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Enhancing subjective well-being through strategic urban planning: Development and application of community happiness index

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ABSTRACT

Sustainable development is practiced globally as a comprehensive strategy for promoting urban sustainability and well-being. Achieving sustainable development goals depends on the ability to monitor human well-being to track policy outcomes and the connection between ecosystem and human well-being. We developed a framework of community happiness index (CH-index) that fully integrates broad sustainability domains – human well-being and eco-environmental well-being sub-index along four sustainability dimensions (social, economic, environmental, and urban governance) to capture individual subjective perceptions of their experience of communities and development impact. The model was developed by aggregating its constituents using linear aggregation techniques based on subjective weightings using Delphi technique. A cross-sectional survey was conducted to validate the framework applicability using case study approach. The result shows that the case study Putrajaya displayed a good performance of eco-environmental well-being (M = 7.313) and Human Well-being (M = 6.534), moderate sustainability, and a medium-high level of community happiness (6.866) on 1–10 scale. The finding reveals that the level of community happiness depends on the existing level of sustainable urban development. The CH-index provides the planners with a new subjective well-being tool to help in-depth analysis for more targeted interventions and a baseline data to improve community happiness.

1. Introduction

Urban development is increasingly becoming a concern among nations to achieve sustainability. With urbanization which placed the vast population of the people in the cities and urban areas, enhancing, creating healthy and viable communities has become a central focus of public policies which target city communities. Governments in both developed and developing countries are task with the increasing concern of most communities and policy about the well-being of their citizens and the need to involve the concepts of sustainability (Michael, Noor, & Figueroa, 2014).

For decades, the sole measure of progress has been the Gross Domestic Product (GDP). However, there has been a growing criticism for the dependence on standard of living as the only measure because it does not adequately portray well-being (Stiglitz, Sen, & Fitoussi, 2009). There is growing competition between cities for investment, however, the ability to compete depends on much more than creating a fiscal environment to attract inward investment (The New Climate Economy 2015). Creating places where people want and choose to live is at the top of agenda of today's globally mobile world (Habitat, 2013). People are attracted by the quality of life a city offers.

Rapid urbanisation presents acute challenges for national and local governments such as constrained capacity and finance for infrastructure and civic amenities delivery and urban services that promote well-being of the citizens (The New Climate Economy, 2015). Urbanization process has increased pressure on human well-being and ecosystem (Krekel, Kolbe, & Wüstemann, 2016), thus the growing number of research seeking to understand the factors that influence and constitute well-being and its potential synergy with sustainability (Michael et al., 2014). The goal of sustainability is to minimize environmental impacts and maximize human well-being (Dietz and Jorgenson, 2014; Prescott-Allen, 2001). Human well-being improvement and Sustainability is the ultimate goal of human development (Yang, McKinnon, & Turner, 2015). According to Chambers et al. (2000, p. 3), "we need to balance the basic conflict between the two competing goals of ensuring a quality of life and living within the limits of nature to make sustainability happen." Achievement of sustainable development goals depends on the ability to monitor human well-being to track policy outcomes and the connection between ecosystem and human well-being (Turner et al., 2012; Yang et al., 2015). Thus, the possible way to materialize a more

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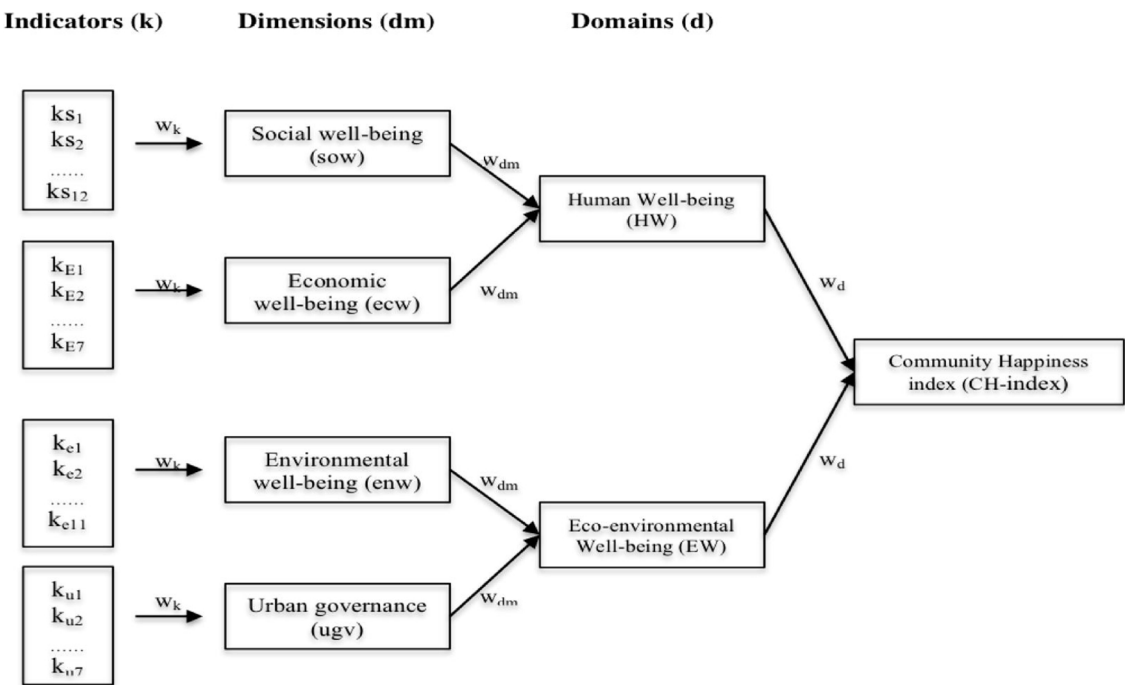

Fig. 1. Hierarchical Structural Model of CH-index.
Note: Ks = Social well-being indicators; K_E = Economic well-being indicators; Ke = Environmental well-being indicators; Ku = Urban governance indicators.

sustainable global development is to align the basic requirements of sustainable development with human needs for happiness and life satisfaction (Zidanšek, 2007). Sustainable urban planning must take into account environmental, social, economic, political, and governance factors that can influence and determine the relationship between the natural system and human system (Tang & Lee, 2016).

A definite need has been identified to develop a comprehensive, integrated framework of sustainability criteria that focuses on the performance of cities and urban areas and more specifically the sustainability assessment of communities in the context of subjective well-being. There are increasingly many measures of subjective well-being indices developed to measure and rate quality of life in different cities or countries. However, these indicator systems do not employ holistic sustainability frame (Hák, Moldan, & Dahl 2012). For example, the Happy Planet Index (2012), Gallup-Healthways Wellbeing Index (2011), UN Development Index (UNDP, 2013), Better Life Index (OECD, 2013a) and the Happy Planet Index (Abdallah, Michaelson, Shah, Stoll, & Marks, 2012). Others address one particular aspect of sustainability (e.g., Ecological Footprint) (Wackernagel, Kitzes, Moran, Goldfinger, & Thomas, 2006). Communities are not only physical but also social, economic, political, psychological and cultural settings (Mutisya & Yarime, 2014; McCrea, Walton, & Leonard, 2015). Understanding the trends in subjective life evaluation is particularly salient in emerging countries to bring about the sustainability of growth policies and the economic and political institutions (Djankov, Nikolova, & Zilinsky, 2016). Furthermore, there are no indicators frameworks that aggregate measure of subjective well-being of community to simplify and quantify urban sustainability in a composite indicator. Literature evidence has shown that lack of a synthetic index summarizing the sustainability indicators is the reason behind Local Agenda 21st failure (Marsal-Llacuna, Colomer-Llinàs, & Meléndez-Frigola, 2014).

