Understanding the Relationship Between Walkability and Quality-of-Life of Women Garment Workers in Dhaka, Bangladesh

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Introduction

Bangladesh's multimillion dollar garment industry provides work to over a million women. About 90 % of them earn a minimal wage ($20–$70 a month depending on occupation and overtime) (Absar 2002) and face problems of getting decent accommodation, transport and commuting security, thereby exposing them to the typical problems of the poor living in urban habitats (Absar 2002).

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Walking is probably the most important form of mobility since every trip starts and ends on foot. Especially for the poor in developing country cities, walking is a major transport mode. In Dhaka, Bangladesh, about 62 % of daily trips are conducted by walking (Tiwari 2005). The hostile environment and unsupportive infrastructure provision demonstrates how these 'captive' users are ignored in most policies and planning for transport, especially when it comes to funding allocations, which a review of Bangladesh transport policy documents reinforces (Efroymson 2012). Captive walkers are those who only walk instead of using other modes of transport as they have no choice due to affordability (Tiwari 2005); such captive walkers abound in developing Asian cities (Leather et al. 2011). Also, given concerns about traffic congestion, air pollution, climate change, and the worldwide obesity and non-communicable disease epidemic, an important goal of transport policy should be to make walking more pleasant for those who walk either by necessity or choice.

Bostock (2001) demonstrates that there is a significant portion of Asia's population, particularly poor women, for whom walking is a captive transport mode as they are unable to afford travel by other transport modes, while also living in locations with poor access to needed goods and services. Likewise, Pucher and Renne (2003) find that women are in principle unwilling to walk due to time constraints but lack of financial resources gives them no choice. Convenience is important to them, given that, particularly for women who are working outside the home, little time is available to engage in necessary activities outside of working and commuting for work (Abraham 1998). Bostock (2001) also documented that despite many potential benefits of walking in terms of easily accessing locations for working, shopping, taking children to school etc., walking still forms a source of mental and physical stress for many due to the appalling state of the infrastructure. Safety is also a major issue; according to Sham et al. (2012), the travel behaviour of women differs significantly from men as they face a high risk of becoming victims of crime while travelling, with the risk especially high for younger women.

This paper studies women garment factory workers in Dhaka, Bangladesh, who are vulnerable and captive users of walking between their homes and job locations during day and night. Many of the women garment workers have migrated from the rural areas and are unskilled labourers (Brooks 2007). Their remittances contribute to their family incomes and make them increasingly powerful in household decision making (Salway et al. 2003). However, several livelihood studies (Ali et al. 2008; Kibria 1995; Mahmud 2003) about women garment workers in Dhaka have shown that they are very vulnerable with respect to their mobility and working and living standards, while physical and mental assaults are common. Those factors result in poor health, a lack of perception of safety, and lack of transport options, which are issues of great concern that require immediate attention (Salway et al. 2003). Consequently, their quality-of-life (QoL) conditions are mostly poor. In a recent survey (Ali et al. 2008) almost 100 % of the total respondents reported that transport and communication are the main problem for women garment workers, which included feelings of danger due to the inhospitable environment of

the street.[1] In a focus group survey, Efroymson (2012) found that the route that women garment workers pass every day is often blocked by construction materials, garbage, and parked vehicles; such obstacles, combined with a rough surface, are not suitable for walking. Hence, women are forced to walk on the main road. Furthermore, some of the existing sidewalks do not have manhole covers and lack street lights at night, which contributes to the absence of safety and security (Efroymson 2012). Working in the garment factories for long hours and returning home by walking a long way late at night, they face a multitude of problems including accidents, harassment, and criminal activities.

The concept of 'walkability' characterizes how a particular walking route is responsive to its users considering not only the physical environment of the route (i.e. the objective condition), but also how the person feels about or perceives the surrounding environment, while walking towards a destination (i.e. the subjective condition). Using the quality-of-life concept to measure levels of walkability provides a holistic way to understand the so-called transport quality-of-life (TQoL), i.e. the experience encountered by female workers while commuting to work following (Carse 2011), but also the impact of TQoL on their overall quality-of-life. Ultimately, a better understanding of the level of walkability of a specific route facilitates improvements to the walking environment to make it more walkable, hence, increases in their quality-of-life. Several studies have focused on women garment workers in Dhaka city, but none has looked at issues of walkability and its relation with quality-of-life. Given their lack of affordable alternate transport, most women garment workers walk 4 to 5 km every day, despite facing these problems (Efroymson 2012). Hence, walkability plays a major role in their daily life, thus affecting their personal well-being. To elucidate their problems and to better inform local policy makers how to address them, it is essential to analyse the walking environment along the routes they use to reach their job locations and understand how this is linked to their individual well-being. Therefore, this paper aims to establish a relationship between walkability and perceived quality-of-life of women garment workers in Dhaka, Bangladesh. This is done by analysing the level of walkability of different walking routes used by women garments workers to reach their job locations in order to better understand the impact of walkability on quality of life.

The research was conducted in Dhaka, the capital city of Bangladesh, which is a densely populated megacity with about 15 million people living on 360 km². The city is facing the typical kinds of problems of fast growing megacities (Salam et al. 2012), including problems of environmental as well as socio-economic sustainability which have failed to keep pace with rapid urbanization to date (Dewan and Yamaguchi 2009).

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[1] While commuting to work is a daily issue faced by virtually all workers, other issues are important as well, including the thoroughly inadequate minimum wage and possibilities of being killed on the job:

"Since 2005, over 1,800 workers have died and thousands more were severely injured in garment factory fires and building collapses. … While the recent tragedies at Tazreen Fashions and Rana Plaza, in which at least 1,239 workers died making clothing for export, have understandably attracted international attention and condemnation, the fact is that most of the 5,000 garment factories in Bangladesh are not up to fire and building safety code–they are death traps." Testimony of Kalpona Akter, Executive Director, Bangladesh Center for Worker Solidarity (BCWS), Senate Foreign Relations Committee, Labor Issues in Bangladesh, June 6, 2013.

The experience of walking in Dhaka can represent an assault on the senses through exposure to smells (traffic fumes, urine), noise (constant honking, vehicle engines, industrial noise), visual assaults (ugliness and lack of visual appeal/relief), intense heat, and rain. Danger is continually present due to obstacles on the sidewalks and their broken condition forcing the women to walk in the street where they must share space with vehicles; road crossings are haphazard and require negotiating through a mix of rickshaws, cars, and buses. Added to all this is harassment by men. Walking is not, however, entirely unpleasant for this 'captive' group, who use their daily commute as an opportunity to socialize with their peers and enjoy some freedom of movement in an otherwise constrained social setting.

Quality-of-Life and Walkability

The concept of 'quality-of-life' involves the assessment of the overall experiences of human life (Costanza et al. 2007) and can be expressed through individual or collective life preferences and priorities (Higgins and Campanera 2011). There are several definitions of quality-of-life but most scholars have agreed that quality-of-life is multidimensional, having both subjective and objective attributes. According to Sirgy et al. (2006), personal feelings, opinions, beliefs, attitudes etc. define subjective indicators, whereas things which can be observed and measured comparatively in a straightforward way are identified as objective indicators.

