RESEARCH ARTICLE

A Model Walkability Index for Sustainable Urban Mobility of a Region: The Case of Soccsksargen- A Transdisciplinary Research Approach

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Abstract
Although walkability studies have been pronounced and recognized as an important factor for sustainable urban development, few studies have focused on calculating a reliable walkability index that captures the multifaceted dimensions of urban mobility. Hence, this study aimed to formulate a Model Walkability Index for SoCCSKSarGen Region as the basis for urban development policies in achieving sustainable mobility. Using a convergent mixed methods design, data were collected from 399 pedestrians, five professional design organizations, and 2 public health experts. Through a transdisciplinary approach, it utilized statistical techniques such as descriptive statistics, inferential statistics, and multivariate analysis. For the qualitative findings, data were analyzed using Quirkos and MaxQDA software. Likewise, Exploratory Factor Analysis (EFA) was employed to derive the key Walkability factors for formulating the Walkability Index Model. Data revealed that all groups of experts were similar in identifying safety, comfort, and aesthetics as walkability attributes. On the contrary, only the transdisciplinary design professionals considered anthropometric measures and activities as walkability attributes aside from those previously mentioned. Likewise, the converged data provided substance in developing the Model Walkability Index (MWI) for SoCCSKSarGen Region. The resulting MWI discussed in the study represents the convergence of transdisciplinary efforts integrating safe roadway design concepts and sustainability considerations. Furthermore, the study offers a holistic assessment of walkability, enabling stakeholders to foster the creation of future walkable urban communities that are safe, healthy, and environmentally conscious.

Keywords: SoCCSKSarGen; walkability; convergence; transdisciplinary; sustainability; safety index

Introduction

The rapid concentration of the population in urban areas poses many challenges to sustainability among these, mobility emerges as one of the main generators of externalities that hinder the achievement of the Sustainable Development Goals (Cayetano Medina-Molina et al 2022).

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As urban populations continue to grow, the need for sustainable and efficient mobility approaches becomes increasingly imperative.

Walking is undoubtedly a sustainable and healthy mode of transport. walking as a viable means of transportation has become the focus of sustainable development policies (Macioszek et al 2022). However, the decision to walk is influenced by many built environment and streetscape attributes (Fonseca et al 2022)

This dissertation focused on developing a comprehensive model walkability index specifically tailored for the urban mobility context of the SoCCSKSarGen, a region situated in the southern part of the Philippines. The SoCCSKSarGen region, comprising the provinces of South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos City, is characterized by rapid urban growth and increasing transportation demands (National Economic and Development Authority, 2022). Given the region's unique geographical, cultural, and socioeconomic aspects, a transdisciplinary research approach is adopted to address the complex interplay between architecture and civil engineering, urban planning, transportation engineering, environmental sustainability, and public health (Loorbach et al., 2017; Mehmood et al., 2022).

The overarching objective of this research is to create a robust and reliable walkability index that captures the multifaceted dimensions of urban mobility in the SoCCSKSarGen region. This index will serve as a valuable tool for designers, planners, policymakers, and researchers to evaluate the walkability of different urban areas within the region and identify opportunities for improving pedestrian infrastructure, enhancing connectivity, and promoting sustainable transportation modes (Schoner et al., 2018). Understanding how urban space influences citizens' perceptions of walkability is critical to designing efficient pedestrian planning policies and guiding future research in this field (Fonseca 2022).

A transdisciplinary research approach is employed to tackle the complexity of the research problem, involving collaboration between various disciplines such as architecture, civil engineering, landscape architecture, urban planning, transportation engineering, and public health, including pedestrian users. Transdisciplinary research can solve problems that cannot be solved in one discipline as the approach is able to connect different disciplines and stakeholders and guarantee a sufficient and efficient consideration of all relevant factors for real-world problems (Stinder et al 2022). This transdisciplinary collaboration engages a holistic understanding of the region's urban mobility challenges and enables the integration of diverse perspectives, expertise, and methodologies to develop an inclusive walkability index.

The study adopts a convergent mixed-methods research design, combining quantitative analysis, spatial modeling, and qualitative assessments to capture both objective and subjective aspects of walkability. Through the integration of pedestrian surveys, interviews, and participatory engagement, the research aimed to generate a comprehensive understanding of the factors influencing walkability in the SoCCSKSarGen Region (Cerin et al., 2017). This transdisciplinary research approach ensures a nuanced, people-centered and contextually relevant model that reflects the unique characteristics and needs of the region.

By developing a robust walkability index, this dissertation contributed to the existing body of knowledge on urban mobility and provided practical insights for sustainable urban planning in the SoCCSKSarGen region. The findings of this research can inform policy interventions, infrastructure investments, and community engagement initiatives aimed at enhancing walkability, promoting active transportation, and fostering healthier and more sustainable urban environments (Giles-Corti et al., 2019; Sallis et al., 2016).

