

CYCLING POTENTIAL DEMAND AND TRAVEL BEHAVIOUR CHANGE IN DAR-ES-SALAAM, TANZANIA

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ABSTRACT

The potential contribution of cycling as an in-expensive, affordable and sustainable mode of travel is immense in less developed countries and particularly in African cities. The benefits of cycling are two fold: It provides better access to activities and facilities that society considers vital for survival, and it creates employment opportunities for the most vulnerable urban population. Despite its well known advantages and significance for facilitating mobility, cycling has remained unrecognized and an inferior mode characterized by a very low modal share in most African cities. For example the current level of cycling in the city of Dar es Salaam, Tanzania is only 5% which contributes to only a marginal amount as compared to its potential demand. There are various arguments raised for the low profile of cycling: safety, security, culture, history, weather, topography and lack of cycling infrastructure and some of these factors such as safety and security cannot be under estimated. There is still a need for understanding, however, how people can be influenced to change their travel behaviour towards the use of sustainable modes and the bicycle in particular.

In this paper the transactional model of behavioural change is adopted to study attitudes and perceptions in relation to cycling for daily travel activity in Dar es Salaam. This model deals with intentional changes in behaviour. In an attempt to change behaviour, an individual typically moves through different stages of change (pre-contemplation, contemplation, preparation, action and maintenance), sometimes several times before terminating a particular behaviour. Such an approach has not yet studied to identify focus groups in

different stages of travel behaviour, whereas this information is relevant for pro-cycling transport policies and marketing strategies.

The paper presents the results of a large pilot survey in the city of Dar es Salaam. The objective of the survey was two fold: first to achieve a market segmentation based on the different stages of behaviour change for the daily travel activity, and second to analyse and understand characteristics of each of the market segments like socio-economic status, current travel behaviour, attitudes and perceptions. The study shows that with respect to cycling as a mode of transport in African cities, it is essential to add a sixth stage in the transactional model, which is the 'relapse' stage.

Keywords: cycling, segmentation, travel behaviour change, daily activities, stages of change

1. INTRODUCTION

Non Motorised Transport (NMT) such as cycling has only due recognition in some African cities and is less or not considered seriously as a mode of travel in many others. Cycling has been neglected as an important mode of transport because of heedless urban transport planning and unplanned city developments. This has significantly affected accessibility to activity locations by city residents particularly the low income households living in urban rural fringes who make their livelihood by working in the urban city centres. There are exceptions however, cities such as Dar es Salaam in Tanzania and other medium -sized cities like Jinja in Uganda have tried to improve the urban mobility of the low income people. These initiatives are mainly meant to integrate low cost modes, such as primarily cycling into the main stream urban transport planning process of those cities (Interface for Cycling Expertise [I-CE] 2007).

In the past few years, considerable achievements have been made in terms of increase of low cost mobility policy and commitment of municipal and local government bodies towards the use of non-motorised transport for urban mobility (Interface for Cycling Expertise [I-CE] 2007). In effect, the modal share of cycling has shown a modest increase from 3 % in 2002 to 5% in 2007 in cities such as Dar es Salaam where cycling promotional initiatives have been implemented (JICA 2007; World Bank 2002). Despite this marginal growth, the modal share remains very low as compared to its enormous potential.

The potential contribution of cycling as an in-expensive, affordable and sustainable mode of travel is immense in less developed countries and African cities in particular. In an African city context, the benefits of cycling are two fold: It provides better access to activities and facilities that society considers vital for survival, and it creates employment opportunities for the most vulnerable urban population. Despite its well known advantages and significance for facilitating mobility, cycling has remained unrecognized and an inferior mode characterized by a very low modal share. For example the current level of cycling in the city of Dar es Salaam is only 5%, which is marginal.

From scientific literature, various arguments are raised for the low profile of cycling: safety, security, culture, history, weather, topography and lack of cycling infrastructure. Some of these factors such as safety and security cannot be under estimated. According to Interface for Cycling Expertise [I-CE](2007), it was argued that if cycling levels are far below its potential, then there are obviously other physical or psychological barriers which need to be investigated or removed. Given the potential of cycling in addressing some of the transport problems and contribution for utilitarian travel, one would question why don't more people cycle? Such an investigation related to cycling potential demand¹ is less or hardly investigated in African cities. This indicates a limited understanding on how people can be influenced to change their travel behaviour towards bicycle use.

2. PREVIOUS RESEARCH

Traditionally in transport planning and travel demand analysis, the travel market is segmented according to socio-demographic variables and transport use (car users, cyclists etc). However, it seems that few differences exist when only socio-demographic segmentation is taken into consideration or when groups are segmented according to transport use. This indicates the need for careful identification of new segments of users according to the underlying psychological constraints, incorporating perceptions and attitudes (Anable 2005; Wedel and Kamakura 1998).

Meanwhile, studies have shown that there are large differences in people's attitudes and perceptions on modal choice. Understanding travel behaviour and the reasons for choosing one mode of transport over another is an essential issue. However, travel behaviour is complex, for each journey, people have the choice between different travel modes, each one having specific characteristics, advantages and disadvantages, and costs. Additionally, the choice of one specific transport mode can vary over time and with the type of journey. Therefore, in order to promote the use of a particular mode (i.e. bicycle), it is necessary to understand the underlying patterns of travel behaviour (Beirão and Cabral 2007). Further, literature suggests that the effectiveness of cycling inclusive urban transport planning and pro-cycling transport policies is very limited if travel behaviour is not well understood.