In the case of subjective indicators, Campbell et al. (1976) emphasized that the satisfaction level to assess subjective quality-of-life is more expressive to present 'life as a whole'. Moreover, life satisfaction considers reflective experiences and realistic views for policy makers, and therefore seems to be a more accepted concept amongst researchers (Marans 2003). According to Diener and Suh (1997, p. 207) social indicators and subjective well-being measures are complementary and therefore effective to measure together. Despite that Campbell et al. (1976) identified that the correlation between social indicators and subjective well-being is not very strong, hence using both measures in parallel is effective because both provide complementary views on different aspects of well-being for different domains (Diener and Suh 1997). In this regard, Campbell et al. (1976) also showed that subjective attributes, in other words people's perceptions, can be reflected in specific satisfaction domains as they have an influence on objective attributes.

Felce and Perry (1995) conducted a literature review involving social science, psychology, urban studies and medical science domains to elaborate a so-called quality-of-life core domains model incorporating indicators representing the physical, material, social, productive and emotional well-being domains, which have been jointly considered to represent personal well-being or quality-of-life. This way the concept of quality-of-life has been applied to various disciplines such as Neighbourhood Quality-of-life (Berhe et al. 2013; Reisig and Parks 2000; Tesfazghi et al. 2010), Urban Quality-of-life (Das 2008; Pacione 2003; Schneider 1975; Van Kamp et al. 2003), Work Quality-of-life (Sirgy 1991; Sirgy et al. 2001) and Transport Quality-of-life (Carse 2011; de Groot and Steg 2006; Spinney et al. 2009) and is growing in extent and amplitude. As such, quality-of-life can be referred to as individual well-being in relation to a particular attribute or phenomenon considering several aspects of life

domains (or well-beings). This paper adds to this pool of evidence by relating quality-of-life and walkability for a particularly vulnerable group of users.

Walking is an active as well as interactive mode of transport, allowing the walker to experience the directly adjacent environment and interact with society (Wey and Chiu 2013). With the emerging problems of traffic congestion and environmental pollution due to fast urbanization and motorization, many cities increasingly look at ways to solve these problems through investments in non-motorized transport, including walking, as ways to reclaim the urban environment. Walkability is an emerging concept of new urbanism in planning, given that many communities are becoming less walk-able due to increasing dependence on other transport modes (Azmi and Karim 2012). As an active transport mode, walking is an effective alternative mode, which can be incorporated into one's lifestyle and has numerous co-benefits by reducing traffic congestion, pollution, noise, transport cost, infrastructure cost, space requirements etc. (Moniruzzaman and Páez 2012). Walking also directly benefits the user not only through cost savings but through provision of a convenient opportunity to engage in daily physical activity. Even 15 min of physical activity a day can reduce all-cause mortality by 14 % and increase life expectancy by 3 years, with additional exercise resulting in additional benefits (Wen et al. 2011). Efforts to modify the built environment can enhance opportunities for safe, pleasant, and convenient walking and thereby address the non-communicable disease epidemic (Beaglehole et al. 2011; Efroymson et al. 2012).

Walkability as a concept explores the extent of conduciveness of the built environment for walking (Lwin and Murayama 2011). Walkability can be expressed as a dimension of the built environment that influences walking behaviour where the characteristics of the environment may have a positive or negative impact on its users during a journey (Leslie et al. 2007). Walkability is typically comprised of a combination of factors such as presence of walking facilities, safety, comfort and convenience of walking (Leather et al. 2011; Litman 2003). See Table 1 for an overview of common walkability indicators.

Walking facilities typically refer to pedestrian facilities such as sidewalks and street lights, whereas safety refers to personal safety or traffic safety, comfort refers to amenities such as trees and benches. and convenience means connectivity and accessibility (Shay et al. 2003). These key factors of walkability demonstrate that the concept comprehends both the walking environment and the behaviour of users. Walking activity can be divided into aspects of opportunity and aspects of motivation. Opportunity provides an external factor consisting of the built and natural environment, including safety, comfort, and convenience of walking, whereas motivation is based on motivations of person of different age, profession, lifestyle and so on, along with behaviour, attitudes and preferences (Shay et al. 2003). A high level of walkability provides an environment that pedestrians can use to walk comfortably and safely to reach their destinations (Galanis and Eliou 2011).

Methodology

To capture both the subjective and objective walkability indicators of walking routes, this study used a mixed methods approach (Creswell 2012). It combined qualitative and

Table 1 Overview of common walkability indicators

Values	Components	Subjective indicators	Objective indicators
Sense of safety from traffic	• Sense of safety in pedestrian crossing affected by traffic speed • Sense of safety in pedestrian crossing affected by crossing facilities • Sense of safety in walking on the sidewalk affected by traffic	Confidence level of personal safety during walking Satisfaction level about safety measures like crossings, walking path Level of expectation regarding safety	Availability of crossing Grade crossing safety Walking path modal conflict Availability of walking path Path condition Traffic volume Travel time Pedestrian bridge[a]
Sense of security from crime	• Sense of security from existence of others • Sense of security affected by visibility at night • Sense of security from visual surveillance from nearby buildings	Level of vulnerability by existence of others Level of apprehension while walking at night Level of satisfaction about security measures	Availability of Street light 1. Pedestrian oriented light 2. Lighting from buildings along walking path Availability of police at night Crowded path 1. Presence of hawkers 2. Young people gathering who disturbs women
Comfort	• Level of service (LOS) and continuity • Sense of street scale and enclosure • Negative environmental effects	Level of satisfaction about LOS Level of comfort regarding scale and enclosure	Continuous path without having to step into street. Public toilets (positive environmental effects) Unclean path (Negative environmental effects) Open sewer (Negative environmental effects) Infrastructure for disabled

Table 1 (continued)

Values	Components	Subjective indicators	Objective indicators
Convenience	• Ease of pedestrian crossing[a]	Level of mobility	Frequency of crossings
	• Easy access to local services	Level of accessibility to other services	Pathway blocked by infrastructure
		Level of expectation regarding time and money	Pedestrian volume
Visual interest	• Visual variety	Degree of enjoyment regarding visual variety	Trees
	• Visual attractiveness	Degree of happiness regarding attractive sights	Vendors/items for sale

Source: Park (2008), Krambeck (2006), Leather et al. (2011)

[a] Although pedestrian bridges can improve safety pedestrians prefer street-level crossings. It is observed that pedestrians avoid climbing stairs. They are a better illustration of a car-friendly than pedestrian-friendly infrastructure. Though vendors/items for sale are components of visual interest and may add to perceived security and safety, they occupy most of the walking paths which become obstacles of smooth walking. Therefore, these indicators are treated both positively and negatively as subjective perception but they have been treated negatively as objective indicators

quantitative methods including walking interviews, focus groups discussions, and a walkability assessment using a geo-tracking device.

Figure 1 summarizes the research design that was adopted. A so-called convergent parallel design, following Creswell (2012), is adopted where the parallel analysed qualitative and quantitative data are compared, related and interpreted. The level of walkability assessment considers the different routes of the women garment workers from their home locations to the factory during the day and coming back at night, since different routes may be used during the day than at night.

