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The factors influencing bicycling in the Bangalore city

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ABSTRACT

Bicycling, in an urban context, have many benefits, compared with motorized transports, like reduced carbon footprint, and lower maintenance, health, social and infrastructural costs. The present paper analyses the various factors contributing to a low percentage of bicycling in the Bangalore city and elicits certain policy aspects to improve the attractiveness of bicycling. The study focuses mainly on the behavioral aspects of commuters pertaining to their childhood and current scenario, and uses a face-to-face questionnaire survey for data collection. These behavioral aspects indicated a commuter's perception about social expectation, convenience and bicycling infrastructure using a 5-point Likert scale measurement. Information is also collected about factors that might motivate bicycling, and about demographic variables like age, gender, income, etc. The study used a statistical *z*-test to identify the most influential attitudinal factors and to check whether the various factors are significantly different. The results gave a clear picture about the most dominant attitudinal factors that resulted in the stoppage of bicycling during a commuter's childhood, and that acted as a deterrent to their bicycle usage in a current scenario. The study determined a need for changing the attitude of people towards cycling by programs that would create a positive image for cycling. There was also a need for segregated cycle lanes and signals at intersections so that people could feel safe while travelling on cycles.

1. Introduction

Bicycles are sustainable form of transport (Cavill and Davis, 2007; Lumsdon and Tolley, 2001) having advantages like less noise pollution, less congestion, less accidents and less maintenance costs (Rastogi, 2009; Litman, 2003; Rietveld, 2001; Liu et al., 2003; Riplogle, 1992) compared with motorized modes. Bicycling also offers an affordable transport option to the low-income group, especially in developing countries like India, which find it difficult to afford any form of motorized transport (Buis, 2009; Joewono and Kubota, 2005; Guitink et al., 1994; Tiwari, 2002; Pucher et al., 2005; Servaas, 2000; Srinivasan and Rogers, 2005). Indeed, it can form an important means for accessing destinations particularly for trips that are too long for walking or are not served by transit (Murphy and Knoblauch, 2004).

Despite these benefits, bicycling is not a popular choice in Indian cities among commuters. The impediments to bicycling include factors like long trip distances of commuters, harsh weather conditions, difficulty to use it in nonutility trips

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(entertainment, recreation, etc.), infrastructure unavailability, extreme traffic conditions, and a lack of health and environment consciousness among people. These barriers are, in one way or the other, manifestation of the internal and social considerations of commuters such as their current attitude, social norm perception, and built environment considerations. The effects of these impediments may change from individual to individual depending on their perception of bicycling and their level of experience with cycling (Gatersleben and Appleton, 2007). For example, non-cyclists may value these impediments quite differently from cyclists (Heinen et al., 2010a). Further, the effect of these impediments may also have a link with an individual's perception of bicycling during his childhood. Dill and Voros (2007) associate an individual's childhood bicycle usage with his habit that decides the current bicycle usage. Eliciting this childhood perception can extract the necessary steps that can maintain a respondent's bicycle usage even after his transition from childhood to adulthood. There is an absence of studies that educes this correlation (Heinen et al., 2010b).

In an Indian context, only few works has been done eliciting the impact of various factors on cycling. Most of the studies limited themselves to the effect of socio-demographic factors and physical infrastructure factors (Verma et al., 2015; Rastogi and Rao, 2009). These studies also failed to understand the varying requirements of a cyclist and non-cyclist, for commute-trips, as the latter group can be expected to have a less positive outlook towards bicycling.

Given the above context, the objectives of the present study are set as follows.

- To analyze the variations in factors correlated with cycling during childhood and at present between commuters who cycle and who do not cycle currently.
- To identify the most prominent factor in childhood and at present, for each aggregate category, among people who have discontinued cycling in their childhood. The aggregate categories include variables like attitude, social norms, comfort and convenience, etc.
- To understand the important motivational factors that can improve a commuter's propensity to cycle.
- To formulate specific policies that can aid in the promotion of bicycling for urban commute.

2. Literature review

Attitudes and perceptions of an individual towards a particular mode influence the trip making behavior of that individual (Davies et al., 2001). This is more so in the case of a non-motorized transport like a bicycle that requires a physical effort from part of the user. So, there is a need for a detailed understanding of these factors to bring in a positive behavioral change among the trip makers. Greig (2001) and Daley et al. (2007) explored the attitudinal impact of general bicycling facilitators and barriers using qualitative research approaches and found the qualitative facilitator 'reducing pollution and fossil fuel consumption' having a positive impact on bicycling. Another qualitative factor that was found having a positive impact on the usage of bicycles was an individual's negative perception towards motorized vehicles (Stinson and Bhat, 2005).

Various conceptual frameworks have been used by studies till now to elicit the effect of attitudinal factors on bicycling. Two specific behavioral approaches that have found immense applicability in bicycle-behavior research are the ecological models and the theory of planned behavior. Ecological models assume that a person's behavior is influenced by factors that originate at an individual level and that later enlarge to include the social and environment factors. Handy et al. (2010) and Xing et al. (2010) used this approach to model the general attitude of people towards bicycling. Handy et al. (2010) modeled the effect of individual's attitude like 'enjoy riding bicycle' on bicycle ownership, and Xing et al. (2010) modeled the effect of individual's attitudes on bicycling propensity and vehicle-miles travelled using bicycles.

The theory of planned behavior (Ajzen, 1991) assumes that an individual is influenced by various factors like attitude, habit, perceived behavioral control and social norms while adopting a specific behavior. Two important studies that have used this conceptual approach in the area of bicycling were done by Lajunen and Rasanen (2004) and Heinen et al. (2010b). While Lajunen and Rasanen (2004) investigated the application of this theory in promoting helmet usage for cycling, Heinen et al. (2010a, 2010b) explored the impact of various factors on bicycle usage. Lois et al. (2015) explored the cycle commuting intention based on the theory of planned behavior.

Another important aspect explored with respect to bicycling was the influence of perceived built environment. Ma and Dill (2015) studied the impact of perceived built environment on bicycling and concluded that the built environment as perceived by a respondent had a considerable influence on bicycle mode choice. Bolstering this observation, the study of Ma et al. (2014) had found an insignificant contribution by the objective built environment factors in the regression models when these models were controlled for perceived built environment factors. These two studies highlighted the need for considering perceived factors while modeling the bicycle mode choice, and observed a dearth in studies eliciting this impact.

Different population segments were found having different attitudinal impact on bicycle usage. Gatersleben and Appleton (2007) classified the trip makers into five separate groups based on their existing behavioral stage - precontemplation, contemplation, prepared for action, action and maintenance, and identified separate policies for promoting bicycle usage among these groups. Daley and Rissel (2011) also, in their study, divided the respondents into three categories - regular riders, occasional riders and non-riders – while exploring the potential influence of images and perceptions on cycling.

Within a developing country context, only few studies have been done exploring the influence of attitudinal factors on cycling. One study was of Yao and Wu (2012) who tried to understand the correlation between safety attitudes, risk perceptions and aberrant riding behaviors in the cities of Beijing and Hangzhou. Another study was by Li et al. (2013) who segmented the bicyclists in Nanjiang (china) into six attitudinal groups using a systematic procedure involving factor