Community happiness or well-being encompasses a broad range of economic, social, environmental, cultural, and governance goals and priorities identified as of greatest importance by a particular community, population group or society (Cox, Frere, West, Wiseman, & Victoria, 2010). Community happiness is a state of being with others and natural environment that arises where human needs are met, individuals and groups can act meaningfully to pursue their goals, and be satisfied with their way of life'(Armitage, Béné, Charles, Johnson, & Allison, 2012; Brown & Westaway 2011). Happiness therefore, is not only an individual characteristic but also a community characteristic (Quercia, Seaghdha, & Crowcroft, 2012) that depends highly on local amenities. Community amenities and environmental conditions contribute to the domains of happiness of residents (Leyden, Goldberg, & Michelbach, 2011). However, the mainstream sustainable community development frameworks neglect to make happiness a goal (Cloutier & Pfeiffer, 2015). A community indicators system reflects collective values, providing a more powerful evaluative tool for monitoring progress toward balanced or sustainable development because they provide information for considering the impacts of development, not only in economic terms but also in social and environmental dimensions (Sirgy, Phillips, & Rahtz, 2009). Community indicators can have potential to be used systematically to gauge impacts and evaluate successes when integrated into the stages of comprehensive community or regional planning (Kee, Kim, & Phillips, 2015).

This paper developed a community happiness index (CH-index) that integrates broad sustainability domains – human and eco-environmental well-being domain – with four sustainability dimensions (social, economic, environmental, and urban governance) to measure individual subjective experience and perceived satisfaction of community development impact, and applied the model in a sampled case study. The index model in this study is an important improvement and alternative to empirical literature on subjective well-being measure.

1.1. Quantifying community happiness index: content specification

We defined community happiness as satisfaction with social, economic, environmental, and urban governance factors identified by individuals and their communities as essential for happiness and fulfilment of their potential from urban development. Thus, community happiness is operationalized to integrate two broad sustainability domains: human well-being (hw) and eco-environmental well-being (ew) which depend upon a range of social, economic, environmental (La Placa, McNaught, & Knight, 2013) and urban governance forces that provide the measures and the contexts for the generation and maintenance of well-being or happiness at all level of the society. The

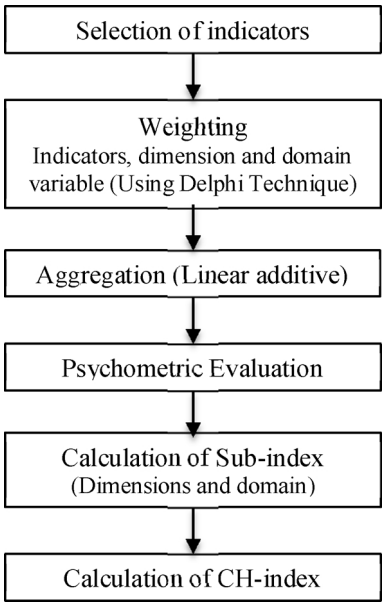

Fig. 2. Hierarchical Stages of CH-index Model Construction.

dimensions are underpinned with indicators and their corresponding relative weight value linearly aggregated into a composite index model. Fig. 1 shows the hierarchy theoretical model of Community Happiness index (CH-index).

Constructing the CH-index framework model required that each indicator, dimension, and domain variables be aggregated for easy identification of their trends. To begin with, all the 37 items metrics value (k) are combined to generate each indicator score ($\overline{x}_k$) from the survey response of the resident's perception of their community in urban area using Eq. (1).

$$\overline{x}_k = \frac{\sum_{i=1}^{n_c} x_{m_k}}{n_s} \tag{1}$$

The indicator scores represent the parameter of sustainable development interventions obtained from the survey information associated with the dimension elements (e) such as social (x_{sow}), economic (x_{ecw}), environmental (x_{enw}), and urban governance (x_{ugv}). Based on this information, the dimensions (*dm)* score for an area (x_{dm}) can be computed each as a function of normalized individual indicator score (x_k) and the relative importance weight (w_k) as follows:

$$x_{dm} = \sum_{i=1}^{dm} (\overline{x}_k . w_k) \tag{2}$$

Where x_{dm} represents dimension score for an area, k = indicator, $\overline{x}_k$ = indicator score according to each indicator metric values, w_k = relative importance weight of indicators.

The domains (*d)* score in an area (x_d) can be computed from equation (2) as a function of dimensions' score (x_{dm}) and the corresponding weight (w_{dm}) value as expressed in the equation (3):

$$x_d = \sum_{i=1}^{dm} x_{dm} \cdot w_{dm} \tag{3}$$

Where x_d = domain element score (hw and ew), x_{dm} = dimension score for a given area (x_{sow}, x_{ecw}, x_{enw}, and x_{ugv}), w_{dm} = dimension weights value of the dimension element (e), and dm = number of dimension elements. Based on Eq. (3), the two domain components can be express as follows:

$$hw = \sum (w_{ecw} \times x_{ecw} + w_{sow} \times x_{sow}) \tag{4}$$

$$ew = \sum (w_{enw} \times x_{enw} + w_{ugv} \times x_{ugv}) \tag{5}$$

Community Happiness index (CH-index) is, therefore, computed by aggregating domain variables (equation 3) with the corresponding domain relative importance weight (coefficient) using the Eq. (6) below:

$$CH - index = \sum_{i=1}^{d} (x_d . w_d) \tag{6}$$

where x_d represents domain score according to paradigm x (where x = Hw or Ew), w_d = weight of the dimension elements, d = domain variables (hw and ew).

Substituting the two domain variables (hw and ew) as expressed in eqs. (4) and (5) into Eq. (6), the overall CH-index can be rewritten in an expanded equation as an aggregate of the weighted sum of the two synthetic domain indices, dimensions and indicator as presented in Eq. (7).

$$\begin{aligned} CH - index = {} & w_{dm_{hw}}(w_{ecw} \times \sum (w_{k1}x_{k1}+...+w_{k7}x_{k7}) \\ & + w_{sow} \times \sum (w_{k1}x_{k1} + ...+w_{k12}x_{k12})) \\ & + w_{\mathrm{dm_{ew}}}(w_{ecw} \times \sum (w_{k1}x_{k1} + ..._{...} + w_{k12}x_{k12}) + w_{ugv} \\ & \times \sum (w_{k1}x_{k1}+...+w_{k7}x_{k7})) \end{aligned} \tag{7}$$

where: x_{k1} = normalized indicator score across dimension elements; w_{k1} = indicator weights across dimension elements; w_{ecn}, w_{sow},w_{env}, w_{ugv} = weights across each dimension; w_{hw}, w_{ew} = weights of the domain variable.

2. Methodology

2.1. Construction of composite CH-index

The triangulation method which combines both the qualitative and quantitative research methods has been employed in this study to enhance validity. The reason for this revolves round the complex nature of the enquiry, which cannot be fully explored by adopting one research methodology. Construction of a composite index includes several steps as presented in Fig. 2. This includes indicators selection, weighting, and aggregation into a single composite (Mazziotta & Pareto, 2013; Nardo et al., 2008). Each step is discussed below.