The subjective walkability indicators such as level of satisfaction regarding safety, security, and pleasant and unpleasant experiences are measured and compared in order to gain an understanding of the impact of walkability on quality-of-life, while objective walkability attributes that are measured include quality, access, affordability, safety, and choice of routes, in order to understand in some depth the built environment.

It is anticipated that different levels of walkability have an influence on the quality-of-life of garment workers and that a diversified level of walkability affects some life
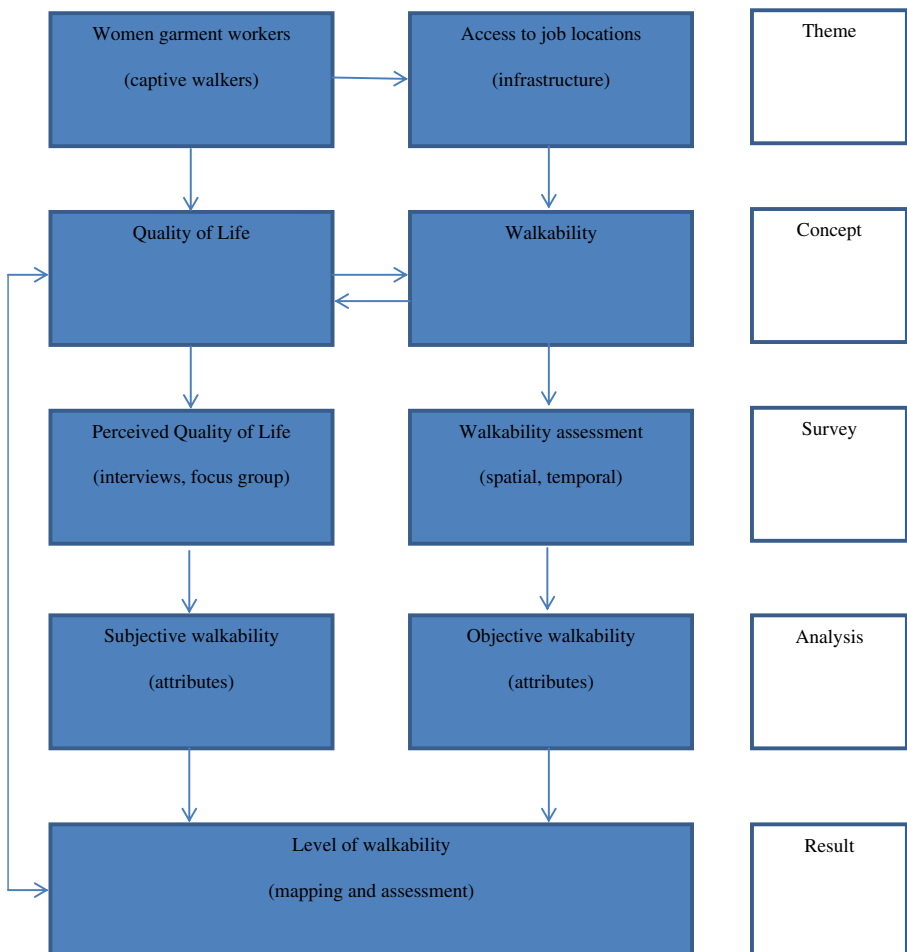

Fig. 1 The convergent parallel research design combining qualitative and quantitative data

domains. Analysis of the intersection between the various aspects of walkability and life domains should elucidate a relationship between walkability and quality-of-life.

Participants

Twenty-eight participants for this research were recruited from four locations in Dhaka City. The four locations were purposively selected from two areas of the city: north and south. In both areas, two locations were identified as being representative of the residence and job locations (i.e. garment factories) of the garment workers.

Due to the characteristics and vulnerability of the participants and the impossibility to enter garment factories, a non-probability, non-discriminative, snowball sampling strategy (Atkinson and Flint 2001; Browne 2005; Noy 2008) was used where one garment worker referred two other participants. The criteria for selecting the participants were that they should be women, work in a garments factory, and be 'captive' walkers, i.e. they do not use transport modes other than walking for their daily commute. All the participants provided informed consent.

As the women typically start their journey in the early morning, the first participant was selected from her place of residence. Correspondingly, and to compare day and night routes, another woman garment worker was selected from one of the garment factories for observing the return trip at night, etc. Thus origins vary between the home location and the workplace of the women garment worker. This method resulted in the ability to observe both day time and night time walking route patterns for a total of 28 participants (i.e. 28 individual routes).

Data Collection

Walking interviews (Evans and Jones 2011) were conducted using semi-structured questionnaires with open and closed questions. During the walking interviews the participants were able to show and discuss the pleasant and unpleasant locations and features and describe situations along their walking routes. They also expressed their personal perceptions including satisfaction level about the walking environment along the walking route and choice of routes, which helped in gathering qualitative and spatial data. Some summary statistics on the walking interviews are given in Table 2.

A focus group discussion with ten women garment workers was also conducted in order to gain more in-depth understanding about walkability and its relation to quality-of-life. The participants of the focus group were mostly selected from the walking interviews. Only two participants did not give walking interviews as they did not come from any of the selected case study areas. During the focus group discussion, more general issues related to walkability of walking routes and also impacts of walkability on their quality-of-life emerged.

After the walking interviews, the various routes that the participants walked from their origin to destination were walked again by the researchers and tracked using an open source geo-tagging application (CyberTracker) on an IPAQ with GPS to measure objective walkability indicators (De Freitas and Levene 2003; Parr et al. 2004). The routes of in total 28 trips (routes) of 28 participants were

Table 2 Summary of walking interviews

No of respondents	28
No. of routes	28
No. of unique and distinct routes	5
Average route length	R1: 2.56 km, R2: 2.43 km, R3: 1.95 km, R4: 2.27 km, R5: 870 m. Average length: 2.013 km
Overlapping ratio	Route: 1,2,5: 5/1 Route: 3,4: 6/1
Average travel time	45 min
Average starting time of morning commute	7:30 am
Average starting time of evening commute	8:00 pm

tracked, with some of these tracked routes overlapping with each other as many respondents live in the same area and work in the same neighbourhood, which is partly caused by the snowball sampling strategy. Roughly five unique and distinct routes remained. During the tracking, the objective walkability indicators for each of the five routes were measured as point or segment elements, following the walkability factors presented in Table 1 above, which is discussed next.

Objective Walkability Data Analysis

The walkability of the different routes was assessed using the pre-defined objective indicators from Table 1. Table 3 presents the indicators with their weighting/scoring system. A database was populated for each unique route. Some of these indicators were tagged as points, for example street lights and dustbins, while some indicators were measured at the level of segments, for example, path condition and traffic volume. Segments of 100 m were deemed appropriate for averaging path modal conflicts, path conditions, traffic volume and pedestrian volume. After completing the segmentation, indicator scores as well as walkability scores have been summarized per segment using a multi-criteria evaluation based on the different weights and score standardization.

The objective levels of walkability were accordingly mapped using Geographic Information Systems (GIS) software. The scores have been classified into three categories (high, medium and low walkability) using equal interval classification.