This dissertation represents a pioneering effort in the development of a model walkability index tailored to the urban mobility context of the SoCCSKSarGen Region. Through its transdisciplinary research approach, this dissertation aimed to provide a comprehensive understanding of the complex interplay between urban planning, transportation engineering, environmental sustainability, public health, and pedestrian users. The results of this research hold significant potential for fostering sustainable urban development and improving the quality of life for residents in the region.

Literature Review

Defining Walkability

The term walkability is used to describe the extent to which the urban environment is pedestrian-friendly, usually by quantifying multiple built environment attributes at the neighborhood scale (Fonseca et al 2022). It encompasses the design, infrastructure, and amenities of an area that encourage and enable individuals to walk for their daily needs, recreation, or commuting purposes (Litman, 2020). Walkability is often assessed based on criteria such as sidewalk availability and quality, street connectivity, presence of crosswalks, pedestrian safety features, land use patterns, access to public transit, and the proximity of essential destinations like schools, workplaces, shops, and parks (McCormack et al., 2018). The concept of walkability only started to be used in transport and planning studies in the early 2000s, but rapidly became a widely used concept in sustainable mobility and other disciplines (Fonseca et al 2022) This concept plays a crucial role in creating healthier, more sustainable, and vibrant communities, as it promotes physical activity, reduces dependence on automobiles, improves air quality, fosters social interaction, and enhances the overall quality of life (Litman, 2020; McCormack et al., 2018). The urban areas in SoCCSKSarGen, depended much on personalized public commuter systems such as tricycles and habal-habal, relegating walking to the sidelines.

Walkability has become a major theme of urban research, and also a key goal of various urban design practitioners (Forsyth, 2015; Winters et al., 2017) such as architects, planners, engineers, landscape architects, etc.

However, to comprehensively address the complex and interconnected challenges associated with walkability, it is crucial to adopt a transdisciplinary approach. By involving multiple disciplines, the multifaceted aspects of walkability can be explored, and innovative solutions will truly enhance the pedestrian experience (Marans & Stimson, 2011).

Walkability as a Sustainable Mode of Urban Mobility

Non-motorized or active transportation (walking, cycling, and its variations) plays an important role, and significant and distinct responsibilities in a well-functioning transportation system Walking is a practically ubiquitous human activity that allows for mobility, exercise, and enjoyment.

The ideal practice is to have 10-20% of trips made completely through non-motorized modes, while the majority of motorized trips include non-motorized linkages, such as connecting to public transportation and between parked cars and destinations. Pedestrian environments include parking lots, transportation terminals, airports, and commercial districts. Improving non-motorized transportation is frequently one of the most cost-effective methods to improve motorized transportation.

Walking and cycling are both low-cost modes of transportation. They are typically relied on by physically, economically, and socially disadvantaged persons, so enhancing non-motorized transportation can assist in achieving social equity and economic opportunity goals. The most prevalent kind of physical activity is active transportation and the most practical strategy to promote public fitness and health is to increase the frequency of walking and cycling. Non-motorized modes can help planners meet their goals in the reduction of traffic congestion, consumption of energy, and pollutant emissions They can also aid in the achievement of land use planning goals including urban redevelopment and more compact "smart growth" development.

The most accessible public realm or spaces include a large number of pedestrian contexts (sidewalks, walkways, and hallways). Many useful behaviors (socializing, waiting, buying, and eating) take place in pedestrian contexts, and the quality of these spaces has an impact on them. To attract clients, shopping areas and resort communities rely on walkable environments. Popular recreational activities now include walking. Improving the pedestrian-built environments helps users in terms of enjoyment and health, as well as supporting related industries such as retail, recreation, and tourism.

The popularity of walking is still inherent as much research suggests that people continue to walk for transportation and enjoyment despite the availability of motorized vehicles. In many cases, improving walking conditions while restricting motor use is the greatest method to improve urban transportation. It improves overall accessibility to locations in terms of convenience, comfort, and affordability.

Walking is the most cost-effective and environmentally friendly among other modes of transportation and recreation. Its potential cost and resource savings are often highlighted (Litman 2018).

This high value placed on driving and the low value placed on walking in conventional planning reflects how transport is measured (Litman, 2018). Because short trips, non-work travel, travel by minors, recreational travel, and nonmotorized links are most often overlooked, and most travel surveys undercount nonmotorized travel. Most travel surveys, for example, label "auto-walk" or "walk-transit-walk" trips as "auto" or "transit." Walking links, regardless if they happened on public driveways or rights-of-way and consume as much time as motorized links, are also left unnoticed. According to previous research by Zapata-Diomedi et al (2017), in Brisbane, nearly 80% of adults travel for work or education by private cars about 20% of urban trips are conducted by active transport. While in Germany, just 22% of trips are entirely made on foot, although 70% include some walking.