2.1.1. Selection of indicators

Extensive literature review of theoretical and empirical studies related to different community well-being elements was carried-out with the aim of determining elements that are integral to community well-being that could inform urban policy. In this context, the proper indicators are selected and sorted according to the four sustainability dimensions. The development includes multidisciplinary group of 31 experts in a Delphi survey to select items. A consensus was reached on 37-items across the four sustainable dimensions: Social wellbeing (12), Economic wellbeing (7), Environmental Wellbeing (11), and Urban Governance (7) (See Appendix A) with a high level of group agreement (Kendall's W = 0.5, $p < 0.001$). The outcome (selected items) forms the pilot questionnaire to examine residents' satisfaction across four dimensions on 10-point response scale (where 1 = very dissatisfied, and 10 = very satisfied).

2.1.2. Indicator and parameters weights (Dimensions and domains aggregation)

Composite indicators require weighting of indicators to establish a ranking among different indicators to reflect the relative importance given to the variable included in the index (Blanc, Friot, Margni, & Jolliet, 2008). A normative technique which depends on the judgement or expert opinion for better policy priorities (Golušin, Ivanović, Andrejević, & Vučenov, 2014; Tomao et al., 2015) was used. A Delphi

technique was used to derive the weights of the indicators, dimensions and domains variables in the model.

Delphi technique is a widely used technique common to survey research that formally elicits expert opinions through a series of questionnaires rounds and feedbacks process to collect data to reach panel consensus on a complex research problem in which there is no precise information available (Bolger & Wright, 2011; Linstone & Turoff, 2011). The technique has been used for developing a rank evaluation of criteria and indicators (Yigitcanlar, Kamruzzaman, & Teriman, 2015). This technique was employed to weigh the relative importance of items based on prioritization of their impact on the overall community happiness for urban planning policies through participatory expert consensus to ensure that they are applied to policies and practices for decision-makers (Lowe et al., 2015). Subject matter experts were asked to rank the relative importance of indicators contributing to community happiness on 5-points Likert scale ('1 = very low', and '5 = very high' importance), and also given 100-point scale to allocate to each category variable (dimensions and domains elements) to determine the weight in the composite index based on experience in practice and knowledge (Nardo et al., 2008). The weight is computed by dividing the individual mean ratings by sum scores of each indicator, dimension and domain elements (Yeung, Chan, Chan, & Li, 2007). The summary of all weights for indicators and parameters in each category to be used in the framework as obtained from the Delphi survey findings is shown for each indicator and dimension and domain parameters in Tables 1 and 2.

Table 1 presented the result of the expert ratings of the indicators weightings across group. The result shows that, in the environmental well-being dimension, 'air pollution' is rated highest importance in determining environmental well-being, this is followed by 'water pollution', 'water quality and accessibility' and 'sanitation and hygiene'. The 'natural disaster' indicator is rated the lowest importance in determining environmental wellbeing. In the urban governance dimension, an indicator of citizen chatter (right to access basic services) was found to be the most important, while indicator of public participation was the least rated. In the social well-being dimension, urban crime indicator is rated highest importance among others, while 'tolerance of diversity' indicator was rated the lowest. In the economic well-being dimension, cost of living was rated the most important, while energy cost indicator was the least rated. The result of Kendall coefficient of concordance (W) computed to assess the level of agreement among participants ratings of the indicators weight (Azevedo, Govindan, Carvalho, & Cruz-Machado, 2013) shows a high value ($W = 0.5$, $p < 0.001$), indicating a high degree of agreement among participants' judgments about the indicators relative importance. Kendall's W value ranges from 0 to 1 where $W > 0.7$ indicates a strong level of consensus, $W = 0.5$ (moderate consensus), and $W < 0.3$ (weak consensus) (Schmidt, 1997). However, Cohen (1975) suggests that a correlation coefficient (W) of 0.5 and above is considered as high correlation.

Table 2 presents the results of the dimension and domain category aggregation. In the dimension category, the result shows that the experts' panel rated environmental well-being dimension the most important ($M = 26.77$, weight = 0.62), followed by social well-being dimension ($M = 25.81$, weight = 0.55), economic well-being dimension ($M = 31.29$, weight = 0.45), while the urban governance dimension was rated the least ($M = 16.13$, weight = 0.38). The experts rated social well-being aspect of higher importance over the expected economic well-being factor and as well rated environmental dimension of higher importance than the urban governance in determining community happiness through human well-being and eco-environmental well-being domains respectively in urban area. The expert's level of agreement in the ratings of these factors provides a significantly moderate Kendall's Coefficient of Concordance ($W = 0.4$, $p > 0.001$). Similarly, in the domains sub-index, the expert result reveals that the human well-being ($M = 57.4$, weight = 0.574) was rated higher of importance over the eco-environment well-being ($M = 42.6$, weight = 0.426) in assessing level of community happiness in urban area. The group assessment of the domain factors based on expert priority rating provides a strong and significant level of agreement ($W = 0.5$, $p > 0.001$).

Table 1
Indicator relative importance (Weightings) for Delphi expert

Variable	Statistics		
	Mean rating	Rank	Weighting
Envinonmental Well-being Dimension			
Enw1 Physical/built environment	4.10	10.5	0.08
Enw2 Air pollution	4.84	2.5	0.10
Enw3 Water pollution	4.71	2.5	0.10
Enw4 Noise pollution	4.35	7	0.09
Enw5 Housing/Home environment	4.32	7	0.09
Enw6 Transport	4.35	7	0.09
Enw7 Water quality & accessibility	4.71	2.5	0.10
Enw8 Sanitation and Hygiene	4.71	2.5	0.10
Enw9 Waste generation and management	4.65	7	0.09
Enw10 Green/Natural environment	4.55	7	0.09
Enw11 Natural disaster	4.00	10.5	0.08
Number (n)	*31*		
Kendall's Coefficient of Concordance (W)	*0.5*		
Level of Significance	*0.000*		
Urban Governance Dimension			
Ugv1 Public participation/forum	4.23	4	0.14
Ugv2 Performance delivery	3.61	6	0.12
Ugv3 Facility for citizen complaints	4.35	4	0.14
Ugv4 Trust	4.39	4	0.14
Ugv5 Fairness in enforcing law	4.68	1.5	0.15
Ugv6 Citizens' Charter (right of access to basic services)	4.71	1.5	0.15
Ugv7 Appropriate range and quality of council services	4.61	1.5	0.15
Number (n)	*31*		
Kendall's Coefficient of Concordance (W)	*0.4*		
Level of Significance	*0.000*		
Social Well-being Dimension			
Sow1 Urban crime and safety	4.84	25	0.09
Sow2 Health care service adequacy	4.68	2.5	0.09
Sow3 Recreation/sport,	4.16	8	0.08
Sow4 Transport/mobility adequacy	4.32	8	0.08
Sow5 Food security	4.58	2.5	0.09
Sow6 Poverty	4.23	8	0.08
Sow7 Education service adequacy	4.58	2.5	0.09
Sow8 Neighbourhood connectedness	4.10	8	0.08
Sow9 Social connectedness	4.10	8	0.08
Sow10 Work connectedness	3.84	12	0.08
Sow11 Tolerance of diversity	3.97	8	0.08
Sow12 Community value	4.16	8	0.08
Number (n)	*31*		
Kendall's Coefficient of Concordance (W)	*0.5*		
Level of Significance	*0.000*		
Economic Well-being Dimension			
EcW1 Family income	4.45	5	0.14
EcW2 Cost of living	4.68	2	0.15
EcW3 Home ownership	4.32	5	0.14
EcW4 Housing price/affordability	4.58	2	0.15
EcW5 Access to job/employment	4.48	2	0.15
EcW6 Energy efficiency	4.19	5	0.14
EcW7 Energy cost	4.00	7	0.13
Number (n)	*31*		
Kendall's Coefficient of Concordance (W)	*0.5*		
Level of Significance	*0.000*		
Overall			
Number (n)	*31*		
Kendall's Coefficient of Concordance (W)	*0.5*		
Level of Significance(p)	*< 0.001*		