Subjective Walkability Data Analysis

The walking interviews and the focus group discussions were coded and analysed using Computer Assisted Qualitative Data Analysis Software (CAQDAS). During the walking interviews, a questionnaire using a 5 point Likert scale (with 1 being worst or most negative, 5 being best or most positive) was used for each indicator to measure the satisfaction level of the walking environment. A high value accordingly indicates that the satisfaction level is high and low value indicates

Table 3 Scoring/weighting system for walkability assessment

Indicators	Weight/scoring options			
Availability of signalized crossings	No. of signal crossings/ total no. of crossings per unit			
Grade crossing safety	Yes = 1	No = 0		
Walking path modal conflicts	More than 4 modes = 4	4 modes = 3	3 modes = 2	Less than 3 = 1
Availability of walking path	Yes = 1	No = 0		
Path condition	Bad = 3	Moderate = 2	Good = 1	
Traffic volume	High = 3	Medium = 2	Low = 1	
Pedestrian bridge	Yes = 1	No = 0		
Availability of street lights	Pedestrian oriented light = no. of lights			
	Lights from buildings = no. of lights			
Police post	Yes = 1	No = 0		
Young people gathering who disturb women	Yes = 1	No = 0		
Presence of hawkers	Yes = 1	No = 0		
General people gathering	Yes = 1	No = 0		
Continuous path without block	Yes = 1	No = 0		
Public toilets	Yes = 1	No = 0		
Unclean path	Yes = 1	No = 0		
Open sewer drain	Yes = 1	No = 0		
Disability infrastructure	Yes = 1	No = 0		
Construction materials	Yes = 1	No = 0		
Dustbin	Yes = 1	No = 0		
Pathway blocked by infrastructure	Yes = 1	No = 0		
Pedestrian volume	High = 3	Medium = 2	Low = 1	
Car parking blocks road	Yes = 1	No = 0		
Motorbike/rickshaw blocks road	Yes = 1	No = 0		
Trees	Yes = 1	No = 0		
Vendors	Yes = 1	No = 0		
Items for sale	Yes = 1	No = 0		

For the weighted summation in the multi-criteria evaluation some of the indicators were treated as costs (e.g. unclean path) and others as benefits (e.g. police post). In **bold face** are the indicators treated as costs. Presence of hawkers, general people gathering, vendors and items for sale indicators are treated as cost in the objective indicators as they becomes obstacles for smooth walking. The vendors/hawkers block the pathway and also generate huge people which make the road unable for smooth walk. Therefore, they have been treated as 'cost'. However, the perceptions of respondents are sometimes different about these particular indicators due to their visual interest and the fact that their presence adds to perceived safety and security

the satisfaction level is low. In addition, an average value considering all indicators by all respondents has been estimated next to obtain route-specific average levels of satisfaction.

Establishing the Relationship Between Walkability and Quality-of-Life

The five unique routes were selected for further analysis. All routes are within 1 to 3 km in length and have been divided into 100 m segments where each segment is scored considering the objective indicators of the route. After giving weights and making standardization of the indicators using spreadsheet-based multi-criteria evaluation (MCE), each segment was given a particular score which ranges from 0 to 1 where 0 is considered as no walkability and 1 is considered as high walkability. All segments have accordingly been classified into three groups: High, Medium and Low Walkability, and visualised in maps.

The objective measure of walkability has thus been derived for each of the 100 m segments. The overall level of walkability of the route has been evaluated considering the different scores of the particular segments, given that the perceptions of the interviewees mostly addressed the whole route they use. Apart from some direct observations during the walking interviews, the respondents mostly did not provide segment-based observations. Consequently, a caveat is that the subjective and objective measures are not directly comparable at the scale of 100 m segments.

The relationship between walkability and quality-of-life has accordingly been obtained looking at the resulting subjective and objective dimensions of the walking environment of the five main routes. As walkability has been measured from a quality-of-life perspective, the methodological approach itself facilitates the understanding of this relationship. Moreover, quality-of-life consists of different domains such as physical, material, social, productive and emotional well-being along with other aspects which can become impacted by walkability. The results section will indicate which aspects of the different domains are impacted by the state of walkability of the five main routes.

Mapping and Analysing Levels of Walkability in Dhaka

In this section, some key results of the study are presented. Different maps show the various levels of walkability of particular routes in terms of both their subjective and objective dimensions.

The objective indicators show high to low levels of walkability and are mapped using three distinct colour bands: green, yellow and red. The subjective perceptions are accordingly illustrated by symbols or line segmentation, designating the pleasant and unpleasant places along the same route as indicated by the women while being interviewed. Thus the graduated line colours represent the objective dimensions and the symbolic points or segmented lines represent the subjective perceptions. The maps also represent the alternative routes when these are present.

Two Routes Compared

Although the routes have been selected randomly due to the randomized sampling for participant selection, it appeared that three out of five routes largely pass through the older part of the city, while two pass through the more newly developed part. Here we discuss and compare one route from the old part (*route 1*) and one from the new part of
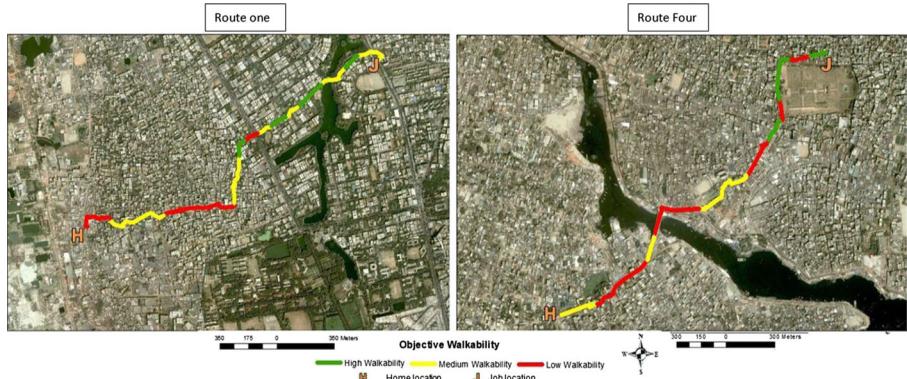
Fig. 2 Mapping the objective walkability dimensions of routes 1 and 4

the city (*route 4*) as they have clearly distinct characteristics both for objective and subjective dimensions of walkability, as illustrated in Fig. 2.

Next, Fig. 3 shows the objective walkability along with subjective perceptions for route 1 from Jigatola to Kolabagan, which goes through the northern (i.e. the older) part of the city. The locations that respondents indicated as places of fear and also the places of attraction have been mapped. Moreover, the map shows the alternative route, which the respondents take at night when going back to their homes. Interestingly, certain places that were described as places of attraction in the morning became places of fear at night. Figure 4 accordingly shows four graphs representing the perceptions on walking route quality, safety, security and the general walking environment using a Likert scale. The maps and pictures illustrate that perceptions change during the day versus the night and also due to spatial factors.

