

SIDEWALK SUSTAINABILITY THROUGH NEED-ASSESSMENT OF STREET USERS IN ASIAN CITIES

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ABSTRACT

The concept of sustaining street use has proved elusive, especially in an ever changing landscape that has for the past 60 years catered to private vehicle needs at the expense of other street users (i.e. pedestrians). Studies have however indicated that street user presence has helped decrease crime rates and increased overall city liveability. This research sheds light on the importance of a user-centred approach in the design and improvement of urban spaces, particularly sidewalks. To increase user loyalty, the paper examines the criteria of needs of street users, investigates various attributes that contribute to their need-satisfaction and, through the use of a decision making tool, Analytic Hierarchy Process (AHP), empirically prioritise the needs and need-satisfier attributes of contemporary street users. Attributes which were initially derived from the evaluation of visual archival data will also be assessed for their relevance and applicability within the contemporary urban context. Survey investigations were carried out along the streets of Manila and Bangkok. A total of 250 respondents were gathered. The derived information would prove relevant in effectively and efficiently designing and improving sidewalks for people thereby achieving street space sustainability. The study was able to define street user needs, the need-hierarchy framework, attributes that define a positive street environment and provide an indicative policy recommendations to improve Asian street space with the end view of encouraging people to use urban spaces more, increasing their participation and, ultimately, eliciting their loyalty.

Keywords: *Street user behavior, non-movement aspect of pedestrian, Street user need-hierarchy framework; sidewalk design and management; street sustainability, user-centred approach*

1. INTRODUCTION

The paper demonstrates that the study on walking leads us naturally to the study of streets which can be subdivided into two main themes: the study of the street environment (context) and street use. The introduction elaborates on the problem, examining the macro-level up to the individual level factors, the methodology employed and expected results from the exercise.

1.1. Impacts of Transportation

Transport influences and impacts various facets of human life both at the global and local levels. At the macro-level, the transport sector accounted for almost a quarter of carbon dioxide (CO₂) emissions from global energy use while at the local level, studies have illustrated the corresponding economic, social and environmental cost of sprawl and extensive suburbanization (European Commission, 1990; Owens, 1992). Fragmented land development patterns coupled with the lack of alternatives to private transport further exacerbated automobile dependence. Short trips which can be done through walking and cycling are typically accomplished by car because of the general perception of an unsecure and unsafe walking environment, convenience of a door-to-door service and its perceived 'elite' status. However, the implication of increasing private car use on unhealthy lifestyle, environmental degradation, and resource depletion has led to identifying and promoting of initiatives such as encouraging public transport and active transport such as walking and cycling.

At the individual level, transport provision determines level of accessibility, mobility and mode choice. An increasing proportion of the elderly utilize walking as an important source of outdoor physical activity (Borst et al, 2009). It also serves as a more equitable means to access destination especially for the transport-disadvantaged.

1.2. Sustainability and Behaviour Change

Sustainability has become a byword that has been used to articulate the need to improve both living and non-living systems, from local up to the global context. However, to be achievable it requires collective efforts and diverse approaches such as changing individual lifestyles, improving practices, use of new technology, reorganizing urban living conditions, and increasing awareness. Within this premise, a new 'mobility culture' has to be defined, a culture that encourages sustainable transport alternatives, reduces unnecessary travel, promotes foot power, minimizes use of fuel and encourages travel that would limit environmental impact.

Transport demand management approaches such as pricing and charging, road space rationing and restraint, physical infrastructure change (IEAust, 1996) and voluntary behaviour change (Taylor and Ampt, 2003) are some potential measures to achieve desired transport outcomes in the most cost-effective and efficient way. In recent years, travel choices are

becoming more intelligent due to increasing awareness on the need to lead sustainable lifestyles. Individuals are now turning to transport options that least impacts the environment while finding their own method of changing travel behaviour and pattern. McFadden (1978) with the use micro-economic theory explained that individuals chose the mode with the highest relative utility or least cost as measured by fiscal and non-fiscal (time, comfort) aspects of available choices (Frank, 2004). Voluntary behaviour change, rather than act as a response to external policies or pressures, provides freedom to the individual to choose and adopt approaches to change their travel behaviour pattern which is consistent with the user-centered approach to urban space design and development.

1.3. The User-centred Approach to Urban space design and development

A user-centred approach considers the users as agents of change. Their loyalty towards a given space is manifested by their constant presence not only as passers-by but as active participants in the given space thereby reflecting the level of effectiveness of a given facility.

The behaviour of street users is comparable to consumer behaviour wherein the process begins and ends with the user. It initiates by determining what people need, and the process ends with the delivery of the product that satisfies that need. The basic premise of the street user needs, adopted from the area of consumer behaviour, is that a street user behaves in a similar fashion to consumers as they utilize space in a way comparable to consuming a product. Needs and values are the micro-level driving factors of human behaviour (Vallacher et al, 1994) which are then realized through opportunities. The latter refers to products or services referring to the attributes of the sidewalk environment that have the capacity to satisfy one's needs and therefore encourage higher utilization of streets. In the urban space domain, needs and desires are endogenous stimuli which are considered by the street user before he or she decides to use a particular urban space (i.e. need to feel protected, enjoy, etc). The exogenous stimuli refer to the state of the pedestrian environment and how this is perceived by the individual. Based on these factors, an individual assesses the routes. By maximizing his utility (McFadden, 1978), he decides to use the walking environment/streets or not. The decision motivates him to act or react and is demonstrated through physical action and/or sensory responses.