A report from the United Kingdom states that walking accounts for 2.8 percent of overall mileage, 17.7% of travel time, and 24.7 percent of trips. Walking appears negligible when it is measured solely in terms of travel distance, however, when it is measured in terms of trips, travel time, or even outdoor exposure to public spaces and social infrastructure. Because by nature non-motorized transport has slower speeds than its motorized counterpart and considering commuters waiting at bus stations or loading bays, or just merely standing in front of store windows, non-motorized passengers may account for only 5% of person-trips but 40% of person-minutes of public exposure. As a result, how people view the transportation system and the local environment is heavily influenced by their walking conditions.

Active modes of transportation have become one of the beacons of Sustainability/. In the 2030 Agenda for Sustainable Development, the United Nations has determined that countries and regions should provide safe, affordable, accessible, and sustainable transportation for their citizens (Zafri et al; 2021)

The Influence of the Built Environment on Walking

Recent multidisciplinary transport studies that link transportation planning to health studies have acknowledged that walking helps to maintain the physical and mental health of all ages by preventing a variety of health problems (Mohammed 2017), and as a result, researchers are now more concerned with the built environment determinants of active transportation emphasizing the need to identify what are the spatial factors that would influence and condition active transportation. The term built environment refers to the human-made surroundings that provide the setting for human activity (Kaklauskas 2016).

The positive and negative effects of interactions between pedestrians and the built environment influence the pedestrian walking experience. These spatial features are thought to have an impact on a person's decision to walk. The Built environment is increasingly recognized as a key driver of walking and physical activity (Liao et al.,2020).

Walking is now being acknowledged by planners as an important means of active urban transportation as support for urban sustainability grows. The popularity of urban walkability is growing due to rising fuel costs, fuel availability, traffic congestion, pollution, and other urban difficulties induced by a significant reliance on fossil fuel-driven cars.

Environmental Factors Affecting Pedestrian Satisfaction

To obtain insight into urban design techniques that can promote both pedestrian satisfaction and activities, Kim, Park, and Lee (2014) explored the correlations between pedestrian satisfaction and several built environment characteristics. The authors illustrated the significant correlation between the satisfaction of pedestrians and the quality of urban pedestrian environmental factors using econometric instruments, indicating the importance of taking psychological factors into account when studying walkability, such as different pedestrian groups and trip motives. The built environment is shaped by transportation investments and land-use allocation and therefore hinders or encourages walking (Wang 2021). Details of environments, including sidewalk and crossing quality and aesthetics, are believed to affect people's confidence, comfort, and safety for walking in neighborhoods (Sallis et al., 2016), but they have been less well-studied. These attributes were identified using the neighborhood walk audit and through actual observational measures on users' or stakeholders' preferences.

Walkability increases exponentially when people feel a sense of control over the streets they walk. Conversely, streets fail when they seem to be controlled by no one. Walkability and street vitality are important factors in shaping urban life on and around the street.

Pedestrian Experience Principles in Measuring Walkability

Walkability is a key concept of sustainable urban development (Yamagata et al, 2020). Leyden 2003 further states that walkable communities have the potential to contribute to the well-being of communities by way of reducing carbon emissions and improving climate resiliency. Walkability refers to the degree of walking comfort in a walking environment for pedestrians (Kari 2016). Dong Yeong Jong (2017) states that pedestrian's cognition, affect, and behavior occur from the interaction between pedestrian passage and its related environment which he called the pedestrian experience and that to promote walkability, it is necessary to design walking environments according to the pedestrian experience (PX) principles.

Yamagata et al (2020) in their study of the experiential model for the walkability of Kyojima District in Japan identified the following as the five thematic Pedestrian Experience (PX) Principles for walkability :(1) Activity (2) Beauty/Aesthetics (3) Comfort (4) Anthropometric and (5) Security/Safety. These themes are further subdivided into various indices.

These Principles are a set of guidelines developed by the City of Yamagata in Japan to promote a pedestrian-friendly urban environment. The key elements of the Yamagata PX Principles and their significance in enhancing the pedestrian experience were identified as follows:

Human-Scale Design: The Yamagata PX Principles emphasize the importance of human-scale design, which involves creating urban spaces that prioritize the comfort, safety, and convenience of pedestrians. This includes features such as wide sidewalks, pedestrian-friendly crossings, ample seating, and well-maintained public spaces.

By designing for human scale, the principles aim to create a walkable environment that promotes social interaction and enhances the overall pedestrian experience.

Universal Accessibility: The Yamagata PX Principles emphasize the importance of universal accessibility, ensuring that the urban environment is inclusive and accommodating for people of all ages, abilities, and mobility levels. This involves providing barrier-free access, installing ramps and elevators, and considering the needs of individuals with disabilities when designing pedestrian infrastructure. Universal accessibility ensures that everyone can fully participate in and benefit from the pedestrian experience.

