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**UNDERSTANDING AND EVALUATING URBAN QUALITY OF LIFE
FOR ENHANCING SUSTAINABLE URBAN DEVELOPMENT:
A DUAL-COMPLEX-ADAPTIVE SYSTEM
(U2-CAS)**

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**Understanding and Evaluating Urban Quality of Life for Enhancing
Sustainable Urban Development: A Dual-Complex-Adaptive System
(U2-CAS)**

Suen Man Schuman LAM

A thesis submitted in partial fulfillment of the requirements for the
Degree of Doctor of Philosophy
July 2020

This thesis is dedicated to my beloved parents.

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no materials previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgment has been made in the text.

Signature

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Name of Student

ABSTRACT

“If one wants to live a lucid dream, he or she must pay attention to the past, realize now, and envisage the future.”

Our cities are built by the people for the people. All physical environments in the cities should be planned and built to serve human needs by following the global concept of sustainability while compromising the needs of our next generations. Understanding and evaluating the urban quality of life (Uqol) and sustainability are crucial for guiding future sustainable urban policymaking and it has been a great challenge for many governments. However, most current Sustainability-Uqol evaluation systems lack mutual consensus between the top-down policy-driven supply and the bottom-up subjective well-being demand for narrowing the communication gap of both ends. Thus, a mismatching of supply and demand impedes the performance of sustainable urban development (SUD). The main purpose of this research is to develop the multi-dimensional Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS) to integrate the supply and demand sides for understanding and evaluating the expected Sustainability-Uqol criteria to inform future urban development policies in developing countries.

Often, disagreement in the definition of quality of life (QOL) makes it very difficult to create a unified evaluation system due to the internal perception gaps and its external market bias in studying SUD and QOL. The central pillar of this study is to link the ancient Yin-yang universal law to the global sustainability concept for defining the QOL into Uqol, a composite of eleven Sustainability-Uqol indicators consisting of health, environment, mobility, human capital, governance, social, culture, economy, technology-ICT, smart living, and lifestyle. The novel U2-CAS attempts to help people to relearn and rekindle the relevance of ancient wisdom to the contemporary ways of life entailing a sustainable future. The overall research framework

(ORF) was guided by the three logical stages: theoretical base, analytical illustration, and application. First, a series of classical theories founded the future Sustainable Human Eco-City (SHE-City). Second, the SHE-City was developed into a two-pronged Wheel of Sustainability-Uqol (WoSu) by integrating the policy-driven supply and the expected subjective well-being demand. Third, the WoSu application conceptualized the urban-ruralism (UxR) development framework to renew the outdated economy-led urbanization path for solving the global unsustainable issues such as climate change and unbalanced urbanization.

The proposed U2-CAS was established and confirmed with the mixed-methods research validating through the literature review of QOL and sustainability, interviews, Amsterdam's SUD policy review, field observation, desktop comparative analysis of relevant Sustainability-Uqol indices, Uqol survey, and pilot testing. The qualitative and quantitative research design was sustained by two sequential levels of data triangulation for constructing and validating the WoSu evaluation tool and the hypothetical SHE-City model, subsequently for confirming the novel U2-CAS with mean score test, confirmatory factor analysis (CFA), and structural equation modelling (SEM) goodness-of-fit test. Furthermore, the testing results certified transit-oriented-development (TOD), information-communication-technology (ICT), sustainable urban development (SUD), and Maslow's Hierarchy of Needs (MHN) as the four key principles making up the future Sustainable Human Eco-City (SHE-City).

The new approach for defining the abstract QOL into Uqol contributes in three hierarchical aspects: the U2-CAS evaluation system, the WoSu evaluation tool, and the conceptual UxR development framework. The transdisciplinary research offers new insight, direction, and format in defining conceptual words such as "Urban Quality of Life", depicting its trajectory from *ubiquity* to *accountability* and *applicability* while allowing scholars and urban decision-makers to understand, evaluate, and discover significant knowledge in the

process of development. The innovative U2-CAS can define and explain the complex multi-scalar urban ecosystem with the illustrations of a series of microsystems to endorse the action-based solution. In urban planning, the WoSu is a practical urban thermometer to collect local information for drafting, guiding, monitoring, and improving SUD. It is an effective communication platform for enhancing mutual understanding, trust, and cooperation among the stakeholders, particularly for bridging the binary position between government and the public, which is vital for solving pressing urban issues with the participation of community support and safeguarding a harmonious society in the 21st century.