1.4. Study objectives

The study builds upon the concept of a user-centred approach by examining factors that would encourage behaviour change. To encourage user loyalty, the paper undertakes an assessment of needs of street users, investigates various attributes that contribute to their need-satisfaction and, through the use of a decision making tool, Analytic Hierarchy Process (AHP), evaluate the criteria's relevance, empirically prioritize the needs and need-satisfier attributes of contemporary street users. Attributes which were initially derived from the evaluation of visual archival data which was extensively discussed in Mateo-Babiano (2008) will also be assessed for their relevance and applicability within the contemporary urban context. The derived information would add value towards a more effective and efficient

design and improvement of sidewalks for people, thereby achieving street space sustainability.

1.5. Methodology

The research design included two major streams. A novel approach to better understand street users is the spatio-historical assessment of visual representation (Mateo-Babiano and Ieda, 2007) wherein content analysis of visual media (i.e. photos, artworks) resulted in the identification of street user need criteria. The latter was then fed into the second component of the research design, the questionnaire survey development. An in-depth discussion of the spatio-historical assessment of streets is not the scope of this paper but the exercise led to a better understanding of street user behaviour within select Asian cities and provided a viable alternative to potentially realize and achieve street space renaissance (Mateo-Babiano, 2005b).

To evaluate the hierarchy of potential needs of street users and to identify need-satisfying attributes, a questionnaire survey which was based on Thomas Saaty's (1980) Analytic Hierarchy Process (AHP) was designed. This provided a powerful tool to make decisions in situations involving multiple objectives. Comparing the consistency index (CI) with the random consistency index (RI) resulted in the consistency ratio (CR). The latter expresses the internal consistency of the respondents' judgments which indicates that a CR value less than 10% is acceptable but more than that requires a revision of the subjective judgment. The implementation of the survey was done with the primary aim of eliciting response on what a positive pedestrian environment is. It underwent pilot testing to examine the appropriateness and relevance of identified street attributes. The final questionnaire produced three main sections: personal information, travel and walking behaviour, preference between two paired comparisons of what would make for a positive street environment. AHP is designed for situations in which ideas, feelings, and emotions are quantified based on subjective judgment to provide a numeric scale for prioritizing decision alternatives. The results reflected hierarchies of street user needs, concrete prioritization of criteria and attributes that would contribute to sustainable street spaces, and also emphasized elements that describe a positive walking environment. Survey investigations were carried out along the streets of Manila and Bangkok. A total of 250 respondents were gathered. The study culminated with the development of applicable concepts for the effective design and management of streets in select Asian cities. Given the limited evaluation, measurement and prioritization of factors other than those, which are measurable in standard, quantifiable terms (Taylor and Ampt, 2003) the need for an assessment exercise becomes imperative and is further justified.

2. FINDINGS

2.1. Walk Trip Information

The results of the survey investigation indicated that walking had the highest mode share with 31% of the respondents indicating that they walked to their destination. The said group, when queried if they also conducted walking activities within the day, about a fifth did not venture outside their buildings. The majority, at 82%, indicated that they also walked outdoors during the day (see Figure 1). It also became necessary to determine how frequent do they conduct some walking activities. The walk trip frequency of 53% of those who walked was 1-3 times a day; 29% of the sample went walking 4-6 times a day; and 16%, the group that frequently walked, went walking outdoors more than 6 times in one day.

The culture of walking has been in place prior to motorization. This rationalizes the high participation of the sample in walking. Historically, walking was part and parcel of a person's daily activities and often influenced the urban form and pattern of a particular city.

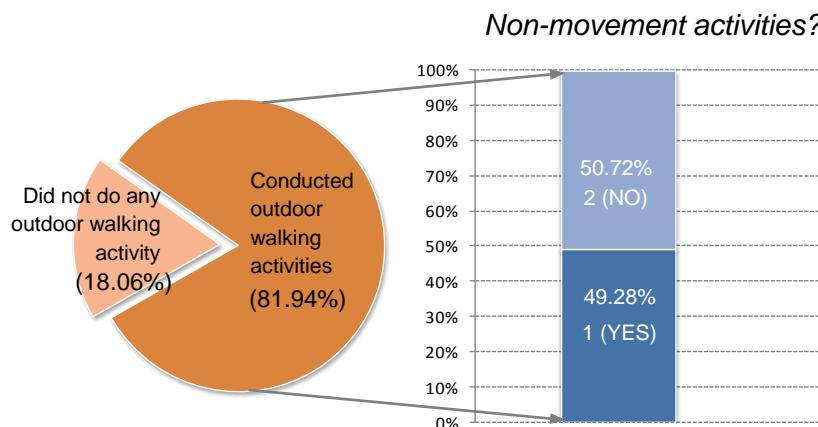


Figure 1. At left, the pie chart illustrates outdoor walk trip participation of respondents while at right (bar chart), shows the proportion of outdoor walkers who also undertook non-movement activities.

In the field of spatial sociology, natural space is converted into a social space once it is peopled (Gans, 2002). Thus, street encounters or exchanges that occur within the urban streets space further drives the point that streets serve not only as access space but also carry a variety of non-walking functions or non-movement behaviour. Non-movement spaces (NMS) emerged as a result of individuals such as pedestrians engaging in non-movement behaviour (i.e. sitting, waiting, chatting, to name a few). Within the walking environment, non-movement behaviour within the Asian context is often intimate, unique and spontaneous. The relationship between movement and non-movement is typically times blurred. Thus, non-movement plays a significant role in the development of the Asian urban space (Mateo-Babiano, 2007). Given that Asians are in general social individuals, usually does not go out alone, prefers to do activities together and are always in groups, the perceived non-movement of Asian pedestrians is examined in the following paragraph.