More importantly, in designing a socially desirable and environmentally sustainable transportation system in line with people's preferences, transportation planners must increase their understanding of the hierarchy of preferences that drive individuals' choice of transport mode. Understanding modal choice is an essential issue since it affects how efficiently one can travel, how much urban space is devoted to transportation functions as well as the range of alternatives available to the traveller (Johansson et al. 2006; J. D. Ortúzar and Willumsen 2001).

Most studies on attitudes and perceptions related to cycling compare the views of cyclists and non-cyclists. However, literature shows that it may be useful to make more subtle

¹ Potential demand for cycling refers to the suppressed demand that is not explicitly expressed or realised but will be present if cycling conditions.

distinctions that is to say classifying within groups of cyclists and non-cyclists on the basis of attitudes and perceptions (Bergström and Magnusson 2003). Because of the complexity of travel behaviour it would be interesting to examine and determine focus groups based on the outcomes of a behavioural survey instead of an a priori classification of groups using socio-economic attributes of travellers.

The extent to which segmentation has been used in travel behaviour research depends on which of the two methodological definitions (a-priori and post-hoc) is used. Travel behaviour research has almost exclusively applied traditional a-priori methods of segmentation which are often based on pre-defined key socio-economic variables such as income, gender, age, car ownership, or behavioural characteristics such as frequency of mode use (e.g. 'high user' versus 'low user'). However, such segments are not necessarily homogeneous in terms of motivation and attitudes which are increasingly transcending demographic lines. Therefore, the most informative and policy relevant segmentation studies use post-hoc research based on psychographic measurements to systematically analyse combinations of factors and define new categories of users. These are interpretable in terms of their attitudinal and aspirational profiles and their potential modal switchability (Anable 2005; Wedel and Kamakura 1998)

In their post-hoc study, (Bergström and Magnusson 2003) were able to distinguish four different groups: winter(summer) cyclists; summer-only cyclists; infrequent cyclists and never-cyclists. Each group appeared to have different perceptions of the factors that are important for their mode choice. For instance winter cyclists valued exercise most whereas weather conditions were especially important for summer cyclists and travel time appeared to be most important for non-cyclists. This suggests that a more detailed examination of the attitudes and perceptions of different mode users may provide more useful information on which to base the development of behaviour change strategies (Gatersleben and Appellton 2007).

Also, Ortúzar et al.(2000) conducted six focus groups with an aid of an expert psychologist. The groups were formed by individuals belonging to several strata of interest for the study, namely: public opinion leaders at the community level; car drivers; public transport users; young people; cyclists; short trip makers (less than 5 km away from homes). Even though most of the factors of interest coincided with earlier findings elsewhere, however, it came out strongly that for many people – particularly of higher income levels, using a bicycle as a means of transport was perceived as an 'embarrassing situation' (*i.e. it is degrading, only gardeners or blue collar workers use it*). Bicycles are also perceived to demand a lot of energy and hence require being in good physical conditions. This stresses a need to study strategies and policy measures to encourage cycling as a means of transport which should be done from the users' point of view while considering their preferences.

Jensen (1999) conducted 30 in-depth interviews and identified six mobility types based on behaviour and attitudes: the passionate car drivers; the daily life car drivers; the leisure time car drivers; the cyclists/ public transport users of heart; the cyclists/ public transport users of convenience and the cyclists/public transport users of necessity. The study pointed

out that one strategy alone is not enough to change the travel behaviour of the population in general.

Gatersleben and Appelton (2007) did a study on attitudes and perceptions in relation to cycling to work by using the transactional model of behaviour change. This model deals with intentional behaviour change. In an attempt to change behaviour a person typically moves through several stages of change (pre-contemplation, contemplation, preparation, action and maintenance), sometimes several times before terminating an undesirable behaviour. Such an approach has not been studied to identify homogeneous focus groups in different stages of change in behaviour whereas this information is relevant for pro-cycling transport policies and marketing strategies.

From the market segmentation literature, however, in order to assess the potential for behavior change, it is necessary to identify the malleable behaviours and understand who the people are that may react to certain messages and interventions. This requires an understanding of the characteristics and size of the various segments in the population that are most likely to respond to these policies. Anable et al. (2006) shows that the greatest potential for behaviour change is often at the margins, and this is invariably ignored in the design of transport policies. Also, to assess the potential impact of behavior change, that understanding of various segments needs to be combined with an assessment of the degree to which people will adapt their behaviour, how behaviour change occurs, how long they are likely to sustain this change and the knock on effects of this change. This requires a detailed understanding of the motivations for behaviour change of each group as the behaviour change is likely to consist of any complementary or counterproductive reactions amongst certain groups (Anable 2005).

Moreover, to assess the barriers to change, an appreciation of the different barriers that exist for different people is necessary. These barriers are individual and collective, objective and subjective. This requires identifying the unique combination of actual or subjective obstacles for each segment in the population or each type of behaviour or organization of interest. By drawing on socio- psychological insights into the nature of those barriers and the way in which people's behaviours are motivated and constrained, interventions can be targeted very specifically towards them (Anable 2005).

While answers to the above questions are never simple to find, segmenting the population allows the barriers, the drivers and the potential for change to be identified in a much more systematic way in preparation for more targeted interventions. Segmentation allows easy wins to be targeted and will add value to existing programmes (Anable 2005). However, in the transport sector, there have been very few attempts to define distinct mobility segments in a systematic and psychologically meaningful sense. On the other hand, segmentation methods are criticized for usually being cross-sectional and not modeling any process of social change. To address this, studies could be designed with the intention of developing an understanding over time of how the segments evolve in response to normative and

contextual developments with respect to travel behavior change² (Anable 2005; Rose and Marfurt 2005).