Safety and Security: Safety and security are paramount in the Yamagata PX Principles. The principles emphasize the importance of creating a safe and secure environment for pedestrians through measures such as well-lit streets, clear signage, and effective traffic management. These measures help reduce the risk of accidents and promote a sense of security among pedestrians, encouraging more people to walk and explore the urban environment.

Integration of Nature: The Yamagata PX Principles recognize the value of incorporating nature into the urban environment. They emphasize the integration of green spaces, trees, and vegetation to enhance the pedestrian experience. By incorporating nature into the urban fabric, the principles aim to create a more pleasant and visually appealing environment that contributes to the overall well-being of pedestrians.

Cultural and Historical Preservation: The Yamagata PX Principles highlight the significance of preserving and showcasing the cultural and historical heritage of the city. They encourage the integration of cultural elements, historic landmarks, and traditional architecture in urban design. This approach fosters a sense of identity and pride among pedestrians, as well as promotes a deeper appreciation for the city's cultural heritage.

Implementing the Yamagata PX Principles requires collaboration between urban planners, architects, transportation experts, and community stakeholders. By adhering to these principles, cities can create pedestrian-friendly environments that enhance mobility, health, and quality of life. The Yamagata PX Principles serve as a valuable framework for cities worldwide to guide the development of urban spaces that prioritize pedestrians and create vibrant, livable communities.

Elements of the Pedestrian Experience (PX) Principle

The Yamagata study further identified experiential attributes for each pedestrian experience theme that relates to walking in public pedestrian facilities.

a. Activity
- a.1 High Vehicular Traffic Volume
- a.2 Presence of Business Establishments along Sidewalks
- a.3 Presence of Food Establishments
- a.4 Presence of Parks and Playgrounds
- a.5 Proximity to commercial complexes

b. Aesthetics
- b.1 Colorful attractive Sidewalks
- b.2 Presence of Landscaping
- b.3 Nice Building Facades
- b.4 Presence of Public Art

c. Comfortability
- c.1 Protection from Heat and Rain (Presence of Tree Canopies)

c.2 Presence of Street furniture
c.3 Good Sidewalk surface quality (Ergonomics)
c.4 Clear unobstructed and leveled sidewalks

d. Anthropometric
d.1 Adequate Sidewalk width
d.2 Adequate Headroom
d.3 High Pedestrian Traffic
d.4 Presence of PWD Ramps

e. Safety
e.1 Good Outdoor Air Quality
e.2. Presence of Traffic Lights
e.3 Presence of Pedestrian Crosswalks
e.4 Clear and Legible Road Signages
e.5 Presence of Loading and unloading bay
e.6 Presence of Rails or Bollards
e.7 Adequate Street Lighting
e.8 Presence of CCTV Cameras

SOCCSKSARGEN Regional Development Plan

In the Philippine setting, before the introduction of automobiles by the Americans, walking, together with animal-driven vehicles, was then the dominant mode of transport. However, as cities experience rapid urbanization, the volume of vehicles also increases which resulted in traffic congestion and the deterioration of outdoor air quality due to increased carbon emissions from fossil fuel-driven vehicles. This phenomenon is happening in almost all major cities in the country, SOCCSKSARGEN Region included.

SOCCSKSARGEN's regional development plan identifies ten (10) preferred medium-term strategies focusing on peace, environment, infrastructure development, and safety and resiliency. Strategy number 3,4,5 specifically identifies improving social infrastructure and building community resiliency that integrates disaster risk reduction, and climate change action (NEDA XII).

Social infrastructure helps in recognizing the public spaces that are often overlooked and undervalued. It draws attention to the breadth, depth, and textures of sociality that can be afforded by different urban environments (Latham and Layton 2019). Klinenberg (2018) defines Social Infrastructure as "public institutions, such as libraries, schools, playgrounds, parks, athletic fields, and swimming pools, including sidewalks, courtyards, community gardens, and other spaces that invite people into the public realm".

Social infrastructure, despite its role in helping recognize the public dimensions, are most often been not prioritized and these public spaces have always been de-prioritized in urban development.

In compliance with the strategies identified by the SOCCSKSARGEN Regional Development Plan, and recognizing the need to improve the social infrastructure and safety of public spaces, the General Santos City public safety office (PSO) recently crafted its Local Public Transport Route Plan (LPTRP), and among its goal is to manage both the motorized and non-motorized mode of transport in the city. Its primary aim is to find a solution to the issues created by the huge volume of tricycles plying the city and to reduce the street hazards and environmental pollution emanating from the high density of motorized tricycles ad private cars plying the urban streets. Among the strategic plan of the PSO, is to encourage active transport, biking, and walking, especially in the dense central business district.

Recently the Department of Human Settlements and Urban Development (DHSUD) issued Memorandum Circular 2021-010 mandating all local government units to enhance the Climate and Disaster Risk Assessment Process to ensure that these are integrated into local development and land use plans.