Respondents who conducted walk trips were queried on their participation on non-movement activities. Non-movement behaviour is defined as non-walking activities participated in by

street users within their walk trip. Approximately half of the sample (49.3%) who conducted a walk trip answered that they also conducted non-movement activities (see Figure 1) wherein in a few instances, the streets became destinations themselves serving as eating places, shopping venues or simply meeting area. Various studies have emphasized that pedestrians do not solely undertake a walking function but non-walking as well (Kamino, 1979; Funahashi, 1979; Moudon, 1997). The spatio-historical study of Edo and Manila (Mateo-Babiano and Ieda, 2005b) further determined that street spaces were the domain not only of people on the move but also catered to other non-movement behaviour. At the same time, street users do not only constitute pedestrians. In a number of cities in Asia (i.e. Bandung, Bangkok, Manila and Tokyo), streets tend to be a multi-functional, multi-user and temporally-dictated haven (Mateo-Babiano, 2008a) giving significance to the non-movement aspect of Asian streets where boundaries are blurred as opposed to the distinct non-movement spaces in some European cities (Mateo-Babiano, 2005b). This also provided a theoretical basis in better understanding street user behaviour (Mateo-Babiano, 2007; Mateo-Babiano, 2008).

Individuals travel to undergo utilitarian (i.e. to work, school, shopping) or optional/leisure trips making movement becomes a derived demand. Those respondents who engaged in non-movement activities were queried on the specific non-movement activities undertaken. Figure 3 illustrates the type and proportion of non-movement activities. These are: a) 40% to buy from a vendor stand, and 25% to enter a store, which are considered as utilitarian trips. About 32% conducted leisure-based non-movement activities (i.e. sit, take a rest or sit down, 15%; admire the scenery or window shopping, 17%). Figure 2 illustrates the type and proportion of non-movement activities as well as some photos indicating non-movement behaviour.



Figure 2. The bar chart on the left illustrates the proportion of sample conducting various non-movement behaviour and activities along the streets: (from left to right, sitting and resting, buying from a vendor, look at map).

Source of photos: Iderlina Mateo-Babiano

2.2. Street User Needs

Street users are considered the most important player within the transportation network wherein their corresponding behaviour serves as indicators on the level of effectiveness of transport facilities. Thus, the consideration of the needs of street users becomes a vital component in the design of sustainable spaces given the premise that street users may be considered as consumers requiring spaces for their activities. Desires and expectations

should be determined at the outset of the design stage and provided by implementing need-satisfiers. The bottom-line is always what the potential user wants and not what the provider thinks the user requires.

The need to develop a street user need-hierarchy was borne out of the premise that it provides a theoretical basis on street user behaviour so as to adequately explain street user behaviour as well as need-satisfactory attributes of street space. Need-hierarchy refers to requisites of the street user, foremost of which is the pedestrian, that when provided would hypothetically increase their level of satisfaction. It is hypothesized that by increasing user satisfaction, user loyalty may be supported and would result in higher use of the street environment.

Initially, the concept was inspired by the human needs theory postulated by Maslow (1954) and Max-Neef (1992) and the pedestrian level of service (PLOS) concept (Fruin, 1971). In this case, the list of criteria was derived from the spatio-historical analysis of select Asian city streets (Mateo-Babiano and Ieda, 2005b). At this point, it is necessary to determine user needs which correspond to street environment attributes (criteria) as well as strategies to fulfil these attributes (alternatives) so as to define an effective street environment. Street user needs may serve as the basis to motivate the creation of sustainable spaces. In no particular order, Table 1 lists the different street user need criteria which were derived from the spatio-historical analysis (Mateo-Babiano, 2007), namely: movement (mobility), protection, ease, enjoyment/socialization, equity, and identity. Each criterion may be fulfilled given concrete alternatives (>1) which were based on the results of the spatio-historical assessment (Mateo-Babiano, 2008). These alternatives are hypothesized to contribute to achieving a positive sidewalk environment. Figure 3 illustrates the relationship between criteria and alternatives as well as the overall results of the AHP survey. The information provided in the figure and table does not attempt to be all-encompassing rather this was based on the results of the spatio-historical study (Mateo-Babiano, 2008) wherein it was determined that a positive sidewalk environment does not only entail the provision for 'seamless travel' or continuous movement but rather it also includes other elements which may be referred to as the non-movement aspect of street user behaviour.

Table 1. Need-hierarchy Criteria Defined

CRITERIA	DESCRIPTION
Movement	This refers to a walking environment which allows barrier-free movement from point of origin to destination at a comfortable walking speed with no or limited impedance and ensures ease in orienting oneself within the street network
Protection	This refers to the quality of a walking environment that would make you feel physically safe and secure while walking by limiting pedestrian-vehicle conflict, providing provisions to ensure that accidents will not happen and discourage robbery or pick pocketing
Ease	This refers to the quality of the walking environment that would make one feel emotionally and mentally secure, comfortable, convenient and stress-free while walking
Equity	This refers to the quality of the walking environment which allows access to transport-disadvantaged persons (TDPs); allows equal opportunities for other activities besides walking (sitting, chatting, eating); and does not limit sidewalk use to pedestrians but allows access to

	other street users such as vendors and leisure walkers. This environment also creates venues for socialization and interaction
Enjoyment/ Leisure	This refers to the quality of a walking environment that creates opportunities for self-expression, serves as venue for socialization and interaction, provides ways of enjoyment and leisure, and adds vibrancy to the place
Identity	This is an environment which is sensitive to socio-cultural needs by creating venues for cultural activities, producing sense of place and encourages a feeling of belonging amongst its users.

The survey queried on the overall respondents' preference on the given six criteria. Overall results of the AHP survey are given in Figure 3 which shows a web illustration of all criteria and how each criterion contributes to the overall global priority of achieving a positive sidewalk environment. This reflects the results of the perception of the sample on the level of importance of each of the criteria in the need-hierarchy framework by providing weights relative to other criteria.