From earlier studies elsewhere, it has been indicated that a staged and a targeted strategy of travel behavior change is likely to be more effective than a 'one size fits all' approach (Anable 2005; Anable et al. 2006; Taylor and Ampt 2003). Driven as they are by different needs, people in different groups behave differently, think differently, perceive or experience different barriers and are motivated by different things (Beirão and Cabral 2007; Wedel and Kamakura 1998). Therefore, different people must be treated in different ways because they are motivated by different factors, experience different impediments to change and are affected in different ways by policy (Teichert et al. 2008; Wedel and Kamakura 1998).

Based on those observations from previous research, this paper uses the transactional model of behaviour change in identifying potential market segments for cycling and presents the results of a large pilot survey taken in the city of Dar es Salaam in March 2009. The main objective of the survey was to; first to achieve a market segmentation based on the different stages of behaviour change process for the daily travel activity, and second to analyse and understand characteristics of each of the market segments like socio-economic status, current travel behaviour, attitudes and perceptions.

METHODOLOGY

3.1. Study context

To investigate attitudes and perceptions of individual commuters from their residential locations, the study area in Dar es Salaam was divided into twelve traffic analysis zones (TAZ) along the four major road corridors in the city. The target group was only commuters (respondents) who travelled to their daily activities (i.e., work, private business, school, shopping, sports and others). The survey was conducted in TAZs along the four major transport corridors where bicycle lanes are proposed to be introduced in the city. A detailed quantitative and qualitative questionnaire-based interview survey was conducted among 620 individual commuters aged 10 years and above.

² Travel Behaviour Change is a term adopted to describe a sub-set of travel demand management measures designed to encourage voluntary changes in 'personal' or 'private' travel behaviour.

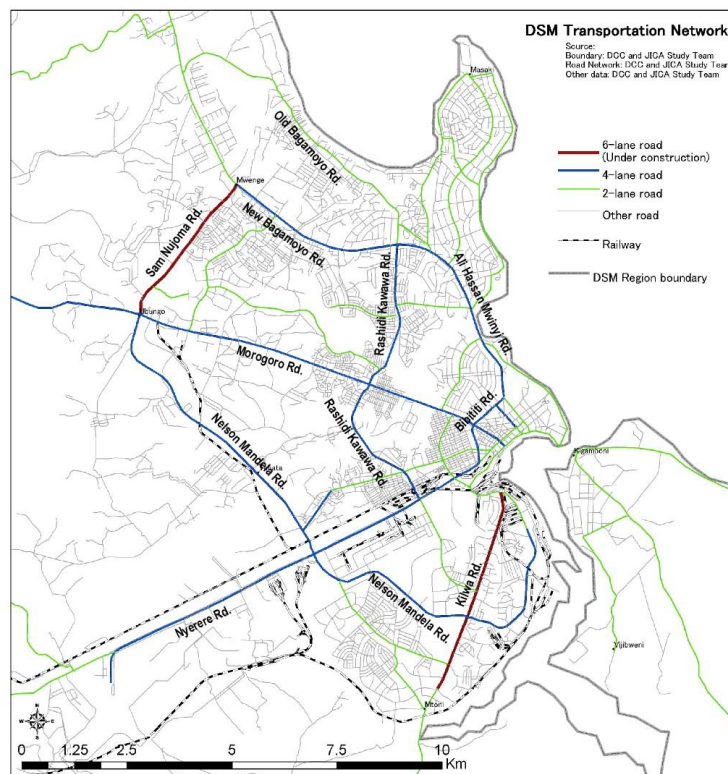


Figure 1 – City of Dar es Salaam major transport corridors along where the survey was conducted

3.2. Questionnaire development

A decision was taken to conduct a questionnaire-based survey using face-to-face personal interview techniques to collect information from the sampled respondents. The survey questionnaire contained a brief introductory statement that was explaining the purpose of the field survey and its benefits to the target city population. The questionnaire was composed of three parts: Part A intended to collect relevant socio-economic and demographic information in order to get the nature of the sampled population; Part B was designed to collect individual travel information which was used to give an overview of the travel characteristics of the sampled population and Part C collected information related to attitudes and perceptions towards cycling. The socio-economic questions were placed at the end of the questionnaire since they comprised of sensitive questions like income and property ownership that would have disrupted the survey had these questions appeared at the beginning. Given the complex nature of the questionnaire which required in depth understanding of the cycling attitudes of the target respondents and the literacy level of the population in the study area, it was necessary and important to use face-to-face interview methods to observe and guide the respondents in answering the questionnaire. Personal interviews were relevant in this study to monitor and clarify on any questions that were not clear to the respondents.

3.3. Sampling strategy

The survey was conducted in residential locations where bicycle lanes are proposed to be provided along the Bus Rapid Transit (BRT) proposed corridors. A stratified random

sampling was applied where individual commuters who travelled to their daily activities on a regular basis were interviewed. The sampled population were only the city residents and not visitors of the city and the questionnaire was set such that only information from the target group was collected. A sample of 620 respondents was interviewed in the survey, resulting to only 598 well completed questionnaires which were considered and taken for analysis. The interviews were conducted to individuals during evening time when people returned from their activity places. This is because the questionnaire was complex and needed more time from the respondent to understand the questions and proper thinking before stating his response which could not have been possible at for example bus stops in morning rush hours. Similarly if the interviews were to be conducted at the work place, it would have required prior permission from the employer or head of the office which is generally difficult to get. Even if permission is secured, the employee or respondent is so hard pressed with the work that he/she would reply as fast as possible. According to (Rastogi and Rao 2002), the responses given in such situation, with lack of peace of mind, will always be less promising and unreliable, and would have affected the quality of the survey. Clearly, the study sample was not intended to be representative for the general population. The study sample was mainly intended for individual commuters who travel to their daily activities on a regular basis and those commuters in particular who live in areas along the major arterial roads of Dar es Salaam, where the proposed bus rapid transit and bicycle lanes are planned. The regular commuting population is likely to be more representative than non-commuters and infrequent commuting population.