Note: for 'mean rating' 1 = very low importance and 5 = very high importance.

2.1.3. Composite index aggregation

Aggregation involves the actual development of the composite index. Aggregation is the final stage (Golušin Ivanović, Larisa & Domazet, 2012) and a potential area of methodological controversy in

Table 2
Expert Mean important ratings of Dimension and Domain Variables.

Variable	Mean raiting	Rank	Weighting	Std. Deviation
Dimensions				
Ecw Economic well-being	31.29	3	0.45	8.3631
Sow Social well-being	25.81	2	0.55	6.0686
Enw Environmental well-being	26.77	1	0.62	8.8080
Ugv Urban governance	16.13	4	0.38	5.7315
Total	100.0			
Number (n)	*31*			
Kendall's Coefficient of Concordance (W)	*0.4*			
Level of Significance	*0.000*			
Domains (Sub-index)				
Ew Eco.environmental well-being	42.6	2	0.426	6.6922
Hw Human well-being	57.4	1	0.574	6.6922
Total	100.0			
Number (n)	*31*			
Kendall's Coefficient of Concordance (W)	*0.5*			
Level of Significance	*0.000*			

Note: BAP based on 100 point.

composite index construction (Azevedo et al., 2013). Aggregation is necessary to combine multidimensional indicator scores to form a single meaningful composite score (Dizdaroglu, 2013), and to improve the overall predictive capacity (OECD, 2013a,b). There are different techniques of composite index aggregation. The Linear methods of aggregation include the additive and multiplicative (Fetscherin, 2010), and the nonlinear methods of aggregations such as multicriteria analysis (Garriga and Foguet 2010). Linear aggregation method involves combination of normalized indicators and the associated weights to compute the mean (Tate, 2012) and assume total compensation among indicators, while the multiplicative aggregation permits partial compensation (Gómez-Limón & Sanchez-Fernandez, 2010). Compensability is closely related to the concept of unbalance (disequilibrium) among the indicators that are used to build the composite index (Mazziotta & Pareto, 2013). Compensability can be a disadvantage of additive aggregation if a low value in one indicator or dimension can be compensated by a surplus in another (Tate, 2013). Both additive and geometric approaches result in a quantitative index score, while multicriteria analysis methods, such as multicriteria analysis, Pareto ranking and DEA, use nonlinear aggregation methods that generate index ranks instead of scores (Tate, 2012).

Linear method of aggregation is appropriate in developing indices when the variables are independent (Foa & Tanner, 2007), lack synergy or conflict effects among the indicators, and have the same unit of measurement, while geometric aggregations are appropriate when non-comparable and strictly positive sub-indicators are expressed in different ratio-scales (Nardo et al., 2008). Linear aggregations reward base-indicators proportionally to the weights, while geometric aggregations reward more with higher scores. In spite of the criticism of linear aggregation, it is a simple method and can easily be understood and replicated thus increases the trust in the method by the general public (OECD, 2015). Also, in policy terms if compensability is admitted, city with low scores on one indicator for instance, in a benchmarking application based on a linear aggregation may have interest in specialising along its most effective dimensions. Thus, this study adopted linear aggregation for constructing the community happiness index for its suitability as widely used in practice due to its simplicity, transparency and ease of understanding by non-experts (Zhou, Ang, & Zhou, 2010) as well as possibility to perform relative comparison across the cities, among the indicators and well-being dimensions (OECD, 2015).

2.1.4. Psychometric property evaluation of CH-index model

The theoretical CH-index model conceptualised and operationalised as integration of linearly combined indicator score and weights, dimension and domain parameters were tested to verify the psychometric property using Partial Least Square–Structural Equation Model (PLS-SEM), a regression-based ordinary least square path modelling analysis (Astrachan, Patel, & Wanzenried, 2014). The psychometric test allowed item, if the operationalized variables included in the composite index model gives a good representation of the underlying theoretical construct (Pallant & Tennant, 2007; Remor, 2013), or relationship between observations and defined concepts (Maggino & Zumbo, 2012; Nardo et al., 2008).

The psychometric evaluation result revealed that CH-index measurement model has sufficient convergent validity. The path coefficient for SOW construct ($\beta = 0.943$, $R^2 = 0.89$), ECW construct ($\beta = 0.803$, $R^2 = 0.65$), ENW construct ($\beta = 0.886$, $R^2 = 0.78$), and UGV construct ($\beta = 0.947$, $R^2 = 0.90$) were above the threshold of 0.80 (Hair, Hult, Ringle, & Sarstedt, 2016) and $R^2 \geq 0.64$ (Chin, 1998). Also, there is no critical collinearity problem for all the indicators across the measurement constructs (tolerance values ranged from 0.322 (Ugv2) to 0.735 (Sow4), and VIF values ranged between 1.36 and 3.247). The TOL values are > 0.20, and the VIF values are < 5 thresholds value for all the indicators across measure constructs (Hair, Ringle, & Sarstedt, 2011). The indicators contribute to the measure constructs significantly ($p < 0.01$) (*See* Appendix B1). Similarly, the structural model analysis showed that social well-being and economic well-being, and environmental well-being and urban governance dimensions significantly ($p < 0.01$) predict human well-being ($\beta = 0.537$, $t = 83.06$) and eco-environmental well-being ($\beta = 0.501$, $t = 72.53$) respectively in the composite model (*See* Appendix B2). In overall, the formative exogenous constructs (social, economic, environmental, and urban governance dimensions) and the endogenous constructs (human well-being and eco-environmental well-being domains) linearly combined to form the composite structure of the community happiness index ($R^2 = 1.0$, $p > 0.01$). This finding is consistent with the studies conducted by (Becker, Klein, & Wetzels, 2012; Bollen, 2011; De Clercq et al., 2014; Hair et al., 2016; Ringle, Sarstedt, & Straub, 2012; Wetzels, Odekerken-Schröder, & van Oppen, 2009). The resulting composite variable is considered a proxy for a latent concept (Rigdon, 2012). The overall results support the conceptualization of community happiness index hierarchical component models. The findings from the psychometric evaluation demonstrated that the CH-index model significantly predicts community happiness level. In view of this, it is possible to suggest the use of the CH-index framework model to measure community happiness level for sustainable urban development.