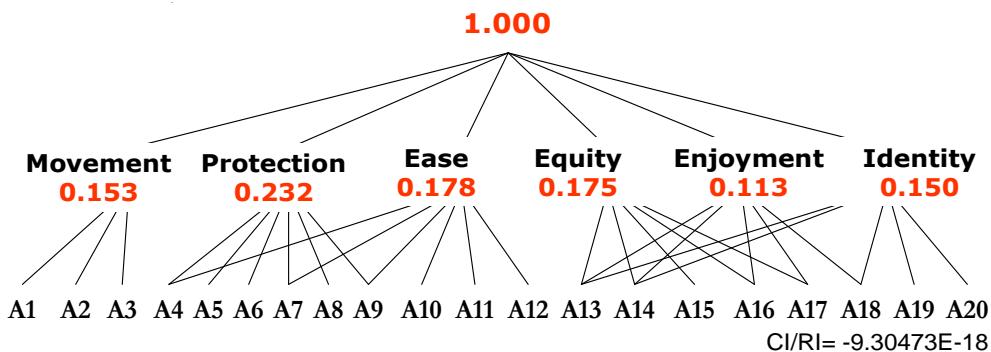


Figure 3. Hierarchical Framework: Results of the Criteria. The survey results indicate that protection is the most important criterion while enjoyment is the least important followed by movement.

The overall results indicate that the most important criterion is protection (wt: 0.232), followed by ease (wt: 0.178) and followed closely by equity (wt: 0.175); movement is considered as the 4th most important criteria (wt: 0.153) while identity (wt: 0.150) is 5th and, last but not the least, followed by enjoyment (wt: 0.113). The survey proved that protection is the most influential element in the decision of street users to utilize streets reiterating the importance given to physical safety. This is followed by ease which signifies psychological safety and security. The criterion 'equity' has surprisingly garnered a relatively high score specifically on giving importance to the presence of other street users such as sidewalk vendors. Comparing the CI to the random Index (RI) to determine the appropriate value of n, $CI/RI = -9.30473 \times 10^{-18}$, the result indicates that the degree of consistency was satisfactory, and the AHP yielded meaningful results. Figure 4 illustrates the results of the criteria weighting in a web format showing its distance from the centre. The farther the criterion from the centre, the stronger its pull or bigger weight, while the nearer it is, the weaker its pull or weight.

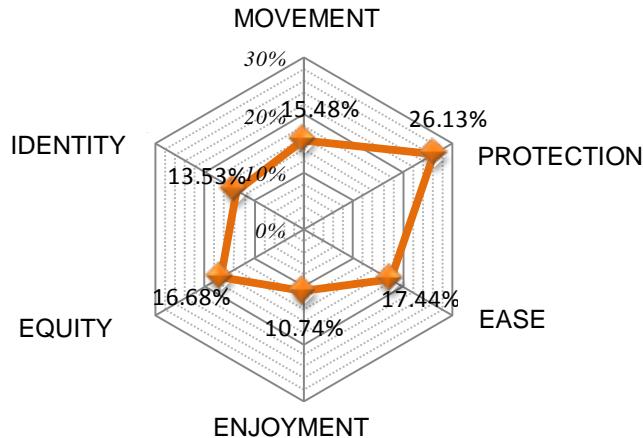


Figure 4. The figure shows the degree of importance from the centre of each of the criterion. Protection has the biggest weight while enjoyment has the least weight or importance.

2.2. Street User Need-Hierarchy

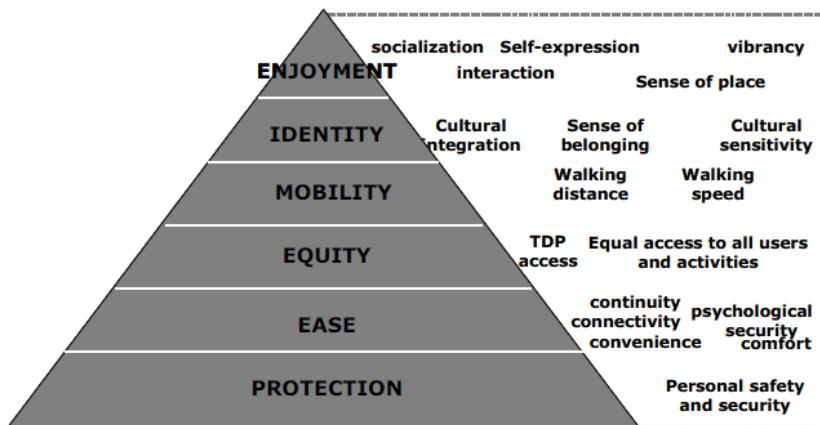


Figure 5. Street user need-hierarchy

The hierarchy of street user needs as summarized in Figure identifies 'protection' as the most basic criteria that provides need-satisfaction to street users, thus, is indicated at the base of the pyramid. To ensure a safe and secure participation in an urban space, an individual expects that elements contributing towards ensuring protection have been provided within the said space. Protection refers to the state of being free from danger or injury while walking by limiting pedestrian-vehicle conflict, providing provisions to ensure that accidents will not happen. This may also be accomplished by providing segregating strategies, either horizontal (physical) or vertical (time-based). On the next level, elements that contribute to 'ease' are also provided. Ease refers to the quality that would make one feel emotionally and mentally secure, comfortable, convenient and stress-free while walking. This is referred to as the state of being in which annoyances and problems are minimized and the possibility of pleasure imminent. In the middle of the pyramid is 'equity' which refers to the ability of the sidewalk environment to allow access to transport-disadvantaged persons (TDPs), allows equal opportunities for other activities besides walking (non-movement activities such as sitting, chatting, eating), and it does not limit sidewalk use to pedestrians but allows access to other street users such as vendors and leisure walkers. This also refers to opportunities for self-expression, serves as venue for socialization and interaction, provides ways of enjoyment and leisure, and adds vibrancy to the place. Mobility refers to the state of the pedestrian environment which allows unhampered access to street users. Unhampered