3.4. Segmentation analysis

Essentially, segmentation, from both marketing and a research perspective, is simply the act of defining meaningful sub-groups of individuals or objects (Teichert et al. 2008; Wedel and Kamakura 1998). At its core, it is about reducing the number of entities being dealt with into a manageable number of groups that are mutually exclusive and share well defined characteristics. Once groups are identified, it is possible to make predictions about their responses to various situations, marketing strategies and types of policy, to allow more creative and better-targeted policies to emerge (Anable 2005). The transactional model of behavioural change was adopted and used to define cycling potential market segments and to study attitudes and perceptions in relation to cycling for daily travel activity. This model is adopted from (Prochaska and Diclemente 1984) and deals with intentional changes in behaviour. The model has been used in public health psychology studies to examine changes in health behaviour. In an attempt to change behaviour an individual typically moves through different stages of change sometimes several times before terminating a particular behaviour. Mounting evidence suggests that behaviour change occurs in stages or steps and that movement through these stages is neither unitary or linear, but rather, cyclical, involving a pattern of adoption, maintenance, relapse, and re-adoption over time (Prochaska and Diclemente 1984). In attempting to explain these patterns of behaviour, the transactional model (see table I) emphasizes that behaviour change occurs in five distinct successive stages change (Pre-contemplation, contemplation, preparation, action and maintenance) where people move in a cyclical or spiral pattern.

Table I – Stages of change in Prochaska and DiClemente's (1984) Transactional Model

Stage	Characteristics	Change strategy
Pre-Contemplation	Un aware of problems, no intention to change	Increase general problem awareness
Contemplation	Aware of problems, thinking about change	Motivate, encourage specific action
Prepared for Action	Intention to change in the next six months	Assist in developing specific plans
Action	Action being taken	Feedback, social support, reinforcement
Maintenance	Has maintained action for 6 months or more	Reminders, feedback, social support

The transactional model of behaviour change has been seen useful in travel behavior studies recently. This model could help policy makers and organizations to develop more effective behaviour change strategies in relation to travel behaviour. The model has proven to be very effective in analysing the propensity to cycling in the absence of a major event in the UK (Gatersleben and Appelton 2007) and in examining the promotion of cycling as a commuting mode from a Ride To Work Day (RTWD) event in Australia (Rose and Marfurt 2005). However, this model has been less exploited in identifying homogeneous travel market segments for cycling in a developing country context. Hence, in this study the transactional model of behaviour change is adopted to identify potential market segments for cycling demand. Also a descriptive statistical analysis is used to analyse and understand characteristics of each of the market segments based on socio-economic status, current travel behaviour, attitudes and perceptions.

3. RESULTS

The study presents the results of a large pilot survey that was conducted in the city of Dar es Salaam. There were (N=598) individual commuters interviewed in the survey. The gender distribution of the sampled population; female (25%) and male (75%) with a mean age of 30 (STD = 10.7). The minimum age of the sampled population was 10 and maximum 80.

4.1. Segmenting the sampled respondents by stages of behaviour change

Understanding the composition of the target audience is an essential part of any promotional strategy. One of the objectives of this study, therefore, is to categorise the type of people who are potentially most easily influenced towards cycling. The sampled population (N= 598) were categorised into one of the five stages of behaviour change as per Prochaska & DiClemente's (1984) model. Each travel behaviour change stage was reflected in a statement presented to respondents (Table II). In separate questions, the respondents were asked to indicate which statement applied to them at the time of the survey.

Table II – Cycling behaviour change stage statements

Statement shown to respondents	Corresponding cycling behaviour change Stage
I never really think about and not even consider cycling to my daily activity place	Pre-Contemplation
I never used a bicycle but sometimes think about cycling to my daily activity place	Contemplation
I rarely or sometimes cycle and seriously consider riding to my daily activity place	Prepared for Action
I have fairly often cycled to my daily activity place	Action
I cycle regularly to my daily activity place	Maintenance
<i>I no longer cycle to my daily activity place</i>	Relapse*

Table II shows the basis under which respondents were classified into six groups (pre-contemplation, contemplation, prepared for action, action, maintenance and relapse*) based on the statements they selected as applied to them during the survey. Using these classifications of behaviour change it is possible to identify homogeneous segments in the survey sample (see figure 2). However, during survey period, it was found out that there exist another group of respondents who used to cycle in the past to their daily activities but no longer cycle currently. This led to the modification of the survey instrument and a new cycling behaviour change statement “*I no longer cycle to my daily activity place*” was added to capture the cycling travel behaviour of this group of respondents (see table II). This behaviour change statement resulted to the formation of a new behaviour change stage after the maintenance stage in the Prochaska’s transactional model which was referred to as “Relapse stage” in this study. The Prochaska & DiClemente’s (1984) transactional model emphasizes that behaviour change occurs in five distinct successive stages (pre-contemplation, contemplation, preparation, action and maintenance stage). Depending on the study area context, however, the Prochaska’s model of behaviour change may be modified and thus from this study it is revealed that a sixth behaviour change stage referred to as the ‘*Relapse stage*’ can be added to Prochaska’s model to capture the cycling attitudes and perceptions of the sampled respondents that have relapsed from cycling. Figure 2 shows how the sampled respondents have been classified into six distinct segments based on the transactional model of behaviour change.