Through the verification of the U2-CAS, newfound findings show that different demographic variables affect the expected well-being evaluation, and exhibited geographically; there are distinct significant well-being disparities of economy, technology-ICT, smart living, and lifestyle between the developing and developed countries; the significance of economy and location is no more the real factor for people's relocation, but job opportunity is; socio-economic-technological advancement is strongly desired by the developing countries, and the contextual environment shaped by ICT will become the dominant driver to form or reform the urban-rural landscapes. In such a case, the TOD-ICT-based UxR development framework is suggested for cultivating the bare landscapes in developing countries. The research predicts that the developing countries can possibly leapfrog the developed countries in economic-social-environmental-technological advancement in the digital age. As for the significant impact of the Belt and Road Initiative (BRI) in developing countries, and the future urbanization trend, a BRI Index derived from the WoSu is worth further development for securing balanced urbanization and progressing the global sustainable development goals (SDGs) as a whole in parallel motion.

PUBLICATIONS ARISING FROM THE THESIS

Journal Papers

- Lam, S., Li, H., & Yu, Ann T.W., (2021). A Demand-Side Approach for Linking the Past to Future Urban–Rural Development. *Planning for Rapid Change in Cities, Urban Planning*, (ISSN: 2183-7635) 2021, Volume 6, Issue 2, DOI: <https://doi.org/10.17645/up.v6i2.3798>
- Lam, S., Li, H., & Yu, Ann T.W., (2021). Rethinking Urbanization: A Transit-Information-Communication –Technology-Oriented Development Path for the Developing Countries and Post-Industrial Towns. *Geosfera Indonesia*, [S.l.], v. 6, n. 1, p. 1-19, apr. 2021. ISSN 2614-8528. DOI: <https://doi.org/10.19184/geosi.v6i1.20810>
- Lam, S. & Li, X., (2016). Setting Up a Virtual CIB Community for Integrated Design & Delivery Solutions (IDDS). Winner of the CIB Sebestyén Future Leaders Award 2016, International Council for Research and Innovation in Building and Construction.

Conference Papers

- Lam, S., & Tecla, Z. (2018). An Urban Policy Evaluation Tool for Improving Urban Governance and Well-Being: A Case Study at The Community of Mirafiori SUD. Paper accepted by the EUCANET (a European Agencies Network for citizenship).
- Lam, S., & Chan, E. (2017). An Empirical Study on the Relationship Between Transit-Oriented-Development (TOD) and Quality of Life (QOL). Paper accepted for the 11th Built Environment Conference, organized by the Association of Schools of Construction in Southern Africa (ASOCSA) 2017
- Lam, S., & Chan, E. (2017). A Multi-Disciplinary Approach in Developing Sustainable Built Environment: A Case Study in Hong Kong Kowloon East Development Project (KEDP). Presented at the World Sustainable Built Environment Conference 2017 Hong Kong (WSBE17 Hong Kong). https://wsbe17hongkong.hk/bin/ckfinder/userfiles/files/PDF/Session%205_3_4.pdf
- Lam, S., & Chan, E. (2016). Is Transit-Oriented-Development (TOD) a Means to an End for Optimizing Quality of Life (QOL) in the Developing Regions? Paper accepted for the SBE16 Seoul International Conference on Sustainable Building Asia, December 2016
- Lam, S., & Chan, E. (2016). Implementing Global Concept of Smart Infrastructure for Solving Local Issues in Hong Kong: A Case Study in Kowloon East Development Project (KEDP), proceedings of the RISUD Annual International Symposium 2016 – Smart Cities (RAIS 2016)

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The core spirit of practicing Philosophy of Doctor (Ph.D.) is *'revealing and discovering the "Truth" philosophically, scientifically and empirically, while learning how to understand and assess the "Reality" comprehensively, inclusively, analytically and logically in the realm of a lucid experience interacting with the external environment.*