Figures 5 and 6 show the results for route 4, which passes through the newly developed part of the city. The respondents indicated the places which they perceive differently during day and night time. The pictures in Fig. 5 show the conditions of the walking route during rain and at night time. In Fig. 6, the subjective perceptions of the respondents for the various indicators are expressed using a Likert scale.
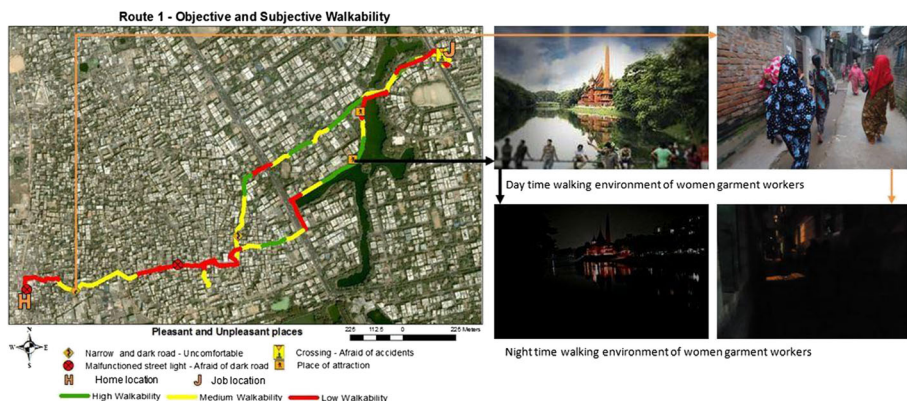

Fig. 3 Combining the objective and subjective walkability dimensions of route 1, including day and night time pictures
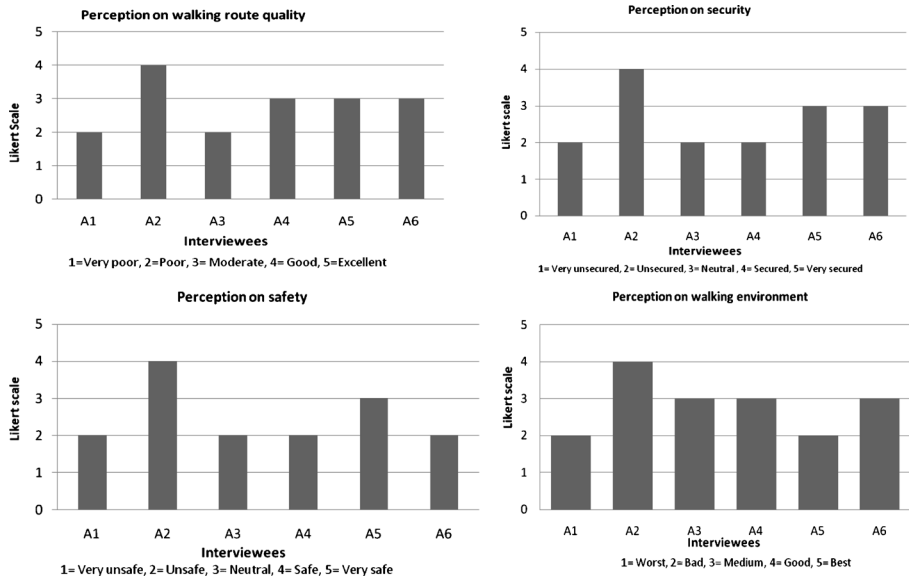
Fig. 4 Likert scale subjective perceptions of walkability dimensions for route 1

From both figures it can be concluded that the measurements for the objective and subjective indicators are complementary to each other and facilitate the gaining of a good understanding of the level of walkability of each route and the women's perceptions of walkability. The similarities and dissimilarities of the routes have also been identified, which helps to understand where subjective and objective measures do and do not match well and the reasons for such discrepancies. For example, for the whole route and/or in different small segments of the routes, it is helpful to gain an idea about where objective measures and subjective perceptions are applicable to understand the situation of that particular segment and the route as a whole.
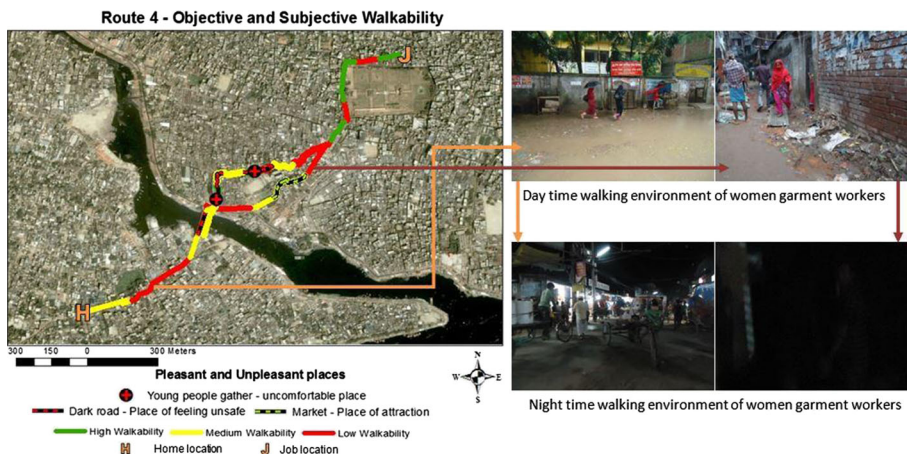

Fig. 5 Combining the objective and subjective walkability dimensions of route 4, including day and night time pictures
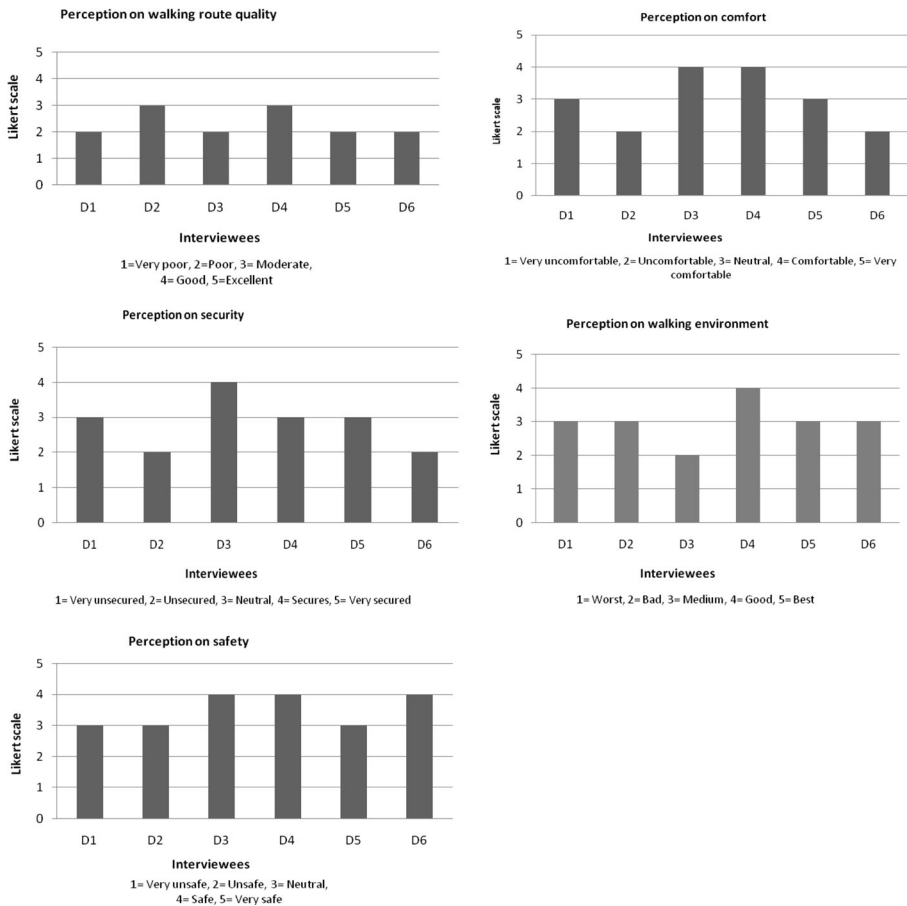
Fig. 6 Likert scale subjective perceptions of walkability dimensions for route 4