* A new added stage of change where respondents used to cycle in the past but no longer cycle currently

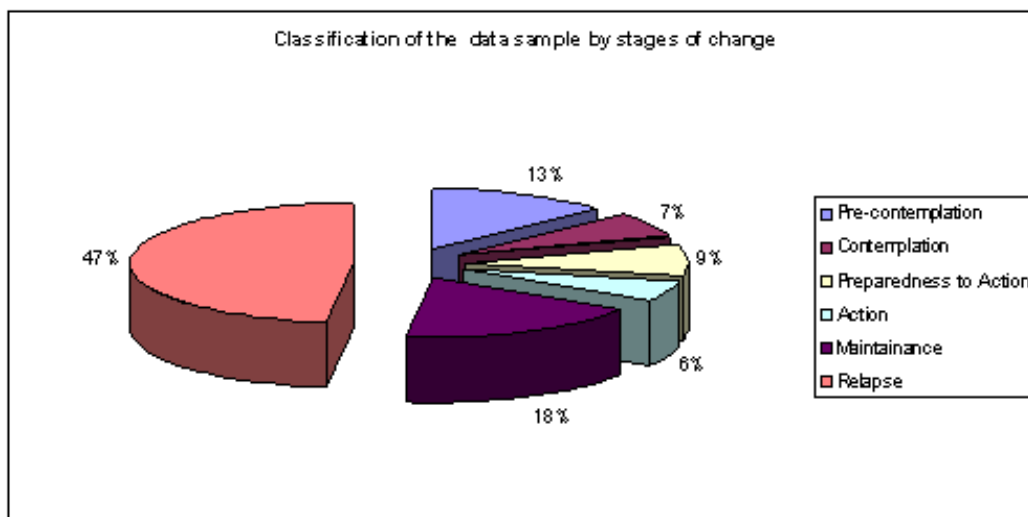


Figure 2 – Segments from the transactional model of behaviour change

From figure 2 it is shown that 13% of the sampled respondents had never used a bicycle to travel to their daily activity place and do not consider using one, these were classified in the 'pre-contemplation stage'. 7 % of the Respondents had never used a bicycle but sometimes think using one to travel to their daily activity place; these were classified in the 'Contemplation stage'. 9 % of the sampled respondents who indicated that they rarely or sometimes use a bicycle and seriously consider cycling to their daily activities were classified in 'Preparedness to Action stage'. 6 % of the sampled respondents who indicated that they fairly often cycle to their daily activities were classified in the 'Action stage'. 18 % of the sampled respondents indicated that they cycle regularly to their daily activities and were classified in the 'maintenance stage' while most of the sampled respondents (47 %) indicated that they used to cycle in the past but no longer cycle to their daily activities currently and these were classified in the 'relapse stage'.

4.2. Travel Behaviour and Socio- demographic Characteristics

Using the derived classifications, it is possible to identify the travel behaviour and socio-economic differences between the different stages of change segments. Table III shows who cycled and who did not. Regular cyclists were mostly men whereas those who had never contemplated cycling were mostly women. The mean age for all the stages of change segments was almost equal suggesting that the age factor is not a necessary barrier for cycling. Chi-square test has shown that people's adherence to different stages of change segments is highly associated to their travel behaviour and socio-demographic factors ($p \leq 0.001$).

Table III – Travel behaviour and socio-demographic variables of respondents by stages of change segments

	Pre- contemplation	Contemplation	Prepared for Action	Action	Maintenance	Relapse
	n=79	n=40	n=51	n=34	n=107	n=287
Back ground information						
% Female	67	78	12	0	3	20
% Cyclists	0	0	0	100	100	0
Average Age	32	25	28	31	31	30
% have a car	27	0	2	0	0	13
% have a bicycle	0	0	6	77	100	9
Travel Distance(km)						
% (0 - 5)	51	45	71	79	73	55
% (5 - 10)	25	18	8	9	16	23
% (10 - 15)	6	10	4	0	2	6
% (15 and above)	4	5	8	3	0	1
Travel Mode						
% using bicycle	0	0	0	38	100	0
% using public transport (PT)	60	73	84	0	0	74
% using car	28	0	2	0	0	10
% walking	6	23	12	0	0	8
% using motorcycle	1	0	0	0	0	3
% using bicycle/other mode	0	0	0	62	0	0
% using car/other mode	2	3	0	0	0	4
% PT/Walking	3	3	2	0	0	2

Obviously, respondents in the maintenance stage segment were regular cyclists who always cycled to their daily activities. These people appeared to have bicycles available to use and nearly 90 % of them live within 10 km distance from their daily activity places which lies within the recommendable cycling distance as noted from other cycling scientific literature (Ikono et al. 2008; Muller et al. 2008; J. Ortúzar et al. 2000; Shahan 2007). Nearly 80% of the respondents in the action stage segment have bicycles available to use, however, most of them use alternative modes to bicycles and only a few of them (38%) fairly often use a bicycle to travel to their daily activity place. Even though most of the respondents in the action stage segment use alternative modes to cycling, nearly 90 % of them live within a cycle able distance of 10 km to their daily activity place. Bicycle use was not considered at all for those segments who give it less consideration (i.e. pre-contemplators, contemplators, the prepared for action and the relapsed segments) and most of them do not have bicycles available at home. Despite being non-cyclists, most of the respondents who had never

contemplated cycling and those that relapsed from cycling live within 15 km distance to their daily activity locations which is still not a far distance to cycle. However, there was slightly a higher percentage of non-cyclists that travelled more than 10 km distance to their daily activity locations than the cyclists (i.e. the action and the maintenance stages of change segments). In general, most of the respondents in the different segments live within acceptable cycling distance based on findings from other studies done elsewhere. Hence, travel distance is not necessarily a barrier for cycling in the context of the study area.