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CHAPTER 1: INTRODUCTION

We cannot improve urban quality of life (Uqol) without thinking and studying the human needs confined by the urban conditions. We cannot talk about sustainable urban development (SUD) without understanding and evaluating Sustainability-Uqol for effective urban policymaking. Thus, a crucial choice in utilizing the limited resources to serve human needs while balancing the three sustainability pillars becomes a challenge in many governments. In the past decades, economy-led industrialization and urbanization have been demonstrated as the culprit causing the global unsustainability crisis: climate change and many others. To solve the issues effectively, we need to have a functional mechanism to merge the Sustainability-Uqol evaluation and communication gaps between the governments (supply of Sustainability-Uqol criteria) and the residents (demand of Sustainability-Uqol criteria) for realizing the theme-goal of “SUD enhances Uqol”. Critically, underlining the future development model adopted by the developing countries can affect the fate of all living creatures on this planet. This chapter highlights the research background stating the motivation, global urban issues, the background of quality of life (QOL), research questions, key research gaps, needs, and core statement, aim, and objectives, as well as its significance to start the discussion.

1.1 MOTIVATION

Ideology, cultural, religious differences, and subjective “individual reality” often lead to disagreement and misunderstanding among people. It impedes urban policymaking and SUD¹ achievement. In society, mutual understanding and cooperation are the keys to sustainable personal growth and social prosperity which should be pre-conditioned in a sustainable living environment. Thus, this research explores a new format to define the rhetoric QOL into

¹ Sustainable Urban Development = SUD is an urban development that upholds the scheme of sustainability, a proxy of sustainability.

Sustainability-Uqol indicators for enhancing consent among the stakeholders, especially the policymakers and the public.

To the outsiders or planners, according to the Book of Changes (Pao, 2010), the world is made of “duality” with constant interaction inside one Yin-yang ecosystem through time-space, a binary system which resides in “All” things eyes can see, so as the QOL: the external supply side of policy-driven urban living environment by the government and the internal demand side of subjective well-being needs by the residents might contend, conflict and complement with each other. In a lucid dream, flying through the time-space of “cause” leads to “effect,” cause-effect becomes the means for the end (means-goal) in the Human Ecological System (HES). In the HES, who can differentiate the right from the wrong, sustainability or unsustainability, with what criteria? How, when, and where relates to the living environment? It would be right for the West, but wrong for the East, or right for now, but wrong for later. By upholding the Yin-yang universal law and the economic theory of demand and supply, equilibrium becomes the state of sustainability for guiding the thesis development.

To the insiders or actors, the constant interaction of the opposition is the norm to reach for the state of equilibrium, which is the points making up the lines and drawing relationships of the components to form the holistic HES and the global society. The whole pattern is easily overviewed from the standpoint of an outsider or a third party, but the insiders. In a social system, the Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS) as the third party can be realized and defined to neutralize the critical binary gap² (governments vs. residents) for the one-sided urban conditions evaluation system. To minimize the binary gap for reaching the state of “collective reality,” mutual understanding, trust, and cooperation can be realized at its ideal. Only when the absence of conflict is materialized, then the complementary

² The principle of contrast between two mutually exclusive terms, an important concept of structuralism, which sees such distinctions as fundamental to all language and thought. <http://www.oxfordreference.com>.

relationship can prevail. In such a notion, the idea of understanding and evaluating QOL for enhancing SUD was born, contributing to the teamwork of building a harmonious living environment for serving people's well-being needs.

1.2 GLOBAL ISSUES

Nowadays, pressing global urban issues caused by overdevelopment and rapid urbanization appeals for practical solutions. The conventional economy-led urban development policy, mainly driven by economic progression, has been proved to be the due cause (Baumol, 1988). *To solve the urban problems we are all facing, world leaders must employ progressive SUD policies for managing the future urbanization trend of the developing countries, where most of their bare landscapes are yet for development.* How can the future development policies balance their people's expected ways of life while preserving enough resources to accommodate the needs of the next generations, affects the sustainable growth in our society, and living environment? This research not only provides the system to inform the policymakers but also the urban solutions for practice in developing countries.