A significant portion, i.e. more than half the women ranked various aspects of the walking environment as poor or very poor, a finding that was seconded by the observations. However, some women felt positively about various aspects of the environment on their routes, indicating the potential for improvements to other sections. The overall unpleasant nature of the walking environment is indicated by the prevalence of yellow and red in Figs. 3 and 5.

The occasional mismatch between subjective perceptions and objective level of walkability could often be explained by different circumstances during different times of the day or because of the season. Whereas objective indicators are applicable regardless of time, subjective perceptions are clearly dynamic and may change over parts of the route.

The perceptions about safety, security and the walking environment of the routes are different in day time from night time. For example, the workers indicated some places where they feel safe at night are inconvenient at daytime. Some places are crowded at night; therefore it is safe for them to walk as the presence of people makes them feel protected. Walking through the same place in the morning generates sensations of annoyance as crowds of people cause delays to reach their job locations.

Two Spots Compared

Although it would appear that perceptions differ from objective condition indicators, subjective impressions are often derived from objective indicators. For example, the number of street lights or number of signal crossings has been considered in the objective measure, which in turn is an important issue for personal safety in the subjective measurement. Therefore, the results show an evidence of the theoretical model of Campbell et al. (1976), where they state that subjective measures or people's perceptions are influenced by objective attributes (Fig. 7).

In this section, parting from a personal level walkability assessment, a variation in subjective and objective indicators has been found between spot one (Routes 1,2,3 concentrated in the old part of the city) and spot two (Routes 4 and 5 concentrated in the new part of the city). If we consider the objective indicators and the objective level of walkability, spot one is better than spot two, but if we consider perceptions of the interviewees considering subjective level of walkability (on a Likert scale), spot two performs better than spot one. Therefore, it can be concluded that objective indicators did not influence subjective perceptions of the respondents in this case.

The provision of pedestrian facilities and services is better in spot 1 than in spot 2, while the street environment around routes 4 and 5 is far worse regarding pedestrian facilities and services. However, respondents of all routes have more or less the same perspective about the routes they are using. In some cases women garment workers of routes 4 and 5 showed a higher satisfaction level than users of routes 1, 2, 3 due to such measures as visual attractions and comfort. The reason behind these differences might be the land use setting around these two routes. The area of routes 1, 2, and 3 is part of a well-established urban setting where infrastructure facilities and services (foot paths, trees etc.) have been available from the very beginning, while the area under routes 4 and 5 is built recently with services and infrastructural facilities just being established and thus drawing a lot of attention by their users.

Different levels of walkability affect the psychology of the workers; therefore, they choose the route according to their perception of walkability, which is itself a synthesis of various factors, both objective and subjective. Most of the time they take the shortest route to reach their workplace in the morning, but at night they weigh safety and security more heavily in their choice of route. If they find that the shortest route
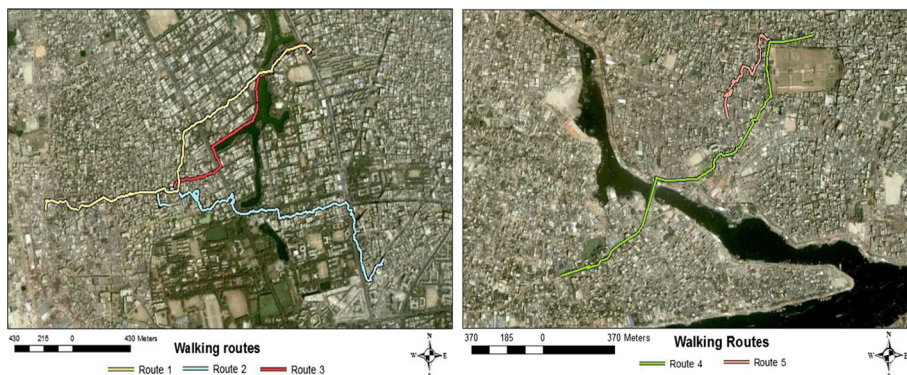

Fig. 7 Mapping the objective walkability around two spots

contains parts that entail risk to their safety and security, they consider alternative routes. However, not all routes have an alternative, which poses unavoidable risks for the workers as well as possibly stress.

Relating Walkability and Quality-of-Life: Methodological and Domain Aspects

Parting from the objective and subjective dimensions of walkability, the quality-of-life concept contains several related domains as discussed in "Quality-of-Life and Walkability" section as walkability impacts on them. Assessment of the objective measures and the subjective perceptions on each of these domains therefore permits the derivation of levels of satisfaction in each of these domains.

The objective measures have considered objective indicators such as whether roads have street lights, whereas the subjective perceptions of the respondents represent that they are satisfied with the conditions offered to them. For example, the level of walkability was low in those places where street lights are unavailable and/or not functioning. As one of the respondents explained: "*There are a few parts of the road that do not have any light and are very dark, which makes me feel scared*" (Liza, Route 3).

The focus group discussion in addition demonstrates that indeed varying levels of walkability have an impact on different domains of overall quality-of-life. Walking is sometimes pleasurable to garment workers, for example when walking with others allows for social and personal interactions: "*When I walk with others, the distance seems very short but when I walk alone, the distance seems so long*" (Shima, Route 1).

The level of walkability relates to the quality of the walking environment, which was assessed from a quality-of-life perspective. Although perceptions on pleasant and unpleasant experiences differ between people and between objective and subjective measures, it is clear that a poor environment results in low walkability, which in turn has an effect on quality-of-life via its negative impact on the mobility and walking experiences of women garment workers. This negative impact comes out when looking at their bad impression of, and expression about, the routes they use. Comments in the focus group discussion clarified that improved walkability has a positive impact not only on their mobility and access to the workplace and other destinations, but also on the different domains of life such as physical, social, and emotional well-being. Focus group discussants furthermore revealed both positive and negative aspects of walking that impact on their quality-of-life. Problems include traffic jams, garbage, flooding during the rainy season, difficulty in using over-bridges, lack of safe and convenient road crossings, lack of lighting, and particularly harassment by young men. Positive aspects mentioned include hearing music from shops, seeing children playing, being able to buy goods, enjoying views and the sight of birds, and chatting with their colleagues during the walk. Several workers also mentioned that they would like to walk more to get out of their home for pleasure and 'refreshing their mind', but only if the walking environment were improved.