access refers to the lack of physical and psychological barriers from point of origin to destination. Furthermore, this also refers to permitting a comfortable walking speed while ensuring ease in orientating oneself within the street network. Enjoyment and socialization refer to the quality of the walking environment which allows equal opportunities for other activities besides walking (sitting, chatting, eating) and does not limit sidewalk use to pedestrians but allows access to other street users such as vendors and leisure walkers. This refers to facility attractiveness manifested through aesthetics of urban features; interaction or level of participation of people (vibrancy). Furthermore, this environment also creates venues for socialization and interaction. Identity refers to elements that acknowledge socio-cultural needs by creating venues for cultural activities, producing sense of place and encourages a feeling of belonging amongst its users by calling on integration of local culture, sense of place, source of pride, historical significance, and contextual sensitivity (Mateo-Babiano and Ieda, 2005).

2.4. Prioritization of Alternatives

Each criterion can be satisfied by a number of alternatives. Using the analytical hierarchy process, the respondents were queried on their preference between two need-satisfiers or alternatives. The result of the global priority of weights for all alternatives in descending order is indicated in Figure 6.

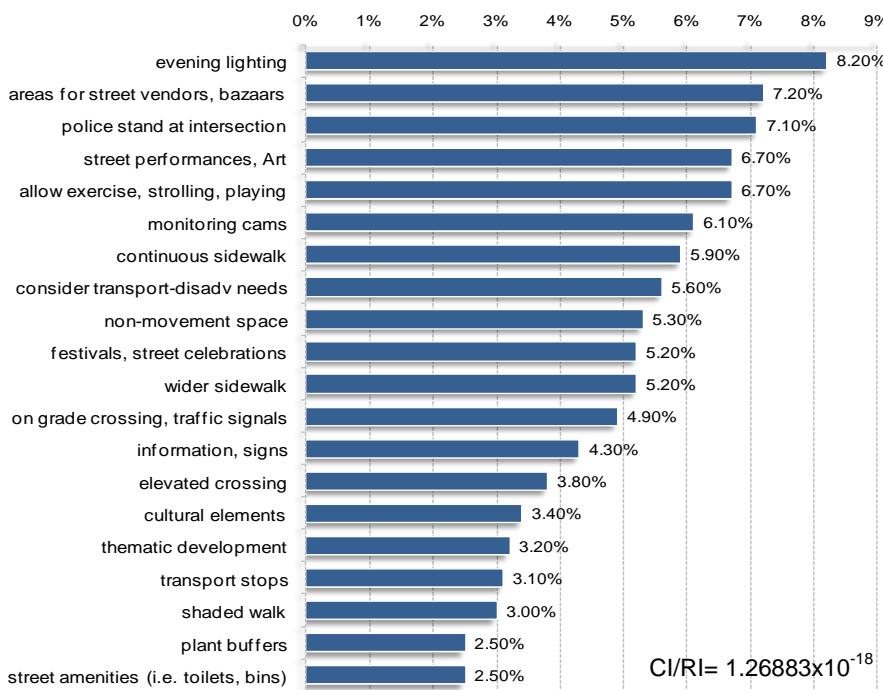


Figure 6. The hierarchical list of Alternatives with Corresponding Weights

The consistency index (CI) and random index (RI) are compared and yielded $CI/RI = 1.26883 \times 10^{-18}$ which is less than 0.10 indicating that the degree of consistency is satisfactory and the AHP indicated meaningful results.

Three alternatives garnered the highest rating (which belonged under criteria 'protection' and 'ease'), namely: (A4) adequate lighting during evenings; (A7) install monitoring devices such as cameras; and (A9) police stand at intersection. Under the criteria 'equity', three more

alternatives earned the highest score: (A13) areas for street vendors and street bazaars; (A14) encourage street performances and street art display; and (A16) allow other activities such as exercise, strolling, playing. These results strengthen the overall global street user need hierarchy that ‘protection, ease and equity’ are important attributes that would encourage the development of a positive sidewalk environment. Respondents felt a general need to encourage diversity as reflected in providing areas for various street uses and allowing different activities within the street space while the need for ease and protection is highlighted by providing adequate lighting, police presence, monitoring cameras, and wider sidewalks. The CI and RI are compared and yields less than 0.10 results which illustrates that the degree of consistency is satisfactory and the AHP yields meaningful results.

With respect to the Criteria ‘protection’, local priorities show that evening lighting and on grade crossing contribute to the criterion protection. While global priority illustrates how much evening lighting contributes to the overall goal of determining a positive sidewalk environment. Table 2 and Figure 7 illustrate the weights on both local and global priority. The consistency ratio garnered a value of $CI/RI = 7.61296 \times 10^{-18}$ signifying the consistency of the results of the sample, both for preference and weights.