In 1972, the "Limits to Growth" published by the Club of Rome (1972) warned that economic growth would run into its limit due to the depletion of resources on earth and ultimately leading to the end of civilization. In the same year, the United Nations Environment Program (UNEP) and many other national environmental protection agencies were established (Sustainability Timeline, 2021) to study and seek solutions. Since then, SUD has become the focal point of study in United Nations Programs and academic institutions, including disciplines of architecture, urban planning, and urban studies, as well as construction and environmental study as far as spurring into the other disciplines like agriculture, food and beverage management, business development and urban policy. Although unsustainability has been blamed for polluting the living environment, global warming, water shortages, famine,

etc., the *Club of Rome* firmly stated that these phenomena were caused by collective human action and subsequently should be resolved by humans working collectively: “humans are the root of problem and solution”. It stated that human attitudes, “*habitus*”, and habitation dictate the quality of our living environment (*physical-human-contextual environment*), which affects people's well-being directly. The city has characteristics like humans because a city is the collective footprint of humanity, the embodiment of evilness and goodness. Undeniably, human nature³ shapes the city's reality because most humans inhabit the urban area. In such a case, studying and evaluating urban sustainability and Uqol has become a hot research topic for scholars and urban policymakers in the past decades.

Industrialization and economy-led urbanization have been the prevalent force in reshaping our urban landscapes in both the developed and the developing regions of the world (Figure 1.1). In 2018, United Nations (UN) showed that over half of the world population lives in the cities. In the future, the urban population will reach 85.9% in the developed regions, which means 3 out of 4 people will habitat, work, or commute to work in the urban area. In the same token, the predicted 64.1% of the developing regions will follow the developed world's footsteps, with a faster pace in urbanization, disregarding impact from cross-nation immigration. Whether the conventional policy-driven urban development model can deal with the unprecedented shift of human settlement is doubtful in urban policymaking. How can humans regain or improve the balance of social-economic-environmental growth? Would the emerging Mega Cities such as Tokyo, Shanghai, New York City, Mumbai, and London be the suitable city paradigm for the developing countries to emulate?

³ The fundamental dispositions and traits of humans. <https://www.merriam-webster.com/dictionary/human%20nature>. The ways of behaving, thinking, and feeling that are shared by most people and are normal. <https://www.oxfordlearnersdictionaries.com/definition/english/human-nature>

In record, the trend of globalization fosters economic growth and urban development. It also undermines social and environmental sustainability because of overexploitation of social capital and natural resources. The misuse of capital leads to global unsustainability and degradation of people's livelihoods. Rapid urbanization (Figure 1.1) in the developing regions shows that sustainable development policymaking of the developing countries is crucial for the future global and local sustainable growth. They are the parties who can either avoid or intensify the collapse of the Human Ecological System (HES).