Respondents who had never contemplated cycling (pre-contemplators) mostly use public transport (60%). They were also more likely to drive (28%) to their daily activity place than to walk (6%) and this segment was more likely to have car available to use than in other segments. Respondents who had contemplated cycling but had never tried (contemplators) use mostly public transport (73%) to travel to their daily activities. However, this segment was more likely to walk and did not seem to drive at all and no person in this segment that do have car. Those who were prepared to take action (prepared for action segment) mostly use public transport (84%) and were more likely to walk than to drive and also in this segment, few of these people had a car available to use (2%). Respondents who cycled fairly often to their daily activities (action stage segment) appeared to use mostly other modes for the journeys that they did not cycle. However, 38% of respondents in this segment use only bicycle to travel to their daily activities and in this segment respondents do not have car meaning that are less likely to drive. People who used to cycle in the past but no longer cycle (relapse stage segment) mostly use public transport to travel to their daily activity locations and are slightly more likely to drive than to walk to their daily activities and also 13% of the people in this segment have car to use. Overall the use of public transport was high among the non-cyclist segments (pre-contemplation, contemplation, prepared for action and the relapse) but very low for the cyclist segments (action and maintenance). On the other hand, walking was low among all segments but especially among cyclists.

Table IV shows what level of education and main purpose of travel for the different stages of change segments. Chi-square test has indicated that people's adherence to different stages of change segments is highly associated to their socio-economic characteristics ($p \leq 0.001$). The pre-contemplators were most likely to have high education and were dominated by business people, office workers and slightly students. All the respondents in the contemplation stage segment have at least an elementary school education and 70% of them had a secondary and higher level education. This segment is likely to be dominated by business people and students. Respondents who are prepared for action are most likely to have primary and secondary level education and also more likely to be business people and students. Most respondents in the action and maintenance stages of change segments have primary and secondary level education and both segments are mostly dominated by business people. However, the action segment slightly does more shopping activities than other segments while the maintenance stage segment is slightly occupied by students and office workers. In the relapse segment, most people have at least a primary level education and a slightly higher percentage of university graduates. This segment is occupied by business people, students and office workers. Overall, the education levels were high among

the non-cyclist segments and are most likely to be business people, students and office workers. Generally, the percentage of people travelling for business purpose was high among all segments but especially among the cyclist segments.

Table IV – Socio-economic variables of respondents by stages of change segments

	Pre- contemplation n=79	Contemplation n=40	Prepared for Action n=51	Action n=34	Maintenance n=107	Relapse n=287
Education level						
% No education	3	0	4	6	2	1
% Primary school	17	30	33	65	56	20
% Secondary school	24	38	51	27	33	40
% University Level	57	33	12	3	10	39
Main Travel Purpose						
% Office work	25	8	6	3	9	17
% Private Business	39	30	57	71	76	47
% School	18	50	22	3	11	23
% Shopping	3	10	6	15	5	4
% Social/recreational Activity	10	3	8	9	0	7
% Other	5	0	2	0	0	2

4.3. Attitudes to cycling and future bicycle use intentions

The main objective of segmentation analysis is not only to identify the salient features of each segment, but also to assess whether these attitudinal segments can predict the likely propensity to cycle to daily activities. The aim is to discover whether the population falls into distinct segments according to their predisposition to use bicycles for daily activities. The outline statistics in Table V illustrate that the attitudinal variables correspond to distinct behaviour change segments with respect to perceptions and intentions to use bicycles for the daily activities. Chi-square tests has revealed that all attitudinal variables (Table 5) are highly significant different in relation to the stage of change segments ($p \leq 0.001$). This means that people in different stages of change segments have different perceptions and intentions to use bicycle and therefore should be treated differently.

Table V – Cycling perceptions and intentions for future bicycle use by stages of change segments

	Pre- contemplation n=79	Contemplation n=40	Prepared for Action n=51	Action n=34	Maintenance n=107	Relapse n=287
Intentions on future bicycle use						
% Have a motorcycle buy plan	0	3	8	9	8	5
% Have a car buying plan	27	0	4	9	1	16
% Have car driving license	37	0	8	6	7	24
% Think using a bicycle one time to daily work	0	98	100	n/a	n/a	46
% Have a bicycle buying plan	0	15	49	27	21	13
% know to ride a bicycle	0	0	100	100	100	100
% Like learning to ride a bicycle	0	98	84	n/a	n/a	20
Perception on cycling as a fast travel mode						
% Bicycle	18	80	90	91	98	65
% Public transport (PT)	71	20	10	9	1	31
% None of the two (Bicycle or PT)	10	0	0	0	1	4
% No response	1	0	0	0	0	0

Note: n/a indicates 'not applicable'; meaning that these questions were not applied to the cyclist groups.