3. Application of CH-index framework to exemplar case study: putrajaya city

Putrajaya is Malaysia's new Federal Government Administrative Capital and the nation's largest urban development project on a Greenfield site, and a modern city of sustainable development. It is located about 25 km south of Kuala Lumpur. Putrajaya covers 49.31 km^2 of land comprises approximately 40% of natural elements and lush greenery integrated taking full advantage of the natural surrounding (Yap, Usman, Tahir, & Abidin, 2011). The city undulating terrain offers the community vistas of the natural environment with planned landscape in botanical gardens, wetlands, and parks, integrated into the built environment with the intention of green concept within processes of urbanization. Putrajaya city has a population of 80,000 residents, and currently the home of 25 Ministries, 51 Government Offices that provide 254,000 job opportunities (Azmi & Romle, 2015). Putrajaya has become a vital development catalyst due to its role as a model city, the nation's nerve centre, an ideal place to live and work, conduct business and engage in sports and recreational activities. The city design conceptualization and development objective as a high-

quality environmental standard sets a roadmap in embracing sustainability and committed to a holistic strategic framework that integrates economic, physical and social development make it an ideal case study.

3.1. Measure instrument

The CH-index is a 37-item self-report instrument that assesses four dimensions: social well-being, economic well-being, environmental well-being, and urban governance on 10-point scale (1 = 'very dissatisfied' to 10 = 'very satisfied'). *Social well-being* aspect of the community examines the degree of residence satisfaction with the urban condition of crime and safety, health care, recreation, transport and mobility, public transport, food security and poverty, education, urban demography, art and culture, tolerance of diversity, personal connectedness, and neighbourhood connectedness. Social well-being addresses the extent of their satisfaction with the quality of services and local facilities. *Economic Well-being* examines the degree to which urban economic aspect in the city satisfies the residence perceptions of well-being. *Environmental Well-being* examine the residents perceived satisfaction of the urban eco-system which is characterized by the interplay of the built and natural environment, which generate much of the problems that urban areas face. Lastly, Governance, which remains a critically important dimension of urban sustainability, especially when discussing urbanization in developing countries, given rapid population increase and imbalances in socio-economic development. *Urban governance* aspect assesses the level of satisfaction of resident's involvement in decision making process and effect of governance in meeting the community needs.

The questionnaire was translated and back translated into English and Bahasa Malaysia by a professional language interpreter at the Centre for the Advancement of Language Competence (CALC), University Putra Malaysia (UPM). The instrument was tested in a pilot survey to ensure suitability, and to resolve ambiguity issues after the translation process. The minor differences in both languages were reconciled prior to the main survey (see questionnaire in Appendix C).

3.2. Participants

The target population for this quantitative section was the urban residents with age ranged between 18 years and above who live and work in Putrajaya city, the case study. A total of 400 participants completed the self-reported survey. Overall, the final sample (see Table 3) was mostly males (50.7%) and females (49.3%) with age range of 26–35 years (61.5%) and 36–45 years (26%). The residents are mostly Malay (87.8%), predominantly practice Islamic religion (88.5%), married (74%), with a university degree (50.7%), mostly employed (91.5%) in government work, earning a gross monthly income range of RM1, 501–RM3, 000 (26.5%), and acknowledged staying in the city for between 5 and 10 years (40%) and 10–15 year (35.3%).

Table 3
Socio-demographic profile of the urban residents.

Variable	n	%		n	%
Gender			Level of Education		
Male	203	50.7	Primary	4	1
Female	197	49.3	Secondary	66	16.5
Respondents age			Technical	127	31.8
18–25years	29	7.2	University degree	203	50.7
26–35years	246	61.5	Respondents Occupation		
36–45years	104	26	Self-employed	9	2.3
46–55years	15	3.8	Government employed	366	91.5
above 55years	6	1.5	Private employed	24	6
Ethnicity			Retired	1	0.3
Malay	351	87.8	Gross monthly income		
Chinese	20	5	< RM1500	39	9.8
Indian	18	4.5	RM1501–RM3000	166	41.5
Others	11	2.8	RM3001–RM5000	106	26.5
Respondents religion			RM5001–RM7000	59	14.8
Islam	354	88.5	RM7001–RM9000	23	5.8
Christianity	20	5	> RM9000	7	1.8
Buddhism	10	2.5	Number of years lives in the city		
Hinduism	16	4	< 5years	141	35.3
Marital status			5–10years	160	40
Married	296	74	10–15years	70	17.5
Single	100	25	15–20years	14	3.5
Widow	2	0.5	> 20years	15	3.8

4. Results and discussions

4.1. Community happiness index calculation

The survey data of the resident's happiness based on their perceived satisfaction with sustainable development interventions in the community were analysed. The summary of indicator scores, weight for each attribute, and the overall community happiness index score from the survey in the case study area is presented in Table 4. The composite index score is benchmarked on six comparative levels: very low (1.0–2.5), low (2.5–4.0), medium-low (4.0–5.5), medium-high (5.5–7.0), high (7.0–8.5) and very high (8.5–10.0).

Participants reported favourable levels of satisfaction across the variables in the four sustainability dimensions used to assess community level of well-being. In environmental Well-being dimension, physical/built environment (8.45), green/natural environment (8.31) and housing environment (7.98) were highly rated, while water quality accessibility (6.9) was rated low satisfaction of the environmental aspect by the residents in the City. In the economic well-being dimension, housing price/affordability was rated low with the mean score of 4.13. Energy efficiency (7.68) and cost of living (7.24) rates are satisfactory among the residents in the city. For Social well-being dimension, transportation/mobility adequacy (5.64) is an issue to the residents. There is need for improvement in transport/mobility adequacy, poverty and food security that were rated low. Similarly, in the urban governance dimension, citizen chatter (right of access to basic services) was rated high, while others were averagely rated with trust (6.22) been the least. The governance institution is required to improve on indicator – 'trust, law enforcement and public participation – in the city. The improvement of these parameters will improve performance and promote sustainability.

The survey result reveals that Putrajaya obtained high scores in the composition of its individual sustainability dimensions and the domain sub-index. In the dimension category, the result shows that environmental well-being has a high score of 7.693 for social well-being (6.955), urban governance (6.693), and economic well-being with the least score (6.190). These scores suggest that the individual sustainability factors in the case urban area are potentially sustainable, with room for improvement in economic well-being aspect. Similarly, in the domain sub-indices, the result reveals a higher score for Eco-environmental Well-being sub-index (M = 7.313) than the Human Well-being sub-index (M = 6.534), suggesting that the city displayed a good performance of eco-environmental well-being. In general, the city exhibits a moderate level of urban sustainability (van Dijk & Mingshun, 2005; Pearce & Giles, 1995). This finding is consistent with Choon et al. (2011), whose study on city sustainability in Malaysia displays range of 0.45–0.72 indices score and concluded that the majority of cities in Malaysia have moderate performance towards the development of a sustainable city. The findings from the domain sub-indices also is coherent with other studies on city sustainability globally (de Araújo, Pimenta, Reis, & Campos, 2013; Prescott-Allen 2001).

Overall, based on aggregation of the sustainability domain sub-indices and the weighted values, the composite community happiness index (CH-index) for the city yields 6.866 on a scale of 1–10. This suggests that the level of community happiness in the case study urban area is presently at a medium-high level. This finding affirms the assertion about the vision of Putrajaya city as an environmentally

Table 4
Computation of Community Happiness level using the assessment framework.