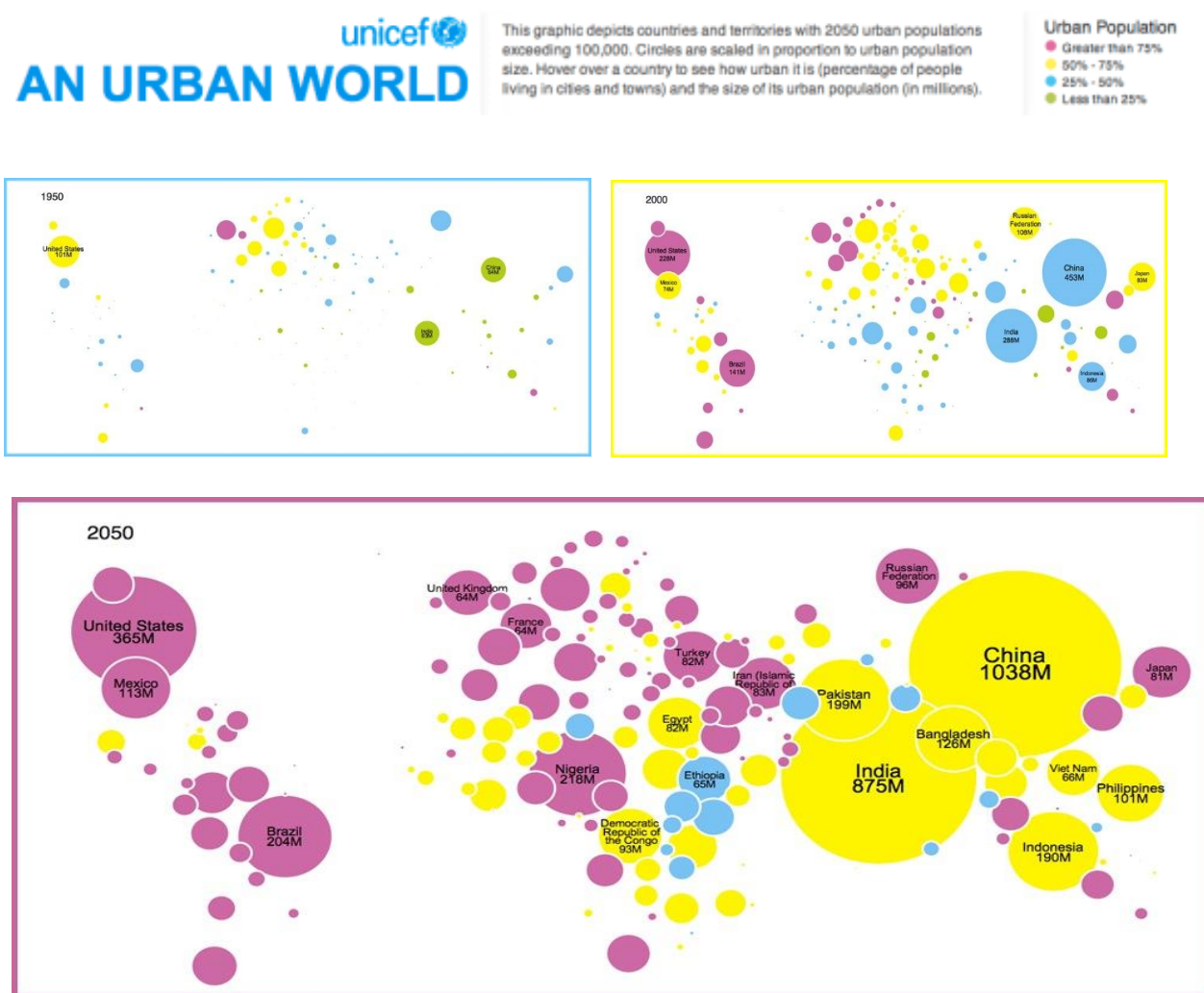


Figure 1.1 Trend of Global Urbanization
Source: <https://www.unicef.org/sowc2012/urbanmap/?lan=en>

In the socio-economic aspect, the city was/is/will become a place inhabited by people with different cultural backgrounds, ways of living, and religious, more profoundly of migrants from the developing countries or refugees from the war-engaged countries. For a long time, the unparalleled human movement has been intensified by the process of globalization resulting in severe damage to the harmony of our society even though GDP has increased, for example, increasing city population by immigration, inflation, housing shortage, cultural conflicts, increase of crime rate, social inequality, and pollution, which the developing countries would like to prevent from walking the same development path as the developed countries.

Accordingly, urban policymakers need to rethink their urban policy to tackle the new challenges facing by these emerging cultural-diversified cities. In the developed regions such as France, Germany, the United Kingdom, and the Netherland whose citizens' Uqol has been ruined by an influx of immigrants from the developing regions (the war-zone Africa and the Middle East). According to the World Economic Forum post on social media dd21/12/2019, between 1990 and 2019, there is an increased number of international migrants by 78%. The new mix of social patterns imposes a new challenge for governance because unique demographic and geographical backgrounds divide people into groups in the urban areas. Frequently, cultural and religious differences can deplete any establishment, more specifically; the local people suffer deprivation of living conditions, which is often the unpleasant outcome of disagreement and conflict due to overcrowded public spaces and disturbing cultural norms.