Table 2. List of Alternatives to Satisfy Criterion: Protection

PROTECTION	Alternative	Local Priority	Global Priority
A6	on grade crossing, traffic signals	0.215	0.049
A4	Evening lighting	0.202	0.048
A9	police stand at intersection	0.163	0.038
A5	elevated crossing	0.160	0.038
A7	monitoring cams	0.148	0.035
A8	plant buffers	0.112	0.025
	TOTAL	1.000	0.232

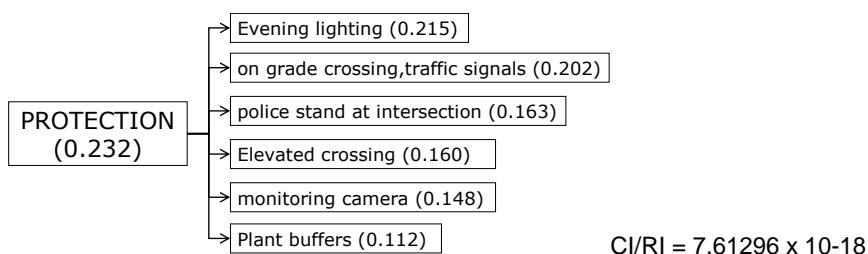


Figure 7. The figure illustrates the hierarchical framework with weights of the criteria ‘protection.’

With respect to the criteria ‘ease’ (0.153), local priorities show that evening lighting, police stand at intersections, transport stops and shaded walks contribute to the criterion. While global priority illustrates how much evening lighting contributes to the overall goal of determining a positive sidewalk environment. Figure 8 illustrates the weights on local priority. The consistency ratio garnered a value of $CI/RI = 5.07531 \times 10^{-18}$ signifying the consistency of the results of the sample, thus, reflects the sample’s preference and weights.

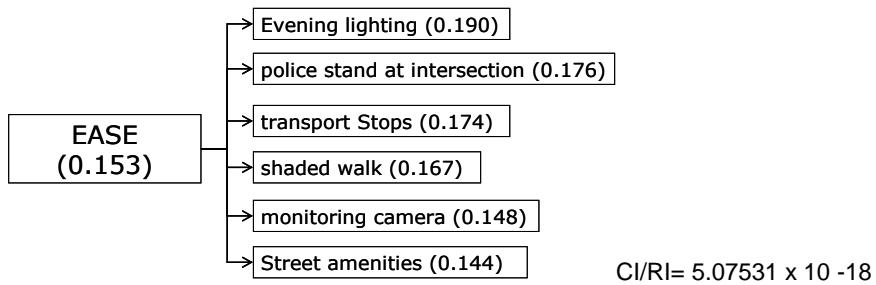


Figure 8. The figure illustrates the hierarchical framework with weights of the criteria Ease.

With respect to the criteria 'equity' (0.175), local priorities: showing that TDPs (facility for blind); allowing exercise, strolling, playing; non-movement space (i.e. eat/drink, chat, meet); areas for street vendors, bazaars; street performances/art, contribute to the criterion while global priority illustrates the contribution of the same alternatives to the overall goal of determining a positive sidewalk environment. Figure 9 illustrates the weights on local priority. The consistency ratio garnered a value of $CI/RI= 0$ signifying the consistency of the results of the sample, thus, reflects the sample's preference and weights.

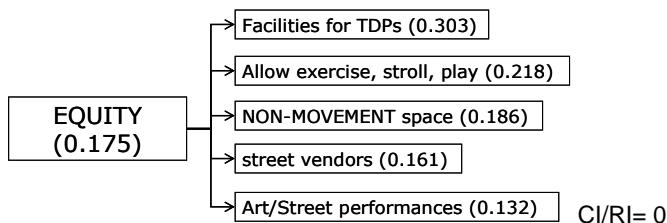


Figure 9. The figure illustrates the hierarchical framework with weights of the criteria 'equity'.

With respect to the criteria 'movement' (0.153), local priorities: continuous sidewalk, wider sidewalk, and information signs, contribute to the criterion. While global priority illustrates how much the same alternatives contribute to the overall goal of determining a positive sidewalk environment. Figure 10 illustrates the weights on local priority. The consistency ratio garnered a value of $CI/RI=1.26883\times 10^{-18}$ signifying the consistency of the results of the sample, thus, reflects the sample's preference and weights.

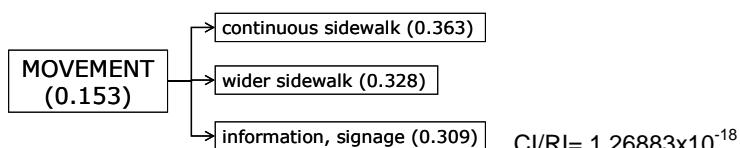


Figure 10. The figure illustrates the hierarchical framework with weights of the criteria 'movement'.

With respect to the criteria 'identity' (0.150), local priorities that garnered higher weights include: cultural elements; thematic development; festivals and street celebrations; areas for street vendors and bazaars; street performances/art. Figure 11 illustrates the weights based on local priority. The consistency ratio garnered a value of $CI/RI=-3.38354\times 10^{-18}$ signifying

the consistency of the results of the sample, thus, reflects the sample's preference and weights.

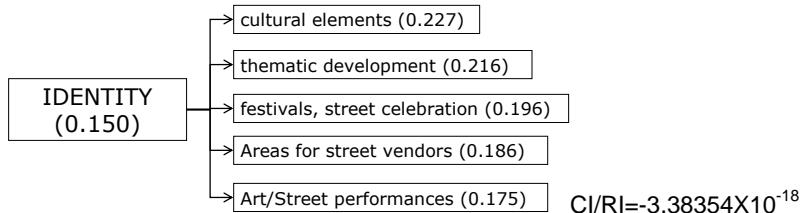


Figure 11. The figure illustrates the hierarchical framework with weights of the criteria identity.

With respect to the criteria 'enjoyment' (0.113), alternatives: allow exercise, strolling, playing; festivals, street celebrations; NMS space (i.e. eat/drink, chat, meet). Areas for street vendors, bazaars; and street performances/art, contribute to the criterion while global priority illustrates how much the same alternatives contribute to the overall goal of determining a positive sidewalk environment. Figure 12 illustrates the weights on local priority. The consistency ratio garnered a value of $CI/RI=3.38354 \times 10^{-18}$ signifying the consistency of the results of the sample, thus, reflects the sample's preference and weights.