Variables	w_k	x_k	w_k. x_k	w_{dm}	x_{dm}	w_{dm}. x_{dm}	Hw	w_d	Ew	CH-index
Environmentall well-being dimension				0.620	**7.693**	4.770	**6.534**	0.574	**7.313**	**6.866**
Physical/built environment	0.098	8.45	0.830							
Air pollution	0.096	7.83	0.748							
Water pollution	0.096	7.39	0.706							
Noise pollution	0.096	7.73	0.739							
Housing/Home environemt	0.094	7.98	0.752							
Transport	0.092	7.41	0.684							
Water quality and accessibility	0.088	6.90	0.610							
Sanitation and hygiene	0.088	7.56	0.668							
Waste management	0.088	7.45	0.653							
Green/Natural environemt	0.083	8.31	0.691							
Natural disaster	0.081	7.56	0.614							
Economic well-being dimension				0.550	**6.190**	3.404				
Family income	0.145	6.95	1.007							
Cost of Living	0.152	7.24	1.102							
Home ownership	0.141	6.36	0.896							
Housing price/affordability	0.149	4.13	0.616							
Access to job/employment	0.146	5.80	0.846							
Energy efficiency	0.137	7.68	1.049							
Energy cost	0.130	5.17	0.674							
Social well-being dimension				0.450	**6.955**	3.130				
Urban crime and safety	0.094	6.68	0.627							
Health care service adequacy	0.091	7.66	0.695							
Recreation and sport	0.081	8.01	0.646							
Transport/mobility adequacy	0.084	5.64	0.473							
Food security	0.089	6.51	0.578							
Poverty	0.082	6.30	0.516							
Education service adequacy	0.089	7.89	0.701							
Neighbourhood connectedness	0.079	6.76	0.537							
Social connectedness	0.079	6.84	0.544							
Work connectedness	0.074	7.13	0.531							
Tolerance of diversity	0.077	6.68	0.514							
Community value	0.081	7.34	0.592							
Urban governance dimension				0.380	**6.693**	2.543				
Public participation/Forum	0.134	6.60	0.882							
Performance delivery	0.138	6.69	0.923							
Facility for citizen complaints	0.139	6.68	0.928							
Trust	0.148	6.22	0.922							
Fairness in enforcing law	0.149	6.48	0.967							
Citizens'Charter(right of access to basic services)	0.146	7.36	1.075							
Appropriate range and quality of council services	0.146	6.82	0.997							

responsible city committed towards the quality of life, and quality of its built and natural environment (Azmi & Romle, 2015; Putrajaya Corporation, 2011). Also, from the findings, it is deduced that the level of community happiness depends on the existing level of sustainable urban development. This is consistent with Gyles-McDonnough (2014), who affirm that “happiness is an effective motivator for sustainable development, and sustainable development, on the other hand, can be regarded as the means to achieve happiness and better well-being” (p.3). Thus, the higher CH-index scores indicate better improvement of sustainability interventions performance in the urban area. The result enables easy interpretation of sustainable development and the community happiness for the urban area and highlights the progress towards sustainability achieved.

5. Conclusions

This paper presents a designing of a framework of community happiness index (CH-index) that portrays performance of urban area in a subjective well-being context along four aspects of sustainability – social, economic, environmental, and urban governance. Since most sustainability information is typically treated separately, this paper illustrates that it is possible to assess the subjective well-being of the community based on integrated approach that simultaneously provides planners a new tool to develop sustainable urban environment. Also, monitoring progress towards a sustainable development required attention to local well-being from a range of indicators monitoring report covering these dimensions in the cities (Morrison, 2007).

The purpose of the CH-index is to give both a simplified and quantified expression for a more complex composition of several subjective indicators. It can be used to inform decision on trends in development of an urban area, to evaluate progress and impact to appropriately direct interventions and target programmes effectively to promoting well-being. In the provision of public services, CH-index might be used to identify and measure the effects of transformations on the living conditions and well-being of citizens, so as to better support the design and implementation of urban policies. The index focus on urban-scale (community), thus help urban planners and managers in understanding the differences in living conditions between different communities and spaces, in order to support a strategic bottom-up urban policies design and implementation. For instance, the model can assist the states and communities to assess the impact of decisions on the sustained well-being of their constituencies. Governmental agencies can use the index to assess both the direct impacts of decisions (e.g., effects of economic decisions on jobs), and also the indirect impacts of these decisions (e.g., economic decisions on social and environmental issues). The significant feature of the CH-index is the possibility of comparing and ranking urban performances in subjective well-being context in terms of sustainable development. Thus, the CH-index could offer consistent and flexible benchmarking for urban developers and planners. Also, the model indicator systems only included subjective parameters which relate to how people assess their well-being and their experiences of life based on the provisions of amenities and urban

services fundamental to the concept of quality of life in the city.

This study contributes essentially by developing the CH-index framework, which is relatively new assessment tool, particularly in Malaysia. The framework mechanism provides in-depth analysis for targeted interventions and improved outcome for different segments of the community need for sustainable development. The assessment framework serves as a veritable tool for development planning within the local planning authority; state, national and regional planning system, thus, making the framework a noble approach. The findings have fully demonstrated that the CH-index model could be applied in a Malaysian context. The significant implication of this study is the outcome and knowledge it provides concerning the residents' perceived satisfaction with the government effort in service delivery in the development of urban area in Putrajaya. However, future research is needed to investigate the index applicability in different urban context.

The possible disadvantage of the model may be the way in which the weights of indicators are determined. One could argue that the weights used priorities according to the opinion of the expert may suffer from a high degree of subjectivity. However, on the contrary, the importance of an indicator, may not be necessary to reformulate the proposed model, but only re-evaluate the weights. However, results of the proposed model showed it was feasible and could be easily applied to assess and compare subjective well-being regarding sustainable development. While no measure of such a complex phenomenon is perfect, the CH-index can be useful in benchmarking the urban sustainability performance in subjective well-being context.

Moreover, well-being indicators are essential tools for facilitating broad community goals and priorities, and evaluating progress towards achieving these goals. The societal indicators require the explicit involvement of citizens to determine what matters to them, and then the experts can try to devise the measure that citizens need (Salvaris & Wiseman, 2004). However, the choice of what matters most to citizens and communities will always reflect differing contested philosophical and political values and assumptions. So also, the choices of the indicators used to prioritise and measure specific outcomes in public institutions. The use of a set of subjective indicators can enable understanding of these disparities in response to different environmental, sociocultural and policy drivers. Further research could consider integration of the cultural dimension of community well-being.

Disclosure statement

The author has no conflict of interests known.