In the environmental aspect, acute car emission, industrialization, and commercialization, infrastructure construction, overconsumption in the developed countries, and exploitation of natural resources in the developing countries have endangered the environment unprecedentedly since the industrial period, continuously heading to the stage of human self-destruction. The 2-degree Celsius threshold line set by the previous Paris Agreement (2016) in fighting climate change has not been materialized, to deepen the fault

further, rapid industrialization and urbanization in Asia and Africa where the developing countries are playing catch up in economic development. Besides, the well-promoted urban sustainability agenda by the world institutions such as United Nations (UN) and European Union (EU) still appears to be too idealistic for reaching and not inclusive enough to address the needs of the public (urbanists) in both the developed and developing countries. When the global sustainable agenda and urban policy drew no resonance from the grassroots, lacking public involvement and support will lead to a failure in the pursuit of SUD. As such, the elements of human needs and participation should be incorporated for succeeding the scheme of sustainability if a remarkable result is expected. Given the implication, the multi-dimensional U2-CAS equipped with a flexible Sustainability-Uqol evaluation tool will come in handy for tackling the global unsustainable issues.

1.3 URBAN ISSUES

In the past and now, the city is the heart of global power where economic, cultural, social, and political centers locate. City development dictates the ways of human living and well-being. The city has been the organ of human development since the inception of human civilization. Nowadays, if one wants to understand where people are, people are in cities mostly. According to the United Nations, 70% of the world's population will live in an urban area by 2050. Although cities generate 80% of global economic growth and wealth, there are economic problems (polarization of income, unemployment, and inflation), social problems (aging population, segregation, immigration, inequality, and poverty), and environmental problems (waste management, pollution, and natural disasters) in urban living. These urban problems draw swift attention to urban development. Urgently, the new challenges for cities' sustainability goals have been discussed and put on the table for work (CIMI, 2018).

Usually, economic growth in cities is essential for improving Uqol. However, how much is the weight of economic growth among social and environmental growth in developing a sustainable city? Does the interrelationship between economic growth and human development conflicting or complementary with each other? Imagine that, if a soldier is over-equipped with combat gear, how can he/she move effectively to fight his/her best battle. Balancing is the art of management. An unbalanced state of the three sustainability pillars was due to the exploitation of our limited resources (physical environment), caused by human behavior (human environment), and triggered by the human mind (contextual environment), which has been fashioned by the economy-led industrialization. *To achieve the sustainable development goals (SDGs), understanding, evaluating, and matching the government urban development goals and the residents' expected well-being requests is the key for designing the applicable development policy.* It is the feasible path for dealing with the future urbanization challenges in the ever-evolving complex society.

The primary aim of this research is to develop a multi-disciplinary U2-CAS for understanding, evaluating, and defining Uqol in the context of sustainability for enhancing SUD policymaking. It can accommodate different users' needs in different levels of operation, particularly for merging the binary gap between the governments and the residents. It is a step-by-step instruction for defining Uqol from its generic term to application. Given this attempt, the U2-CAS was conceptualized, proposed, justified, and confirmed by three logical stages: theoretical base, analytical illustration, and application with a series of outputs: the theoretical HES, the Wheel of Sustainability-Uqol (WoSu), and the conceptual UxR development framework.

1.4 BACKGROUND OF QOL STUDY

This section features the social indicator movement period to help us understand the background of the QOL study, realizing a missing link between the disciplines of QOL and SUD in the research market, and a system gap between the top-down policy-driven urban evaluation tool and the bottom-up subjective well-being survey (SWBS). This narrative leads to the need for developing a two-pronged WoSu, which is an output of U2-CAS.

Quality of Life (QOL) research started two decades ago, and now it becomes a scorching subject to study, not only by scholars but also by urban policymakers and even politicians. Mostly, the materialistic based standard of living of the people, the quantitative variations in the object of possessing, which is the denominator applied to reflect QOL. As suggested by Campbell, Diener, and Marans, QOL should be quantified, understood, and presented as an aggregate result, integrating the top-down policy-driven approach and bottom-up subjective well-being survey (SWBS). However, there was little to none of the combining approaches in practice, so far only limited in concept. Whereas, in this research, the U2-CAS will take up the challenge and attempt to integrate the two approaches and test the two-pronged concept.