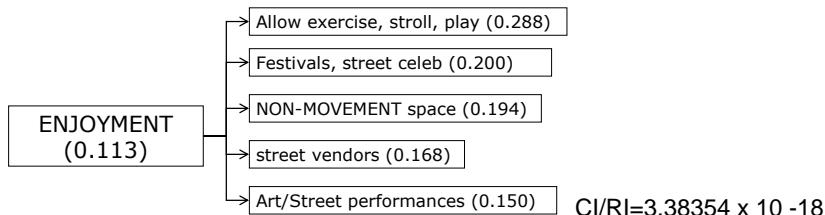


Figure 12. The figure illustrates the hierarchical framework with weights of the criteria identity.

3. POLICY IMPLICATION AND FURTHER STUDIES

Within an automobile-orientated urban context in Asian cities, the paper illustrated the significance of walking as a mode for the sample. This may have been brought about by the need to support public transport combined with the increasing use of indigenous transport such as paratransits and jeepneys within urban centres. Thus, the importance of walking should be strengthened. This requires policies that support the need to increase and improve the walking environment. The frequency of walking is not that high for the majority (at 53%), this still creates an opportunity to determine strategies to increase if not maintain their current walking levels, encourage more frequent walking activities and, also, to encourage their participation in the street space. Moreover, 16% utilise the street space in a more frequent manner. This then requires a different policy approach wherein the important question to ask is to determine the factors that have contributed to their choice to walk. The paper is thus proposing the user-centred approach as a viable and feasible option. However, further analysis and a more detailed assessment are required.

3.1 User-centred Approach to space

The paper puts forward the premise that a user-centred space design and management approach encourages sustainable mobility. User-centred approach considers the decision making process of street users, bases its management strategies on needs and desires of users and how these may be met through the provision and/or implementation of need-satisfiers. It, thus, becomes imperative to analyze street spaces not only from a spatio-historical perspective to be able to define needs but also to determine prioritization of needs in contemporary street users. Defining and providing need-satisfiers will encourage people to use facilities and increase their participation in a given space ultimately ensuring loyalty from street users. The study was able to define street user needs, the street user need-hierarchy and potential viable recommendations to improve Asian street spaces.

3.2. Hierarchy of Street user needs

The hierarchy of street user needs refuted the notion of street users consisting only of pedestrians as well as street user as generally a moving entity. It further identified that street users prefer a street environment that is protected, provides ease and equitable street environment. Within the context of the survey, vendor presence, allowing non-movement activities and provision of non-movement spaces are implied to be contributory factors towards realizing equity, enjoyment and identity. Moreover, to achieve protection and ease, alternative priorities include provision of evening lighting and police presence as well as shaded walking area while to increase identity, integrating cultural elements, thematic development as well as allowing other uses in the streets. Aside from TDP facility provision, priorities to achieve equity include allowing other uses on the streets.

The pedestrian sample indicated that the most important criteria are protection followed by equity. This indicates that for them to be able to use sidewalks and streets more often, these public spaces should offer ample protection as well as give equal consideration to all users, not only to them as walkers but to all other entities on the sidewalks such as street vendors. The justification for this is that although utilitarian trip makes up the bulk of the purpose of walking outside, pedestrians are not mere walkers or passersby as most of them conduct other related activities while walking. Thus, the importance of protection as criteria in improving sidewalk and pedestrian space should be prioritized. Also, sidewalks should provide spaces for both movement and non-movement activities in the street space.

3.3. Equitable and Democratic Street Space

Pedestrian facilities refer to areas relegated for pedestrian use which include sidewalks, parks, playgrounds, crossings, overpasses, among others. However, the focus of this research is on sidewalks since the space is relegated for movement but also serve as space for non-movement. A sidewalk is defined as an uninterrupted facility parallel to a carriageway that is a designated footpath and located in between intersections with the purpose of carrying pedestrian traffic as well as other related activities.

The equitable and democratic character of a street induces the presence of a diverse group which contributes to the overall street liveliness. Aside from facility provision for the transport-disadvantaged, priorities to achieve equity include allowing other uses on the streets. This indicates that for them to encourage use of sidewalks and streets, these spaces should offer ample protection as well as give equal consideration to all users, not only walkers but to all other entities on the sidewalks such as street vendors. Equity in street use translates into allowing diversified activities and other street uses other than walking so as to encourage diversified activities. In high pedestrian density areas, there is a need to include regulated peddling, artworks, performances and other activities as part of a flexi space to create strong identity. We need to call on culture such as encouraging the bazaar culture as well as bringing back the sacredness of sidewalks.

In a number of Asian cities, the present policy of calling for the removal of vending and peddling along streets is reflective of an exclusionary policy which favors movement. It also is indicative of non-user-centred approach to space planning given that it does not consider the perspectives of local communities and groups with local needs. Through the study, the important role played by retailing through vending is not only an economic need but also a cultural requirement. Moreover, socialization and interaction is also encouraged by the presence of local and indigenous activities such as retail trading. Thus, there is a need to re-examine such policies, specifically how it can be considered at the design stage. There should be a compromise derived between vending and regulating to define locations most appropriate for such activities as well as improve the aesthetic quality of their presence. Presence of ambulant vendors and hawkers are perceived as the main contributor to sidewalk congestion and increased danger of the sidewalk. However, historically it has been shown that vendors and street stalls had been part and parcel of Asian sidewalks.

Asian pedestrians do not differentiate between public and private space using communal space as an extension of their living area, a venue for commerce and exchange and a place to socialize. Although utilitarian trips make up the bulk of the purpose of walking outdoors rather than walking for leisure, pedestrians are not mere walkers or passersby but also conduct other related activities while walking.