Appendix A1

See Table A1

Table A1
The Selected Subjective Indicator by Expert Survey

Indicators		Median	CV	Consensus (% item score)	Indicators		Median	CV	Consensus (% item score)
Environmental Well-being Dimension					Social Well-being Dimension				
EW1	Physical/built environment	**4.0**	**0.13**	≥75(**90.4**)	SW1	Urban crime and safety,	**5.0**	**0.08**	≥75(**100.0**)
EW2	Air pollution	**5.0**	**0.08**	≥75(**100.0**)	SW2	Health care service adequacy	**5.0**	**0.10**	≥75(**100.0**)
EW3	Water pollution	**5.0**	**0.11**	≥75(**96.8**)	SW3	Recreation/sport,	**4.0**	**0.14**	≥75(**90.3**)
EW4	Noise pollution	**4.0**	**0.18**	≥75(**93.6**)	SW4	Transport/mobility adequacy,	**4.0**	**0.11**	≥75(**100.0**)
EW5	Housing/Home environment	**4.0**	**0.14**	≥75(**93.5**)	SW5	Public transport cost,	4.0	0.21	≥75(58.06)
EW6	Transport	**4.0**	**0.15**	≥75(**90.4**)	SW6	Food security	**5.0**	**0.11**	≥75(**100.0**)
EW7	Urban design	3.0	0.20	≥75(35.5)	SW7	Poverty,	**4.0**	**0.13**	≥75(**93.5**)
EW8	Population growth	3.0	0.16	≥75(38.7)	SW8	Education service adequacy,	**5.0**	**0.11**	≥75(**100.0**)
EW9	Biodiversity	3.0	0.16	≥75(35.5)	SW9	Art and Culture	3.0	0.13	≥75(19.4)
EW10	Climate change	3.0	0.20	≥75(48.4)	SW10	Urban Demography	3.0	0.16	≥75(35.5)
EW11	Water quality & accessibility	**5.0**	**0.11**	≥75(**96.8**)	SW11	Neighbourhood connectedness	**4.0**	**0.13**	≥75(**90.4**)
EW12	Sanitation and Hygiene	**5.0**	**0.10**	≥75(**100.0**)	SW12	Social connectedness	**4.0**	**0.17**	≥75(**97.1**)
EW13	Waste generation and management	**5.0**	**0.10**	≥75(**100.0**)	SW13	Work connectedness	**4.0**	**0.14**	≥75(**77.5**)
EW14	Landuse/City growth/Sprawl	4.0	0.20	≥75(67.8)	SW14	Tolerance of diversity	**4.0**	**0.14**	≥75(**83.9**)
EW15	Green/Natural environment	**5.0**	**0.11**	≥75(**100.0**)	SW15	Time use	3.0	0.18	≥75(35.5)
EW16	Natural disaste	**4.0**	**0.17**	≥75(**83.9**)	SW16	Community value	**4.0**	**0.17**	≥75(**90.3**)
Economic Well-being Dimension					**Urban Governance Dimension**				
EcW1	Family income,	**5.0**	**0.14**	≥75(**93.5**)	UG1	Public participation/forum	**4.0**	**0.15**	≥75(**90.4**)
EcW2	Cost of living,	**5.0**	**0.10**	≥75(**100.0**)	UG2	Existing Participatory process	4.0	0.17	≥75(54.9)
EcW3	Residents income gap,	4.0	0.17	≥75(64.5)	UG3	Performance delivery,	**4.0**	**0.20**	≥75(**100.0**)
EcW4	Home ownership,	**4.0**	**0.15**	≥75(**90.3**)	UG4	Facility for citizen complaints	**4.0**	**0.13**	≥75(**96.7**)
EcW5	Housing price/affordability,	**5.0**	**0.12**	≥75(**96.8**)	UG5	Trust	**5.0**	**0.10**	≥75(**100.0**)
EcW6	Access to job/employment,	**5.0**	**0.13**	≥75(**96.8**)	UG6	Fairness in enforcing law	**5.0**	**0.11**	≥75(**96.8**)
EcW7	Energy efficiency	**4.0**	**0.13**	≥75(**93.5**)	UG7	Citizens' Charter (right of access to basic services)	**5.0**	**0.12**	≥75(**96.8**)
EcW8	Energy cost	**4.0**	**0.16**	≥75(**80.7**)	UG8	Appropriate range and quality of council services	**5.0**	**0.12**	≥75(**96.8**)
EcW9	Business activity	3.0	0.90	≥75(48.4)					
EcW10	Green jobs	3.0	0.26	≥75(80.6)					
Overall									
Number (n)						31			
Kendall's Coefficient of Concordance (W)						0.5			
Level of Significance						< 0.001			

Note: **Bold** = gained joint consensus based on set crieria. CV: Coefficient of Variation
Criteria: Percentage score of item: ≥ 75% response on item ≥ 4 on the scale; Highest Median (4 and 5); and 0 < CVs ≤ 0.5
Scale: 5 Point Likert scale (1 = Very low importance; 2 = Low importance; 3 = Moderate importance; 4 = High importance; 5 = Very high importance).

Appendix B1

See Table B1–B3

Table B1
Outer Weights and Loadings Significance Testing Results for Social, Economic, Environmental well-being and Urban Governance Construct.

Indicators	Outer weights					Outer Loadings				
	Weight	SE	t value	Sig. Level	p value	Load	SE	t value	Sig. Level	p value
Sow1	**0.169**	0.059	**2.855**	***	**.005**	0.683	0.046	14.917	***	< .001
Sow10	**0.177**	0.058	**3.047**	***	**.002**	0.702	0.039	17.985	***	< .001
Sow11	−0.027	0.058	0.476	NS	.635	**0.473**	0.064	**7.401**	***	< **.001**
Sow12	**0.120**	0.064	**1.870**	*	.062	**0.648**	0.052	**12.474**	***	< **.001**
Sow2	0.062	0.071	0.873	NS	.383	**0.778**	0.044	**17.536**	***	< **.001**
Sow3	**0.339**	0.071	**4.758**	***	**.000**	0.773	0.059	13.185	***	< .001
Sow4	0.026	0.051	0.515	NS	.607	**0.385**	0.067	**5.785**	***	< **.001**
Sow5	**0.100**	0.061	**1.629**	NS	.104	**0.737**	0.042	**17.594**	***	< **.001**
Sow6	**0.305**	0.084	**3.633**	***	**.000**	0.752	0.053	14.136	***	< .001
Sow7	0.116	0.065	1.775	*	.077	**0.702**	0.053	**13.243**	***	< **.001**
Sow8	0.117	0.068	1.727	*	.085	**0.569**	0.051	**11.274**	***	< **.001**
Sow9	**−0.134**	0.069	**1.951**	*	.052	**0.566**	0.052	**10.821**	***	< **.001**
Ecw1	**0.315**	0.082	**3.846**	***	**.000**	0.844	0.032	26.416	***	< .001
Ecw2	**0.238**	0.083	**2.872**	***	**.004**	0.827	0.036	22.821	***	< .001
Ecw3	0.099	0.059	1.676	*	.095	**0.567**	0.052	**10.829**	***	< **.001**
Ecw4	**−0.062**	0.050	**1.242**	NS	.215	**0.324**	0.060	**5.370**	***	< **.001**
Ecw5	**0.328**	0.064	**5.162**	***	**.000**	0.690	0.051	13.513	***	< .001
Ecw6	**0.362**	0.073	**4.969**	***	**.000**	0.752	0.053	14.219	***	< .001
Ecw7	**0.008**	0.048	**0.175**	NS	.861	**0.308**	0.066	**4.639**	***	< **.001**
Enw1	**0.252**	0.081	**3.126**	***	**.002**	0.775	0.047	16.534	***	< .001
Enw10	**0.265**	0.094	**2.818**	***	**.005**	0.853	0.041	21.069	***	< .001
Enw11	**0.237**	0.084	**2.825**	***	**.005**	0.771	0.049	15.826	***	< .001
Enw2	−0.027	0.105	0.254	NS	.799	**0.680**	0.056	**12.230**	***	< **.001**
Enw3	0.016	0.093	0.168	NS	.867	**0.641**	0.053	**12.078**	***	< **.001**
Enw4	0.213	0.102	2.090	**	.037	**0.715**	0.056	**12.848**	***	< **.001**
Enw5	**0.024**	0.106	**0.226**	NS	.822	**0.729**	0.051	**14.431**	***	< **.001**
Enw6	0.140	0.070	2.007	**	.045	**0.669**	0.050	**13.308**	***	< **.001**
Enw7	**0.067**	0.077	**0.881**	NS	.379	**0.615**	0.057	**10.864**	***	< **.001**
Enw8	0.071	0.102	0.692	NS	.490	**0.749**	0.058	**12.901**	***	< **.001**
Enw9	**0.070**	0.078	**0.895**	NS	.372	**0.679**	0.066	**10.241**	***	< **.001**
Ugv1	−0.016	0.078	0.204	NS	.838	**0.504**	0.077	**6.571**	***	< **.001**
Ugv2	**−0.269**	0.124	**2.173**	**	.030	**0.610**	0.074	**8.240**	***	< **.001**
Ugv3	**0.466**	0.106	**4.398**	***	**.000**	0.804	0.043	18.663	***	< .001
Ugv4	**0.170**	0.091	**1.875**	*	.062	**0.688**	0.055	**12.431**	***	< **.001**
Ugv5	**0.057**	0.112	**0.506**	NS	.613	**0.687**	0.055	**12.587**	***	< **.001**
Ugv6	**0.638**	0.069	**9.199**	***	**.000**	0.910	0.036	25.651	***	< .001
Ugv7	**0.090**	0.111	**0.807**	NS	.420	**0.680**	0.058	**11.679**	***	< **.001**