The non-cyclist segments (pre-contemplators and relapsed) slightly exhibit higher intention to use car in the future than other segments. Most of the people in these segments are more likely to use other travel modes and are less likely to cycle. Interestingly, nearly 50 % of the people in the relapse segment intend to cycle to their daily activities one time in the future and highly perceive (65%) bicycle as a faster mode of travel to their daily activity locations. However, most of the people in the relapse segment do not have bicycle available to use (see table III) and they have low intention of buying a bicycle (see table V). Important to note is that the pre-contemplators are most likely not to cycle at all in the future and highly perceive a bicycle as a slow mode of travel (81 %) to the daily activity locations.

The contemplators and the prepared take action segments exhibit very high intentions of cycling to their daily activity place in the future and all highly perceive a bicycle as a faster mode of travel to the daily activities than other modes. Although, the contemplators have shown a high intention of cycling in the future, they do not have bicycles available to use at all (see table III) and they exhibit a very low intention to buy bicycles. In general, most segments had a positive perception towards bicycle as a fast travel mode to daily activity places compared to other modes except for the pre-contemplators who mostly perceive a bicycle as a slow mode despite their travel distances from home to activity places being in the same range and not different from travel distances of other segments. This suggests that

the low perception of cycling as a faster mode of travel by the pre-contemplation segment is not attributed to the long travel distances. There are other factors, however, that contributes to this negative perception attached to this segment.

4.4. Attitudes and perceptions towards cycling by stages of change segments

So now we know who cycles and who does not, the next step is to identify the motivations for these different stages of change segments. Through an open-ended question, the respondents were asked under what circumstances they would be willing to use a bicycle regularly to their daily activities. The respondents mentioned many aspects. Table VI shows what percentage of respondents mentioned the circumstances under which they are willing to cycle regularly. Numbers in bold indicate that the percentage for that stage of change segment is higher than the average percentage of respondents who mentioned the statement. When examining these figures in bold for each column one can see what would motivate the different segments towards cycling. Chi-square test has revealed that the perceived circumstances under which people are willing to cycle are highly associated with the stage of change segments ($p \leq 0.001$). Moreover, Goodman and Kruskal's (λ) further explained that none of perceived circumstances for willingness to cycle variables can predict another ($p \leq 0.001$); this means that each variable perceived as circumstance to motivate people cycling has to be considered regardless of the stage of change segment.

It appears that most people who had never contemplated cycling (pre-contemplation segment) would not cycle under any circumstance. Some of these people did, however, indicate that they would only cycle when the weather is conducive and also did mention that they would cycle when improved security and effective traffic laws and regulations are provided. Some even mentioned that they would only cycle when geared bicycles are available in the market. Also some people in this segment did not comment on what would motivate them to cycle, this would perhaps be due to not considering at all cycling to their daily activities. Respondents who had contemplated cycling but had never tried (Contemplators) would to them (see table III) while all of them know to cycle (see table V). This could be a barrier mostly cycle when special bicycle infrastructure is provided. People in this segment would cycle when they learn how to ride a bicycle and are more likely to cycle in less congested areas. People in the preparedness for action segment would cycle when a bicycle is available to them and when bicycles are sold at a lower price. The bicycle high prices mentioned by this segment is perhaps not surprising as most of the respondents in this segment do not have bicycles available for this segment that is ready to start cycling. People in the action segment are most likely to be motivated to cycle regularly to their daily activities when special bicycle infrastructure is provided. These people also mention that they would cycle under any circumstance. Some people in the action segment tended not to comment on what would motivate them to cycle more and this may reasonably be due to the fact that these people are currently cycling and need no motivation to raise their will for cycling.

Table VI – Percentage of respondents mentioning circum stances under which they are willing to cycle by stages of change segments

Circumstances for willingness to cycle	Pre- contemplation	Contemplation	Prepared for Action	Action	Maintenance	Relapse	Total
	n=79	n=40	n=51	n=34	n=107	n=287	N=598
Under no circum stance, I would cycle	35.4	2.5	3.9			17.4	13.5
If I knew how to cycle	3.8	12.5					1.3
If bicycles are sold at lower price			5.9	.9		.7	1.0
If geared bikes are provided easily	3.8					1.4	1.2
Only would cycle if the daily activity place is at short distance	5.1		3.9	5.9	8.4	8.4	6.9
Provision of special infrastructure for cyclists	31.6	55.0	41.2	44.1	31.8	51.9	44.5
I would cycle under any circumstance	1.3	12.5	15.7	32.4	46.7	5.2	15.1
I would cycle provided I had a bicycle available		5.0	13.7	2.9		3.1	3.2
I would cycle only when the weather is conducive	7.6		3.9	2.9	2.8	3.5	3.7
Would cycle mostly when there is congestion as cycling would be faster	1.3		5.9		.9	2.1	1.8
I would cycle when improved security and effective traffic laws and regulations are provided	6.3	5.0	3.9	5.9	5.6	4.2	4.8
would only cycle in less congested areas	1.3	2.5		2.9		.7	.8
No comment	2.5	5.0	2.0	2.9	2.8	1.4	2.2

Regular cyclists (respondents in the maintenance segment) would cycle at any cost under any circumstance. Respondents in the relapse stage segment are most likely to be motivated to cycle when bicycle infrastructures are provided. These people did, however, mention that they would cycle when their daily activities are located at a short distance, even though the travel distances to daily activities for this segment was similar to that of other segments (see table III). Some people in this segment also did mention that they would not cycle under any circumstance. In general, provision of special bicycle infrastructure was the main motivation factor to cycle regularly for the contemplation, action and relapsed stage segments.

