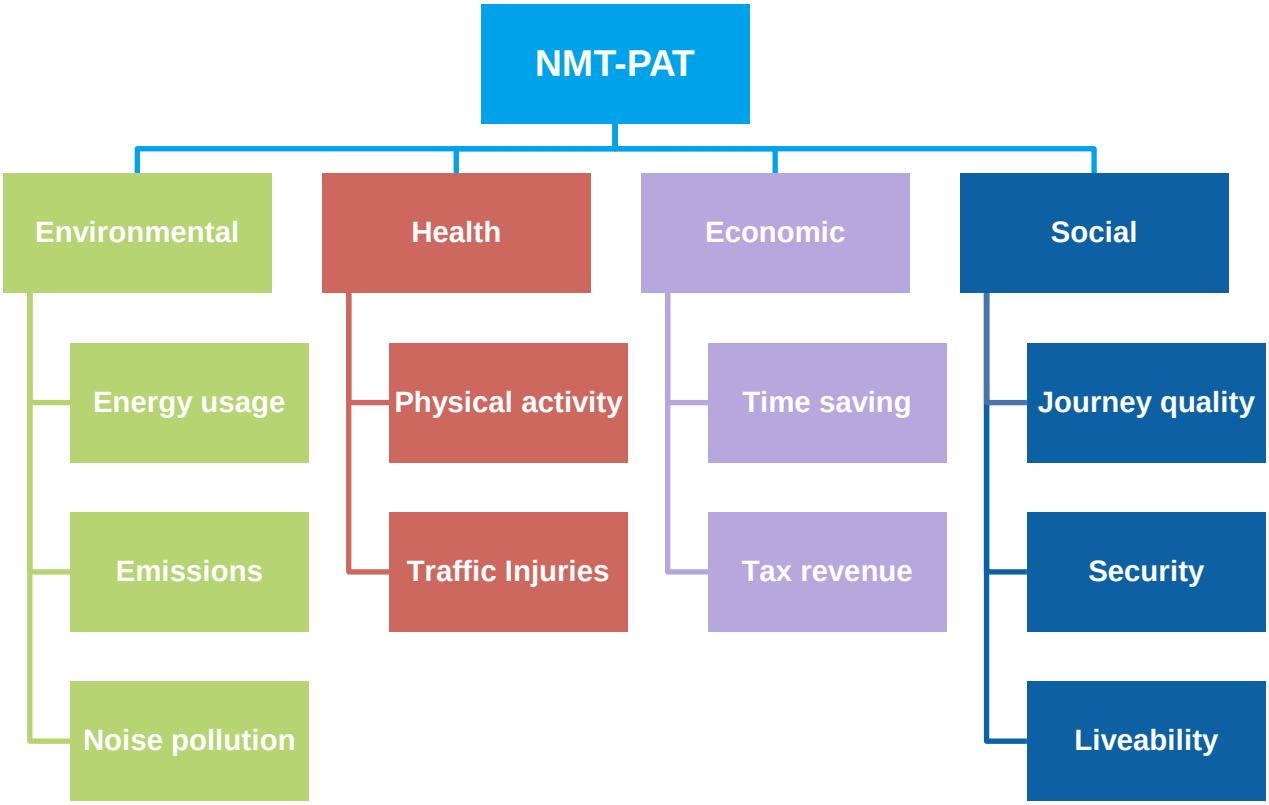


Figure 1: Architecture of UN Environment's Share the Road Project Assessment Tool (PAT)

PAT has four key categories of benefits, or disbenefits, that are considered relevant to non-motorised transport projects: environmental, health, economic and social. To effectively utilise the quantitative and monetary functionality of PAT, data for a certain number of necessary indicators is required. Though, as PAT is designed for data scarce and institutionally under-developed contexts, the ease of which the data was sourced is not an accurate representation of NMT data availability, generally. Through the validation exercises and case studies, it was revealed that the area for which necessary data is least often available is in the prediction of the travel behaviour effects of future scenarios. To overcome the dearth of this critical NMT data, an opinion poll was disseminated to local experts within the field. The panel of experts in each city consisted of a combination of transport engineers within the local government, consultants with transport or urban planning expertise and civil society advocates with technical backgrounds. The poll requested estimations of modal splits based on a description of the future scenario being tested. The poll allowed more detailed analysis of each case study scenario, but the variance in the responses did increase the level of uncertainty in the predictions. However, when coupled with the ability of PAT to test the sensitivity of the results to the uncertain estimates, the opinion poll became a significant and useful tool for the substitution of unavailable data.