Note: Significant associations appear in **boldface**, NS = not significant, Total sample N = 400. *$p < 1.0$. **$p < 0.05$. ***$p < 0.01$.

Table B2
Significance Testing and Total effect estimates of the Second and Third-Order Structural Model.

Paths	β	Standard Error	Total effect	*t*-value	*p*-value	TOL	VIF
SOW − > HW	0.742	0.043		17.22^{***}	$p < 0.001$	0.230	4.36
ECW − > HW	0.310	0.049		6.32^{***}	*p < 0.001*	0.342	2.92
ENW − > EW	0.660	0.042		15.84^{***}	*p < 0.001*	0.354	2.82
UGV − > EW	0.438	0.046		9.473^{***}	*p < 0.001*	0.425	2.35
SOW − > CH-index			0.29	22.10^{***}	*p < 0.001*		
ECW − > CH-index			0.27	17.54^{***}	*p < 0.001*		
ENW − > CH-index			0.32	11.04^{***}	*p < 0.001*		
UGV − > CH-index			0.24	8.42^{***}	*p < 0.001*		
EW − > CH-index	0.501	0.0116		43.297^{***}	*p < 0.001*	0.283	3.536
HW − > CH-index	0.537	0.0108		49.580^{***}	*p < 0.001*	0.283	3.536
EW − > CH-index			0.5109	53.0209^{***}	*p < 0.001*		
HW − > CH-index			0.5298	58.4849^{***}	*p < 0.001*		

Notes: TOL = tolerance, VIF = variance inflation factor; Potential Collinearity problem = TOL < 0.2 and VIF > 5.*p < 1.0. **p < 0.05. ***p < 0.01;(based on $t_{(499)}$, two-tailed test)

Table B3
Descriptive statistics for the Community Happiness index scale, n = 400

Variable	Mean*	Std.
Environment well-being Dimension		
Enw1 Satisfaction with landscape and scenic value the city provided for human activity.	8.45	1.32
Enw2 Satisfaction with Air quality in terms of pollution in the city	7.83	1.63
Enw3 Satisfaction with level of water pollution in the city	7.39	2.00
Enw4 How would you rate your experience of noise effect (e.g. automobiles traffic and others source) in the city?	7.73	1.85
Enw5 Satisfaction with the housing condition and home environment where you live	7.98	1.52
Enw6 Satisfaction with the efficiency of transport services and adequacy in the city	7.41	1.64
Enw7 Satisfaction with quality source of drinking water and frequency of supply.	6.90	1.85
Enw8 Satisfaction with the sanitary facilities adequacy and services.	756	1.28
Enw9 Satisfaction with solid waste collection and management facilities and services	7.45	1.48
Enw10 Satisfaction with availability and state of open green space and natural environment within the city	8.31	1.51
Enw11 Satisfaction with the existing emergency management facilities for natural hazards (e.g. flood, fire etc.)	7.56	138
Economics well-being Dimension		
Ecw1 Satisfaction with your family financial/income situation?	6.95	1.95
Ecw2 Satisfaction with your living situation	7.24	1.74
Ecw3 How satisfied are you with the home ownership and tenancy services in your neighbourhood?	6.36	1.95
Ecw4 Satisfaction with housing price/affordability in the city	4.13	2.23
Ecw5 Satisfaction with unemployment issue and job security in the city	5.80	2.04
Ecw6 Satisfaction with stability or duration of electricity power supplying your area	7.68	1.86
Ecw7 Satisfaction with energy price or energy related taxes charged.	5.17	2.28
Social well-being Dimension		
Sow1 Satisfaction with your sense of personal and property security.	6.68	1.76
Sow2 Satisfaction with the health facilities adequacy and services.	7.66	1.76
Sow3 Satisfaction with availability of parks and green areas for leisure services.	8.01	1.63
Sow4 Satisfaction with transport and parking facilities adequacy and services	5.64	2.15
Sow5 Your satisfaction about the food supply, cost and distribution in the city	6.51	1.87
Sow6 Your view on the poverty or distribution of income and consumption level of the society in the city	6.30	183
Sow7 Satisfaction with education facilities availability and services in the city?	7.89	1.51
Sow8 Your satisfaction with general interaction/relationship with your neighbours	6.76	1.83
Sow9 Satisfaction with your sense of sharing and involvement with other in the society	6.84	1.69
Sow10 Satisfaction with your employer and employees at work.	7.13	1.63
Sow11 Satisfaction with variety of different people working and living in the city.	6.68	1.63
Sow12 Satisfaction with the feeling of been part of your community	7.34	1.49
Urban governance Dimension		
Ugv1 Satisfaction with your involvement as a resident in local forum activities in the city.	6.60	1.65
Ugv2 Satisfaction with level service delivery from local administrators/authority.	6.69	1.50
Ugv3 Satisfaction with available citizen complaint facilities and quality of services	6.68	163
Ugv4 Satisfaction with your assessment about whether other people in the city can generally be trusted.	6.22	1.66
Ugv5 Satisfaction on fairness of law enforcement and access to equity.	6.48	1.77
Ugv6 Your satisfaction with access to basic facilities and services.	7.36	1.46
Ugv7 Satisfaction on the quality of services from council/local authority in the city.	6.82	1.58

Note: *The higher the mean score, the higher the level of satisfaction. Scale: 1 = Very dissatisfied and 10 = Very satisfied

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