The literature review provides a comprehensive overview of the concept of walkability, its importance in promoting sustainable urban mobility, the influence of the built environment on walking, and the principles of the pedestrian experience. However, there are notable research gaps and areas for innovation that warrant attention in this study.

The literature review highlights the reliance on personalized public commuter systems in SoCCSKSarGen, relegating walking to the sidelines. A critical research gap lies in understanding the specific challenges and opportunities for enhancing walkability in this context.

While previous studies acknowledged the need for a transdisciplinary approach to address the complex challenges of walkability, they fall short in providing specific examples or methodologies for implementing innovative collaborations between disciplines such as urban planning, architecture, public health, and sociology. This could involve developing frameworks for effective communication and decision-making among diverse stakeholders to optimize walkability outcomes.

This research focused on investigating and harmonizing the meaning of walkability from the viewpoints of transdisciplinary design professionals and groups involved in the development of the built environment (environmental planners, architects, engineers, transportation experts, public health officials, and pedestrian users.) and in the process identify the attributes of walkability and subject them to a perceptual user survey to determine the individual weights of each attribute has in conditioning pedestrian willingness to walk and integrating all these weights into the development of a walkability index in the context of the stipulated study area.

In conclusion, addressing these research gaps and exploring innovative avenues will contribute to a more nuanced understanding of walkability and inform practical strategies for creating pedestrian-friendly urban environments.

Methodology

Study location and population

The research locale is SoCCSKSarGen, short for South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos, a region situated n in Mindanao. South of the Philippines with a total regional population of 4,901,486.

Due to the limitation of time and resources, the research focused only on key urban districts of General Santos City: namely: Barangay Dadiangas East, Barangay Dadiangas West, Barangay Dadiangas South, Barangay Dadiangas North, Barangay Lagao, Barangay Dadiangas City Heights and Barangay Bula as the model study area in consideration of its status as a highly urbanized city.

The study adopted convergent mixed method research, an approach combining the simultaneous conduct of qualitative and quantitative data collection and analysis methods to comprehensively understand a research topic. Convergent mixed methods research involves collecting both qualitative and quantitative data. Qualitative data were collected through interviews, focus groups, or observations, while quantitative data was gathered through surveys and secondary data analysis (Creswell & Creswell, 2018). The qualitative data collection process was guided by the research questions and was designed to capture a rich understanding of the phenomenon under investigation.

Sampling and data collection

The sample size is an important characteristic of any empirical study in which the aim is to make an inference about a population from a sample (Bujang & Adnan, 2016) it is essential for the researcher to estimate an appropriate sample size to produce reliable results using the statistical procedure (Adhikari 2021). In situations when the population is finite and the researchers do not have enough knowledge about the population's behavior (or distribution of behavior) to determine the optimal sample size, the Slovin formula can be used to estimate it (Adhikari 2021)

The sampling frame for the quantitative survey was pedestrians 15 years and above who utilized the pedestrian facilities within the study area. The sample size for the survey had a 95% confidence level and a margin of error of 5%.

Slovin's Formula was used to determine the total number of respondents in the study from the urban population of 136,987, the computed sample size is 399.

The study utilized the probabilistic sampling design as a stratified random method. The sample was stratified within the four perimeter streets bounding the study area in particular, on the strategic intersections.

This method involves two data-gathering procedures done simultaneously, the quantitative pedestrian survey (Creswell, 2018) and the overall intent of this design is to have the qualitative data help explain in more detail the convergent quantitative results.

This study employed a stratified sampling design from the four quadrants of the study locale. This sampling design is appropriate to ensure a proportional representative for the four urban Barangays of General Santos City. Further, the sample size for the survey was determined using a 95% confidence level and a .05 margin of error.

Focus Group Discussions (FGD) and Key Informant Interviews (KII) were used to gather the opinions of the various professional disciplines. A total of five (5) Focus Group Discussions (FGD) with 6 to 10 participants each, as suggested by Krueger and Casey (2002), and three (3) key informant interviews (KII) were conducted. FGDs were conducted based on the guidelines recommended by Meyer (2021). Before conducting FGDs and KIIs, participants' consent was sought by signing informed consent.

Data Analysis

The data gathered in this study was analyzed using multiple data analysis procedures. On the one hand, quantitative data was analyzed using descriptive statistics, interpreted based on mean value and Exploratory Factor Analysis. Qualitative data gathered through Focus Group Discussion (FGD) and Key Informant Interviews were transcribed, translated, coded, categorized, and analyzed using Quirkos 2.4.2 (2021), a software package for qualitative data analysis. A total of 399 pedestrians participated in the survey. After validation of the accomplished questionnaires, all 399 interviews were used in the data analysis; the distribution of the survey respondents by survey location is presented] Descriptive statistics were used to determine the profile of the respondents.

Ethical Consideration

This study received ethical approval from the Institutional Ethics Review Committee of Mindanao State University, General Santos City.