The focus group discussion shows that indeed varying levels of walkability have an impact on different domains of overall quality-of-life. Table 4 summarizes the quality-of-life domains that are most affected by different levels of walkability. These findings complement and as such relate well to the previous objective and subjective measurements.

Table 4 Quality-of-life domains of women garment workers affected by different levels of walkability

Domains	Aspects
Physical wellbeing	**Personal safety**: Improved walkability increases personal safety while walking as improved walkability suggests having safe roads with less traffic, hence less risks for having accidents. "*I feel so afraid crossing the road as traffic is so fast. We often have accidents while crossing the roads.*"
	Personal mobility: Improved walkability results in improved mobility to jobs and other locations, which implies that less walkable roads take more time to reach destinations due to the obstacles on their pathway rather than having a smooth and direct path. "*Normally it takes one to one and a half hours to go to our job places. If the walking environment were improved, it would take only 30 min.*"
	Health: According to the women garment workers, a high walkability contributes to good physical and mental health as walking freely helps them to refresh their mind and physical stamina. "*If the roads are nice and clean, it helps to refresh our mind and health while walking. Walking is good for health as well.*"
Material well being	**Accessibility**: High walkability improves accessibility to job locations for women workers as they mentioned that less walkable roads do not support or make it difficult to reach their destinations. "*If you improve the walking environment, my ease of movement will be increased. I will be able to get access to my job location properly.*"
	Security: High levels of walkability, by means of more street lights and security measures, contribute to feelings of security along the walkway. The women stated in the focus group that they feel insecure when the street lights and security guards are absent at night. "*At night the road becomes dark due to not having lights in some places. Young people gather in those places and disturb us. At that time, we cannot say anything as it might bring more trouble to us.*"
	Finance: Improved walkability would reduce commuting times and thus reduce pay cuts due to late arrival at the workplace. The women feel that less walkable roads waste a worker's time and money. "*As we are poor, we have to walk and do not have money to take vehicles. The thought of being insecure on the road makes me tense.*"
Social well being	**Personal interaction**: Walking provides opportunities for personal interactions with colleagues and other people on the street, which also makes the women workers feel more connected with society. High walkable roads have those opportunities to interact with people whereas in low walkable road women workers try to avoid interactions due to having several problems like heavy traffic, less street lights, teasing comments etc. "*When the road is quiet, we can chat with each other. Time flies very fast while talking and we forget whether we are walking or going by rickshaw.*"
	Social involvement: Increased opportunities for personal interaction in turn leads to greater social involvement and sense of being part of a community (which in turn could lead to improved ability to collaborate to demand higher salaries and better working conditions). "*I like to walk beside the lake. I can see birds and people which are really nice to see, they make me feel better.*"
Productive well being	**Leisure**: Women garment workers think that improved walkability contributes to the enjoyment of walking as a leisure activity while in less walkable roads they simply avoid spending more time on the street. "*I walk to save money but if the walking environment were improved, I'd walk for pleasure.*"
	Job productivity: Improved walkability would reduce commuting time and improve the mental and physical state of workers and thus improve their job performance. Low walkable roads increase mental stress at least two times daily, which might affect their performance. "*We are poor and bound to work. I don't like anything. If I can't go to the workplace on time, they cut my salary which is really ridiculous.*"
	Personal independence: Women garment workers can enjoy independent mobility when the environment is highly walkable. This sense of independence also increases their confidence level as a person. "*Sometimes young boys smoke and blow fumes on our face when we pass them. This is really humiliating and embarrassing for me.*"

Table 4 (continued)

Domains	Aspects
Emotional wellbeing	**Visual attraction**: Women garment workers gain pleasure from exposure to visual attractions in walkable settings. "*I like to walk beside the lake because of good walking environment and good scenery.*" **Comfort**: Improved walkability increases comfort during commutes; better lighting would mean less harassment and presence of security guard means less possibility of crime and incidents. "*The over bridge is too high to pass. It needs more time to pass too. The factory is very far from my home; therefore, I don't want to waste my time.*" **Satisfaction**: Women appreciate services, safety, security and other issues while walking. "*More road lights and good condition of road make walking easy and comfortable. Police check post is useful and help us to feel more secured at night.*" **Positive affect**: An improved walking experience increases a workers' positive affect at least twice daily, while a low walkability of the road has the opposite effect. "*I like to see shops while walking along the route. People walk, go from one place to another; it seems nice to me as I like to see people.*"

Further issues that emerged from the focus group discussion and personal interviews included the experience of walking, its impact on health, perceptions of walking as pleasure, perceptions of the walking environment as a whole, and perceptions on accessibility. Findings obtained from all the utilised methods (objective measurement, subjective perception on objective measures to find out satisfaction level, personal interviews and focus group discussion) are accumulated and presented in Fig. 8 below. Here, assessment of the different domain aspects is presented as a standard of comparison to estimate the level of walkability and to identify which domains are related to overall life satisfaction. The outcomes of the data have been merged into Campbell et al. (1976)'s model to establish the relationship between walkability and quality-of-life. In this case, the relationship with quality-of-life was established focusing on walkability problems, pleasant and unpleasant experiences while walking, and how improved walkability impacts on overall quality-of-life. Figure 8 thus reveals the key issues that cause this: safety, built environment, negative experiences, mobility, leisure, accessibility, social connectedness, security, visual attraction, health impact, comfort, convenience and economic impacts. The low, medium and high levels of walkability have an impact on quality-of-life considering these standards of comparisons; therefore, personal safety, security, mobility, accessibility, social connectedness, comfort etc. are related to specific domains of individual wellbeing or an individual's quality of life. In this study, it has been shown that route segments with a low level of walkability are less safe and secured than route segments with a high level of walkability. It is also revealed that low to high level of walkability affects respondents' choice of route segments at day and night time, with respondents seeking smooth walking and personal safety and security. Route segments with a high level walkability have a comparatively better built environment than low walk-able segments. A high level of walkability eliminates the desire to utilize vehicles at night for their security and safety. Personal leisure, comfort and health of garment workers are better in highly walk-able roads due to trouble-free smooth walking. These different levels of walkability have different impacts on aspects of personal wellbeing. As quality-of-life has different domains, which are affected by level of walkability, the relation between walkability and quality-of-life can be recognized.
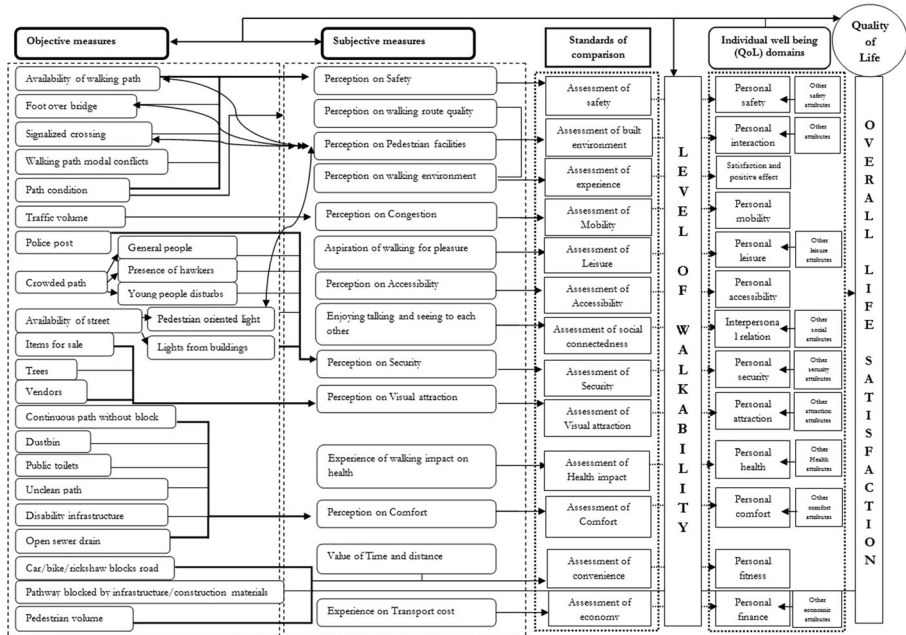
Fig. 8 Relation between walkability and the quality-of-life domain aspects adapted from Campbell et al. (1976). Model and modifications by authors