3.3. The consideration of Non-movement in the Design and Development of the Street space

Non-movement activities are very prominent in the present Asian street space. This further suggests the social quality of Asian space and the need to integrate the non-movement aspect which is an important consideration in the planning and design of street spaces. It also proves that streets are not only for seamless movement but also for non-movement activities to increase socialization of the said space thereby contributes to vibrancy and increase liveability. It established that non-movement space, an emergent space resulting from the change from moving to non-moving mode of pedestrians, is a very significant component in the design of sidewalks. Moreover, areas which attract high pedestrian volume usually have a greater tendency to carry non-movement activities. Thus, non-movement use proliferates in Asian cities indicating that the opportunity to increase sidewalk sustainability

requires the reconsideration of non-movement activities in the design of such space. Sidewalks should provide spaces for both movement and non-movement activities in the street space. On a wider perspective, this provides a fresh viewpoint on pedestrian facility design and space planning by considering and integrating both movement and non-movement behaviour into analyzing space. Also, it hopes to add to the current knowledge in pedestrian transport studies and give additional insight (specifically the socio-cultural history) into street design in Asian cities. With this in mind, the problem may be re-evaluated as being the improper allocation of street space. In people-orientated urban spaces, vendors may be allowed to utilize such space for commercial purposes. This also provides the potential of designing fixed and semi-fixed feature of street elements to make street space more efficient.

3.4 Conceptualization of Ease

An important output of the research is the inclusion of the concept of Ease. The word carries with it a multitude of meanings and dimensions which require further study and analysis. However, as an operational definition, Ease refers to the need to be relieved from constraints within the walking environment so as to make walking easier and make street users feel at ease. The feeling of being at ease is similar to the feeling of relaxation, breathing deeply, free from anxiety, having peace of mind among others. The key phrase in the definition is relief from constraints. This implies that ease is a result of lessening the constraints on street users within urban spaces or pedestrian facilities. These constraints can be defined as conditions that would lead to a decrease in the level of ease. Constraints may be physical referring to the state of being, psychological, referring to state of mind, or sensory, which poses constraints on the five senses. The former is brought about by the physical presence of elements that may pose constraints. Moreover, ease may refer to the feeling of security which is "ease as a state of mind." Another aspect of ease may be comfort while walking. One does not feel too warm or too exhausted from walking.

4. CONCLUSION AND FURTHER STUDIES

The study, through the conduct of the need-assessment, has shown the significant contribution of a user-centred approach to design and management of street spaces to be able to develop a viable sidewalk environment. It was able to evaluate both the quantitative and qualitative criteria and attributes while developing a street user need hierarchy. The corresponding concept, the hierarchy of street user needs, further refuted the notion of pedestrians as only moving entity. Satisfaction can be contributed not only by providing mobility but ensuring that streets and sidewalks are protected, provides ease and equitable. The identified attributes, when provided, assist in creating a better and positive sidewalk environment.

At the micro-level, it analyzed emergent spaces, both functional and social purposes, and how the spaces were derived signalling the importance of street culture in developing

effective spaces. It was able to examine the importance of non-movement behaviour within the Asian street context. Non-movement activities are very prominent in the contemporary Asian street space within the sample cities implying the social quality of these spaces. It further suggests the need to integrate the non-movement aspect as an important component of street planning and management.

As a way forward, the identification and prioritisation of street user needs of both the criteria and alternatives merit further investigation. This is imperative to determine the applicability and replicability in other case cities as well as determine factors that contribute to variability (i.e. attributable to cultural differences or city size).

Also, it is important to note that to a certain extent the built environment influences the behaviour of its users. Thus, designers and planners play a critical role in ensuring that needs of pedestrians and other street users are considered and met at the initial phase of a project to realise a good urban design of public spaces such as sidewalks.

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REVISION COMMENTS AND ACTION TAKEN BY THE AUTHORS

	COMMENTS	ACTION TAKEN
REVISION 1	The structure of the paper was very good and illustrative. The language was understandable and clear.	Thank you
REVISION 1	Some issues could be considered for future research: 1) Street-user need-hierarchy was presented based on Maslow's theory among others. The question is whether the needs apply to street users in various cities and whether variance is due to cultural differences or differences between cities including the size. The same applies to the	I have incorporated this as a potential way forward or future study of this research under the conclusion and further studies section

	results of selection of alternatives.	
REVISION 1	2) It was not clearly explained how the alternatives of each category were selected. If they were predefined prior to the user responses how were they selected? If respondents could propose ideas of their own how the alternatives were presented to the other respondents. A predefined list would make the research process easier, but novel and innovative ideas could emerge by allowing the respondents to give their own ideas of street improvement instead of just prioritising the existing methods.	Clarified the idea of how alternatives were defined in p.7, line 23.
REVISION 2	This is a very good paper drawing attention to an important travel mode and its environment. There could be some perspective to the results.	Thank you
REVISION 2	Safety always ranks the most important, but that does not always translate into behavior (e.g. not speeding while driving). Movement may not be perceived as important because it is the primary function of the sidewalks. Just consider the negatives of the claims: safety/protection not important; or, movement not important.	I agree with the point the paragraph makes, the paper claims that all these attributes are important, too, but there are other attributes that need to be considered such as ease and equity.
REVISION 2	The paper also should point out the need for good urban design where the needs of the pedestrians and those on the sidewalk are considered. No AHP will be creative in itself, it requires a good planner/architect and sensible decision-makers. The paper should make this point more explicitly.	Emphasized this point in the paper's conclusion and further studies section
REVISION 2	The CI and RI and CI/RI should be defined.	Clearly defined in p.4, line 17-20