Results and Discussion

Socio-Demographic Profile of the Respondents

The pedestrian respondents consisted of 215 female respondents comprising 53.9%, and 184 males, comprising 46.1% of the total 399 respondents. This shows that there are slightly more female pedestrians than male pedestrians, by as much as 7.8% more. This is similar to the study conducted by Sallis et al. (2016), who found that women were likelier to walk than men.

The mean age of the respondents was 27.63%, The youngest age was 15, and the oldest was 73 years old. The survey shows that pedestrians are relatively young, with 27.63 as the mean age. However, it must also be noted that the age range is quite broad, with the youngest at 15 and the oldest at 73. This is validated by the study conducted by Sallis et al. (2016), which finds that the age group most drawn to walking is adults aged 18-34 years old.

In terms of respondent distribution by income group, the researcher utilized the Philippine Statistics Authority FIES for 2021. Most survey respondents had a monthly family income of below P7,833.00. This accounted for 195 responses, or equivalent to 48.90%. This was followed by income of P7,834.00 to P11,333.00, 64 (16%); then P13,501.00 to P15,833.00, 36 (9%). Three (3) had a monthly family income of between P37,168.00 to P71,500.00, and three (3) of at least P71,501.00, which accounted for 0.8%.

The initial observation is that many of the current pedestrians plying the streets of the study area came from the low-income group whose monthly family income is below P7,833.00. In particular, research has shown that walkability is the preferred mode of transportation for low-income groups (Gehl, 2010). This is likely because walking is a low-cost, accessible, and convenient option for those who may not have access to a car or public transportation.

Preferred Walkability Attributes

Five focus group discussions (FGD) among the design professional organization to identify themes from the similarities in their preferences;

The distribution of participants in the FGDs are as follows: 10 environmental planners, 8 architects, 6 civil engineers, 5 landscape architects, and 3 transport scientists The mean age was 42.25. The youngest participant was 27, and the oldest was 62 years old.

Three themes were extracted from the data processed through Quirkos software. These are:

Theme 1: Creatively Artistic (Aesthetic attribute)

Aesthetics in walkable environments contribute to creating a distinct sense of place and fostering a sense of local identity. Unique architectural styles, historical references, or cultural elements incorporated into the urban fabric help to establish a sense of character and place attachment (Lynch, 1960). Aesthetically pleasing streetscapes that reflect the local context and heritage contribute to a stronger sense of community and pride, making the walking experience more meaningful and memorable for residents and visitors alike. One participant mentioned:

["In terms of aesthetic, I know maybe it's not really something that is within the design aesthetic but anything that shows festivity or the fiesta' spirit would really, you know, encourage people to walk. I mean, we've seen experiences where you know, where people who don't really walk, but if there are bandiritas there, you know, people would walk. As long as there's that aesthetics, the colorful, the goody and you know the idea of something top of the ordinary people would walk"] (FGD: PALA 10/01/22)

Aesthetics can influence the perceived safety and comfort of walkable environments. Well-maintained and visually appealing streetscapes create a positive impression of safety and security (Wener & Evans, 2007). Adequate lighting, clear sightlines, and aesthetically pleasing design elements contribute to pedestrians' feelings of comfort and security while walking (APA, 2017). By integrating aesthetics into the design of walkable spaces, designers can positively influence the perception of safety and comfort, encouraging more people to engage in active transportation.

Theme 2: Sense of Protection and Security

The physical safety of pedestrians is a fundamental component of walkability. Safe infrastructure, including well-maintained sidewalks, crosswalks, and pedestrian-friendly intersections, plays a crucial role in preventing accidents and injuries. According to the American Planning Association (APA), walkability should prioritize features that protect pedestrians, such as adequate lighting, clear signage, and traffic calming measures (APA, 2017). Ensuring physical safety not only reduces the risk of accidents but also promotes confidence and encourages more people to engage in active transportation. Perceived safety refers to the subjective sense of security that individuals experience while walking in a neighborhood. It encompasses factors such as personal safety, visibility, and the absence of crime or vandalism. Perceived safety is a critical consideration in walkability, as it directly influences people's willingness to walk and their overall satisfaction with the environment. Research has shown that individuals are more likely to engage in.

The Focus Group discussion among the design professionals gathered various viewpoints on sidewalk safety. One participant from the Philippine Association of Landscape Architects (PALA) took note of safety as a major concern; the lack of it in pedestrian sidewalks was glaring since pedestrians were seldom recognized as part of the roadway planning process:

["Basically, our road network here does not provide a safe area for pedestrians for people to walk along pedestrian, so, that's basically one big concern because he is not even identified, so, basically the question on safety is very much a big concern"] (FGD-PALA 10-1-22)

Theme 3: Enjoy its Comfort

Physical comfort is a fundamental aspect of sidewalk design. Sidewalks should be designed with attention to factors such as smooth surfaces, adequate width, and the absence of tripping hazards. Uneven surfaces, cracks, or obstacles can cause discomfort and pose safety risks to pedestrians, particularly for individuals with mobility challenges or using mobility aids. The American Planning Association (APA) highlights the need for sidewalks to be "safe, comfortable, and convenient" for pedestrians (APA, 2017). By ensuring physical comfort, sidewalks can provide a pleasant and enjoyable walking experience for individuals of all ages and abilities.