In Tables 1, 3 and Fig. 8, some objective indicators such as presence of vendors have been considered as negatively contributing to the overall score as their presence on the pathways is creating difficulties for smooth walking. However, these indicators also increase visual interest. Therefore, these indicators are treated as a cost in the objective indicators, while as either being a cost or a benefit from a subjective perspective. Respondents who rated these indicators as a benefit particularly said so at night as they would like to buy something for their family or simply enjoy the attractive sights that also made them feel secure. During the busy day time hours, vendors were rather seen as obstacles blocking their pathway to work. This implies that particularly the outcome of the objective measure depends on day or night conditions.

Policy Implications

This study carries several important policy implications. Since the focus of the study was on walkability and quality-of-life, we herein address only policy issues related to walkability. However, it is important to note that the magnitude of the garment industry as a source of employment for low-income women in Bangladesh, and the importance of that work for them, reinforces rather than obviates the need to address a range of other factors that affect the quality-of-life of these workers, including safe workplaces, decent salaries, access to affordable housing, and better workplace policies and safety.

Specifically in terms of walkability, it is important to recognize the positive as well as negative aspects of the walking experience. For example, women appreciate the visual attractions of vendors on their walking routes during the day and the potential safety of more 'eyes on the street' at night. Banning vendors from footpaths could in

fact decrease walkability for this vulnerable group. Needed changes are visible from the tables accompanying this article and include placement of sidewalks on both sides of streets where feasible, repair of broken footpaths, removal of all vehicle parking from footpaths, safe and convenient crossing facilities, better pedestrian-oriented lighting, and provision of more shade/shelter from sun and rain.

The range of negative factors associated with their walking trips could be addressed most readily if the Government of Bangladesh were to pass a genuine Pedestrian First Policy, which gave priority to pedestrians, both in budgets and infrastructure programs. The precise changes needed to the walking environment are in essence 'details'. If the government acknowledges the importance of walking as a means of transport and prioritizes measures to make walking pleasant, convenient, and safe, then the specific improvements will follow. As long as the focus remains on facilitating travel by private car, vulnerable groups which move about by foot and other means will continue to be undervalued and to suffer the consequences.

Conclusion

Women garment workers in Bangladesh face a number of serious issues that affect their quality-of-life, including low salaries, poor working conditions, and the risk of being trapped during fires. Catastrophic events such as the recent building collapse affect only a relatively small percentage of workers. The low wages and difficulties with commuting, however, are pervasive problems that affect these vulnerable workers on a daily basis. While the wage issue can only be resolved through negotiation with the factory owners, the problems faced during the workers' commute can be addressed more readily by local authorities. Improving walkability for these women would lead to exponential gains; not only these women but all those using the routes would be positively affected, and improvements in walkability could lead to decreased use of motorised vehicles and thus decreased pollution, improved health, and better overall security and sociability as more people interact in the streets. What is now a mixed experience for garment workers, combining pleasant sociability with the unpleasant aspects of walking, could become a far more pleasant twice-daily occurrence.

Understanding the relationship between walkability and quality-of-life requires capturing relevant aspects of the context and how women garment workers perceive it. This research looked both at measurements of the level of walkability following the quality-of-life concept, and the role of walkability in determining the quality-of-life of women garment workers. Walkability of a route used by a captive group of walkers to access their workplaces has been examined, distinguishing objective indicators and subjective perceptions in order to understand the status of the route used by women garment workers following quality-of-life dimensions.

Quality-of-life itself has different domains. Individual well-being or quality-of-life depends on cumulative life domain satisfactions. Mobility is an important domain of personal well-being, particularly in a setting where women overall suffer from cultural mobility restrictions. In this research, walkability and mobility are synonymic to women garment workers as they lack other transport options. Therefore, walkability is an important domain for the quality-of-life of women garment workers.

An unavoidable daily commute can, depending on the circumstances, be painful or pleasurable; given the complex of factors that make walking often unpleasant, its importance and scope for improvement are significant. Women garment workers are a captive group (economically) who do not have other options besides walking to reach their workplace. This lack of choice about their transport means that they have to walk in any condition, which threatens their perception of satisfaction on a daily basis. They work till late at night necessitating night-time travel in unsafe situations, where their vulnerability is enhanced due to gender issues. Mobility and accessibility to workplaces are two important domains in quality-of-life, which directly relate walkability to quality-of-life of the workers. Moreover, the walkability to job locations also includes the employment accessibility domain which has additional importance in overall life satisfaction. Other affected domains include safety, security, visual attraction, leisure, and health, all of which contribute to individual well-being and overall quality-of-life. Importantly, while women complain about the poor existing walking conditions, they also express enjoyment at the social nature of their walks and at some of the attractive aspects of the better routes. Their main request is not for access to other transport modes per se, but for improvement to the pedestrian environment so that they can continue to save money and enjoy socializing by walking to work and to other destinations.

The relation between walkability and quality-of-life is specific to the context, and even time-of-the-day, and significant from both a methodological point of view and from the domain satisfaction aspect. Establishing the relationship between walkability and quality-of-life has important policy implications as it provides quantifiable assessments by actual users of the physical walking environment to create specific recommendations to policy makers for further improvement of the environment, which will in turn improve the quality-of-life of individuals, both the workers themselves and all others sharing the walking routes. This research has considered a specific vulnerable group who are captive users of the walking mode. Policy makers can utilise the obtained data on the objective condition of the routes and perceptions of the workers about their routes to help in the assessment and identification of specific places or routes that require improvement. More significantly, they can rectify the current imbalance in policy attention given to those on foot versus those in a car. Prioritizing walking, at the highest policy levels, as a valuable form of travel would do much towards gaining the attention needed to address the issues raised in this article. Those improvements in walkability would directly benefit women garment workers and their individual well-being domains would be enhanced, which in turn would improve their overall quality-of-life as well as that of others with whom they share the city. Or as one garment worker stated in the focus group discussion: "*Please try to improve walkability not only for us but also for all the people who wish to walk and like to spend some time outside home.*"

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