Quality of Life (QOL) is a critical topic in urban development due to its function in monitoring public policies as an effective tool (Mohammad et al., 2013). In the social indicator movement period, Chicago School began to study QOL by mixing social science and geography (Mikkelsen & J, 2015), which later became a continuous subject taught at the University of Chicago. The study of QOL started in the USA in the 30s. Then the realization of objective indicators as the measurement of QOL was in its maturity in the 60s, which was expanded to include the disciplines of politics, economics, geography, planning, architecture, environmental studies, psychology, medicine, education, and others (Mikkelsen & J, 2015), but not much in the field of sustainable urban development (SUD). In this period, a top-down

policy-driven approach for studying and evaluating QOL, centered around economic development was adopted: objective indicators like GDP, employment data, mortality and morbidity rate, and crime rates have been used to evaluate QOL because living conditions and standard of living to the implementation of economic and social policies were the new approaches to study QOL (Land et al., 2012).

Between the 1970s and 1980s, QOL became a multi-dimensional concept, including other dimensions of human life (de la Vega, 2015). In the past 20 years, it has been a resurgence of the QOL study. This dynamic movement was driven by the research community (academic and private), city government, and world institutions (Marans & Stimson, 2011), especially by public policy, urban governance, planning and management, and sustainable development for enhancing Uqol (McCrea et al., 2006). Many of the studies were nation or city ranking reports mainly driven by economic growth purposes. In the 1990s-2010s, there was an advocacy of establishing a more comprehensive mechanism (top-down policy-driven and bottom-up subjective-well-being-survey – SWBS) for studying QOL by (Diener, 1995; Marans & Kweon, 2011). Until the 2010s onward, there were different types of QOL ranking reports to evaluate QOL *addressing mobility, sustainability, happiness, social progress, and technology*. In general, the study of QOL could be sectioned into five critical periods of development (Figure 1.2):

<u>1930s-60s</u> Social Indicators Movement (Bauer, 1966)	<u>1970s</u> Flourishing Period (Marans & Stimson, 2011)	<u>1980s</u> Death of Social Indicators Movement (Andrews, 1989)	<u>1990s-2010s</u> Resurgent Period (Marans & Stimson, 2011)	<u>2010s-</u> World QOL Indices Period
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Figure 1.2 An Overview of QOL Study in Timeline

1.5 RESEARCH QUESTIONS

Despite the decade's long call for interdisciplinary work for studying QOL, there is currently little research of scholars dealing with the attempt for linking the global sustainability concept to Uqol. This leaves the field of SUD a deep hole to be filled. Negatively, this hinders the efficiency and effectiveness of the economy-led urban development policies, and the gap needs to be addressed for facilitating better urban policymaking.

Solving city issues for enhancing Uqol is always the core mission of SUD. Studying and evaluating the current-future status of the urban conditions concerning Uqol becomes the norm and task in urban policymaking because of the quality of urban and well-being affect each other directly and indirectly. Likely, it has been a growing interest in modelling, evaluating, and measuring Uqol at nation and city levels. The leading players include the United Nations (UN) and European Union (EU), other world institutions, private consulting companies, and scholars worldwide. As more and more people live in urban areas, human-made urban issues have long been the common factors that undermine the healthy growth of living space and residents. What type of a future ideal city will be for securing human-social-economic-environmental sustainability in developing countries? What kind of urban development policies for regenerating the obsolete community in developed countries? All these concerns have been discussed by the global institutions and governments because understanding and evaluating current urban conditions are relevant to the future prosperity of the city (Low et al., 2017) and Uqol in the real term. Thus, this research will reinforce the discussion for expanding to application.

Often, misunderstanding and conflict are caused by ineffective communication among people due to the value gap, ambiguity, and vagueness in the definition of "word" and the platform for conveying messages. The meaning of a "word" can be defined in millions based on its variables such as verb, noun, adjective, plural and single, male or female, and, most

importantly, who is giving and delivering the meaning of the “word”. Therefore, *the study of QOL cannot be only rhetoric; it needs to be in touch with the reality, be specific as well for effective communication so that urban development policy can be designed and executed effectively with full coordination and cooperation between the main actors and participants.* Whereas, QOL is an abstract, conceptual, and ubiquitous term. How to redefine it into a specific term for easy understanding and communicating, thus, “SUD enhances Uqol” becomes the theme-goal of the study.