Environmental factors significantly influence sidewalk comfortability. Providing shade through tree canopies, installing benches or seating areas, and incorporating street furniture contribute to the overall comfort of sidewalks. These features offer opportunities for rest, social interaction, and enjoyment of the surroundings

A convergence of the quantitative and qualitative findings (Table1) shows that there are similarities and differences between the preferences of the design professionals and the pedestrian users. To sum up the quantitative and qualitative findings on the preferred walkability attributes of walkability according to the viewpoints of various groups, data show that all groups are similar in considering safety, comfort, and aesthetics as walkability attributes. On the contrary, only the transdisciplinary design professionals considered anthropometric measures and activities that must be included as walkability attributes aside from those previously mentioned

Table 1. Summary Table of Convergence of Quantitative and Qualitative Findings on the Similarities and Differences in the Preferred Walkability Attributes

Indicator	Quantitative Result	Qualitative Result	Code
Safety	M = 30.81 (Rank 1)	▪ we talk about safety; we are talking about overall or holistic safety wherein in your mind, you feel safe ▪ may protective barriers kasi sometimes hindi talaga maiwasan lalo na dito sa atin sa Gensan andaming motorsiklo, ▪ hindi din full yung streetlights natin pag night. Kung day time, okay lang, but for night time parang hindi pa sya okay ▪ sa akin very important sa akin ang safety, safety from accidents kasi you can see naman doon sa mga ating mga social media captures ▪ the more people that there are in public, there's full sense of safety ▪ proper signage and crossing points ▪ you have children, let's say a stroller with you with the baby, or you are walking your dog if you have like a planting buffer, let's say, between you and the street	P24 P15 P1 P25 P4
Comfort	M = 24.09 (Rank 2)	▪ something na recreational. ▪ same time narerelax din yung utak mo ▪ linear park comfortable enough but not too big naman na where people will really congregate such an ideal lang siya for passing through	P1 P6

		▪ more trees and actually shed structures kasi when it rains you cannot go under the tree you gonna get wet	P8
Aesthetics	M = 15.46 (Rank 4) Creatively artistic	▪ Culturally relevant like sculpture ▪ Mga 3D visuals, mga steps ▪ use of virtual graphs, concept-map, images, and others ▪ design sa ting mga walkways and ang ating interconnectivity ▪ merong outdoor gym yung monkey bar, yung see-saw, yung mga pang twist ▪ designed to develop and nurture potential student-athlete	P3 P4 P19 P16
Anthropometrics	M = 12.82 (Rank 5)	▪ why it is important that you have like filling elements like sculptures, human sculptures you must put sculptures and tree ▪ So, for me in terms of dimensioning siguro kasi wala naman tayong enough na space talaga so, maybe two (2) meters is enough ▪ Ergonomics parin. Anthropometric na din kasi,	P6 P3
Activity	M = 16.83 (Rank 3)	▪ activity what would entice you to go to one place to another for a certain activity should be something that is entirely unique ▪ it should connect a person to a specific concentric center ▪ Place where you can rest like a small coffee shop or something where you can … there's a small bathroom	P11 P10 P8

Creating the Model Walkability Index

The rotated component matrix (Table 2) was extracted through Principal Component Analysis. extracted four (4) factors, each of which has underlying indicators.

By identifying the commonalities of the attributes in each of the four factors, four key factor themes can be created in relation to designing public spaces; it is essential to consider various factors that contribute to a harmonious and functional public space environment.

These four identified key factors are labeled as (1) Physical and Environmental Safety, (2) Aesthetics, (3) Convenience, and (4) Ease and comfort.

Exploratory Factor analysis was used in this research to determine the model walkability index, a mathematical combination of several indicators to form a single number. The model walkability index was then used to describe the entire set of indicators and allow for regional or possibly national differences between places and across time assessed.

Exploratory Factor Analysis is a statistical procedure that identifies the common variance amongst a set of observed variables or indicators and creates a factor (Sarstedt 2014), in this case, the walkability index, comprised of that common variance. The factor scores were calculated with a linear equation incorporating a weighted contribution of each variable included in the analysis. The contribution in weight of each variable was relative to the amount of variance in common with the other variables.