For a detailed description of the emission and energy usage algorithms used in PAT refer to Appendix 1: Climate valuation method. The carbon price used in this study is \$8.57/tCO_2, which is the South African carbon tax, Africa's first, legislated to come into effect in 2019.

Case studies

4 Climate value of NMT: Bogotá

Estimating the climate value of NMT is a nascent science. Therefore, before applying PAT in a data-scarce, African city, a data-rich, ex-post pilot case was needed to validate the tool. The seminal study by Massink et al. (2011) highlighted Bogotá, Colombia as a logical candidate. In 1995, approximately 9 million transport trips were undertaken in the city each day, of which 22.5% were pedestrian trips and less than 0.4% were trips using a bicycle (Wright & Montezuma, 2004). The total number of trips grew to 12.5 million in 2015, with pedestrian trips decreasing marginally to 21% and cycling trips increasing significantly to 5% (Nterés et al., 2017). The rapid increase in cycling has been attributed, in large part, to the CicloRuta network constructed within this 20-year period (Verma, Lopez and Pardo, 2015).

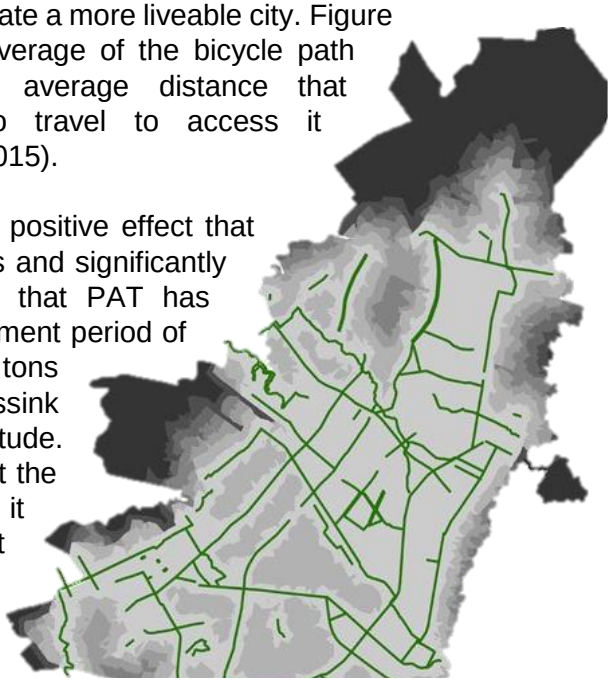
CicloRuta

$1.1 billion

370 km

CBCR: 8.7 (-0.1)

The CicloRuta network is a lattice of dedicated bicycle paths that permeate through the city of Bogotá. They were the brainchild of Enrique Penalosa—who was Mayor of Bogotá from 1998 to 2001 and re-elected in 2016—and formed part of his five urban megaprojects to create a more liveable city. Figure 2 illustrates the coverage of the bicycle path network and the average distance that residents need to travel to access it (Teunissen et al., 2015).



A critical impact of the CicloRuta network for Bogotá is the positive effect that cycling has had reducing Greenhouse Gas (GHG) emissions and significantly improving air quality. Illustrated below are the estimates that PAT has calculated for these impacts during a 15-year project assessment period of 1995 to 2010. The estimation of CO_2 savings by PAT is 57 078 tons per year, which is only 3.6% higher than the value that the Massink et al. (2011) study calculated for a modal shift of similar magnitude. Including all four NMT benefit categories, PAT estimates that the Social Benefit-Cost Ratio (SBCR) on this project is 8.8, but it would be -0.1 if travel time reduction was the only benefit valued as has often been the case in the past.

CO_2 savings:	PM savings:	NO_x savings:
856 kilotons	490 tons	5 240 tons