4. CONCLUSIONS

Though in a different context, most of the findings of this study support previous research. For instance, cycling seems to be more common among men than among women and people who never contemplate cycling are most likely to be women than men e.g. Dickinson et al (2003) and Gatersleben & Appelton (2007). People who had never contemplated bicycle use had a negative perception about cycling and those who had cycled and contemplate cycling had a positive attitude towards bicycle use (Davies et al. 1997; Davies et al. 2001; Gatersleben and Appelton 2007; Pooley and Turnbull 2000).

The Prochaska's transactional model of behaviour change has proved to be a potential approach in identifying potential market segments for cycling. However, depending on the context and specifics of Dar es Salaam study area, one more stage of behaviour change segment was added to the Prochaska's 1984 behavioural model which was referred to as the 'relapse stage' in this study. Most importantly, the study findings have shown that neither all cyclists nor all non-cyclists are the same which may have important implications for targeting cycling policies.

People who had never contemplated cycling (pre-contemplators) had the least positive attitude towards cycling. According to Prochaska's (1984; 1994) model, these people can be brought closer to action by increasing their general problem awareness. To date in most African cities and Dar-es-salaam city in particular, cycling is not well recognised as an alternative mode of travel from individual, policy makers and public perspective. Therefore, it is suggested that much work has to be done through information campaigns on cycling which are not yet in place at all so as to improve the image of cycling in the city. From the study findings, at the moment many of the people who had never contemplated cycling who are most likely to be highly educated office workers and businessmen and students at universities are more attached to public transport and car travel and would not cycle at any circumstance. However, these people are likely to be attracted to cycling: when the weather is conducive; when improved security and effective traffic rules and regulations are in place and also when geared bicycles are easily provided. In order to encourage cycling to this target group, it may be useful for the policy makers to consider those mentioned motivation factors among others, especially if they were to attract more women to cycling.

People who had contemplated cycling, but have never tried (contemplators) are more likely to cycle in the future especially when special bicycle infrastructure is provided. These people who are most likely to be business people and students with medium education would cycle when cycling schools are initiated as nearly all of them do not know how to cycle. These people would also be motivated to cycle in less congested areas. Prochaska and DiClemente (1984; 1994) suggests that these people need to be motivated and encouraged to develop specific action plans. For example in their study Gatersleben and Appelton (2007) suggest that in an environment with few cycle lanes these people may, for instance, need assistance in determining and testing a good cycle route. However, in the context of Dar es Salaam where there no cycling facilities existing yet, these people may be supported by introducing bicycle infrastructure while also providing bicycle riding training centres together with public awareness on bicycle use benefits.

People who are prepared to start cycling (prepared for action) mostly indicated high bicycle prices as an impedance to take action. These people would start cycling when a bicycle is available to them to use regardless of the inexistence of bicycle infrastructure. Prochaska and DiClemente (1984; 1994) suggests helping these people developing specific action plans to help them juggle their new travel behaviour and eventually establish a new travel habit. Clearly, this does not only require individual change but also the government support to reduce the bicycle prices by for example removing bicycle tax to make it affordable for

these people who are predominantly business people and students with medium level education.

People who are already cycling but not on a regular basis (action) had a positive attitude towards cycling. These people who are most likely to be small business people with low level of education would cycle more regularly to their daily activities when special bicycle infrastructure is provided. Still, these people are likely to cycle under any circumstance. Prochaska and DiClemente (1984; 1994) suggests that these people can be persuaded to cycle more often by means of positive feedback, social support and reinforcement. Feedback information such as physical fitness improvements and/or financial savings may increase the number of cycling trips made by these people in the action stage in addition to bicycle infrastructure provision.

People who cycle regularly to their daily activities (maintenance stage) are more likely to be small business people, office work employees with low level of education and students in primary and secondary schools. These people would cycle under any circumstance. These are keen cyclists who appear to cycle to their daily activities despite the lack of cycling facilities, simply because they like cycling. Prochaska and DiClemente (1984; 1994) suggests that these people will be more encouraged to cycle by means of positive feedback, providing reminders and social support.

People who used to cycle but no longer do so (relapse stage) perceive resuming cycling when special bicycle infrastructure is introduced. This segment which seems to be dominated by small business people, office workers and students with medium level education may be motivated to re-think cycling when the travel distances from home to daily activities are short. However, travel distance may not be the only physical barrier which should be probably addressed. Most people in this segment perceive lack of special bicycle infrastructure. Provision of special bicycle infrastructure will undoubtedly bring these people in the relapse stage back to cycling, although provision of special bicycle infrastructure only will not guarantee that more people will cycle (Gatersleben and Appelton 2007; Jensen 1999). According to Davies et al (2001), however, past behaviour is a good indicator of future behaviour. Persuading those people who already cycled before may be easier than those who have never contemplated cycling. More to that those people who have been cycling regularly are more likely to cycle in the future than those who have never cycled.

From this study it is clear that a variety of different strategies addressing different segments, need to be adopted in order to increase bicycle use in the short and the long term. Whereas special infrastructure for cycling is necessary, other factors need to be addressed as well (McClintock and Cleary 1996). Longer term changes require general campaigns and provision of cycling facilities but in the short term cycling can be increased by helping those who are prepared to take action and those in the action stage to cycle more often by giving them positive feedback and support (Prochaska and DiClemente 1984). According to Prochaska and DiClemente (1984; 1994) behaviour change is a slow process which requires a constant attention. Although it is required to address physical barriers such as lack of cycling infrastructure and travel distance, this, in itself will not lead to more people using bicycles in Dar-es-Salaam; other issues such as psychological and social factors need to be

given attention. Even those motivated to cycle need help to get started and especially to continue cycling. Cycling experience must be positive in order for people to continue cycling to attract more people to using bicycles.

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