Table 2. Rotated Component Matrix of Pedestrian Survey Results

Items	Indicators	Factors			
		1	2	3	4
1	High vehicular Traffic Volume			.356	.565
2	Presence of Business Establishments along sidewalk				.741
3	Presence of Food Establishments				.741
4	Presence of Parks and Playgrounds		.603		.360
5	Proximity to large commercial complex		.422		.628
6	Colorful and attractive sidewalks		.746		
7	Presence of landscaping		.724		
8	Nice Building Façade		.620		
9	Presence of public/street art		.746		
10	Protection from Heat and Rain (trees, shelterred, arcade)	.534		.433	
11	Presence of street furniture		.395	.585	
12	Good Sidewalk surface quality	.439		.589	
13	Unobstructed and levelled sidewalk			.689	
14	Adequate Sidewalk Width	.311		.652	.331
15	Adequate Headroom	.304		.698	
16	High Pedestrian traffic	.334		.415	
17	Presence of PWD Ramps	.530		.452	
18	Good Outdoor Air Quality	.678			
19	Presence of Traffic Lights	.782			
20	Presence of Pedestrian Crosswalk	.739			
21	Clear and Legible Signages	.767			
22	Presence of Loading and Unloading Bays	.690			
23	Presence of Protective Rails and Bollards	.613			
24	Adequate Street Lighting	.638		.388	
25	Presence of CCTV Monitoring Cameras	.721			

Formulating the Model Walkability Index

The derivation formula for the walkability index of SoCCSKSarGen utilized the Pedestrian Environmental Quality Index (PEQI), developed by researchers at the University of Hong Kong. The PEQI incorporates factors such as sidewalk quality, pedestrian safety, aesthetics, ease, comfort, and convenience. The PEQI formula is derived through expert judgment and statistical analyses to determine the relative weights of each factor (Cerin et al., 2007).

The formula for the Model Walkability Index is:

$$MWI = \sum Waj*Naj$$

Where MWI is the Model Walkability Index, W is the weight per attribute a, in parameter j. Ni is the Normalized value of attribute an in-parameter j.

Using Group weighted Indicators, the following was formulated:

MWI= (〖F1〗 _ave·W_1) +(〖F2〗 _ave·W_2) +(〖F3〗 _ave·W_3) +(〖F4〗 _ave·W_4)

MWI= (F1ave·55.56%) +(F2ave·11.11%) +(F3ave·11.11%) +(F4ave·22.22%)

Where:

F1 = Physical and Environmental Safety
F2 = Aesthetics
F3 = Ease and Comfort
F4 = Convenience

Based on the pedestrian survey data and utilizing the MWI formula, the derived walkability index for the SoCCSKSarGen Region is 4.33, with a maximum possible score of 5. This unitless score reflects the extent to which pedestrian sidewalk conditions support walking, as per the opinions of the survey respondents. When compared to walkability ratings from a study conducted by Abaya et al. (2011) on major cities in the Philippines, General Santos City surpasses the walkability ratings of Manila (4.14), Davao City (3.42), and Cebu City (3.46) (refer to Table 3). This suggests that pedestrians in General Santos City exhibit a stronger preference for sidewalk conditions in terms of the walkability index, outperforming the existing ratings of the three major cities in the country.

Table 3. Walkability Rating of Major Cities in the Philippines

City	Zoning	Walkability Rating
Metro Manila	Commercial	4.14
Davao City	Commercial	3.42
Cebu City	Commercial	3.46

Source: Eastern Asia Society for Transportation Studies 2011

Conclusions

In conclusion, the significance of prioritizing safety in the design of pedestrian walking environments for fostering walkability is evident. However, it is crucial to acknowledge certain limitations in the current understanding and

implementation of safe design principles. Firstly, the effectiveness of specific safety measures may vary across diverse urban contexts, warranting further investigation into context-specific factors influencing their impact.
Moreover, the long-term sustainability of walkability initiatives requires ongoing evaluation and adaptation to changing urban dynamics. Future research should delve into the dynamic nature of urban environments, considering factors such as evolving traffic patterns, land-use changes, and emerging technologies that may influence pedestrian safety.
While promoting walkability is associated with numerous public health and social benefits, it is essential to recognize potential disparities in access to safe pedestrian spaces. Disadvantaged communities may face additional challenges, and future research should explore strategies to ensure equitable distribution of walkable spaces and their benefits.
Additionally, the current model walkability index, while valuable, may need refinement and adaptation to account for evolving urban design philosophies and community preferences. Future studies should focus on refining and expanding the index to encompass a broader range of factors that contribute to the overall pedestrian experience.
And lastly, the review mentions initiatives such as the SOCCSKSARGEN Regional Development Plan and the Local Public Transport Route Plan, there is a need for research evaluating the effectiveness of these policies in promoting walkability. Future studies should assess the implementation of such plans, identifying successes, challenges, and areas for improvement. This would contribute to evidence-based policy recommendations for other regions facing similar issues.
In summary, while the promotion of walkability through safe design is a commendable endeavor with multifaceted advantages, acknowledging and addressing the aforementioned limitations will be essential for the continued success of such initiatives. Future research endeavors should aim to refine existing strategies, explore innovative solutions, and ensure that the benefits of walkability are accessible to all members of diverse urban communities.

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