As per the scientific research principles, the research questions are the joints for building the thesis structure. The core argument is the dilemma and the reason for proposing the U2-CAS. The hypotheses are the challenges of the study for establishing, validating, and confirming the conceptualized U2-CAS. To reach the aim properly with an argument identified according to reasoning, the overall research framework was created according to the following research questions. The research questions are fundamental for the development, justification, and application of the U2-CAS. Below are the research questions designed for sprouting the three logical research stages:

1. What is the **theoretical base** (theories) to rationalize the urban platform (human-physical-contextual environment) and what kind of future urban platform (SHE-City) should be built for enhancing people’s Uqol?

2. What is the **analytical illustration** for forming and validating the U2-CAS?

2a: What is the background of the QOL study?

2b: What are the differences between the current QOL evaluation systems’ approach and the U2-CAS’ approach?

2c: What are the factual base and global concepts in SUD to the reasoning for the context of SHE-City?

2d: What is the relationship between MNH-TOD-SUD-ICT-QOL?

2e: How to establish, validate, and confirm the U2-CAS with a composite of Sustainability-Uqol indicators?

3. How to implement the U2-CAS in the **application** stage, along with the Wheel of Sustainability-Uqol (WoSu) to test, and verify the new evaluation system?

1.6 RESEARCH AIM AND OBJECTIVES

In philosophy, defining “right” or “wrong” or coming up with the answers to the fundamental theories or issues is only the theme for the means-goal, not the end. Whereas in a binary world evolved through the living and sustaining for progression, it is about the art of swinging for the state of equilibrium in balancing the “scheme of sustainability”, making smart choices beyond opportunity cost. Thus, cause-effect is factored in the act of balancing, constant motion, and movement. In such logic, *the mission of the research is to study the process of exploring, investigating, discussing, analyzing, reasoning, understanding, evaluating, and creating new knowledge for solutions, all for improving the quality of living in a sustainable term.*

For centuries, “duality” is the matter in which both Eastern and Western philosophies battle the idea out constantly: night vs day, black vs white, positive vs negative, chaos vs order, individual freedom vs collective freedom, subjective vs objective, top vs bottom and generalization vs specification. Is there any common ground where both ends can exist and grow harmoniously: Yang in Yin and Yin in Yang? Does “duality” equal absolute “ambivalence”?

Professor Angus Campbell (one of the founding fathers of QOL research) stated that QOL was a vague and undefined term in which many people encounter difficulty in defining it comprehensively (Lotfi et al., 2011). The goal of this research is to define QOL comprehensively with the specification to avoid unbiased communication. However, how can

comprehension and specification exist in the same equation because the two terms are locked from the two opposite ends? Premised by the Yin-yang universal law, time and space allow the interaction of both ends where *"flexibility"* is the key for their co-existence in the same unit. Inside the HES, all matters must have a theme-goal for identifying the context, only through the process of defining QOL from its contextual term to a composite of indicators; QOL can be defined and evaluated pragmatically.

Because of the alarming scarcity in our natural resources due to overpowering urbanization, decision-making for SUD requires a new approach that can integrate and synthesize all the identified components and dimensions of an urban evaluation system for drafting and executing the urban policies efficiently and effectively. The research explores the magnitude of quality reiterated by quantitative data to reflect the complexity of urbanization in different layers, from general to specific in order to neutralize the *"reality gaps caused by subjective perception"* in the society, to facilitate sustainable development policymaking. Therefore, *the research aims include developing the U2-CAS for defining QOL into Uqol from rhetoric to specification with evaluation capability, and to develop the WoSu evaluation tool to identify the realistic well-being requests for exploring a new urban-rural development path to inform future development policymaking in developing countries.* The aims are realized through the three sequential objectives:

1. Conceptualizing the future Sustainable Human Eco-City (SHE-City).
2. Constructing and validating the Wheel of Sustainability-Uqol (WoSu), and SHE-City.
3. Testing the WoSu to inform future urban-rural development in developing countries.

1.7 RESEARCH GAPS IN DIFFERENT DIMENSIONS

QOL definition can end in diverse meaning and interpretation depending on different disciplines and purposes. QOL study is multi-faceted and quite inter-disciplinary, and it is not easy to illustrate the real meaning comprehensively and yet precisely. There is no agreeable definition of QOL with this kind among different or even the same discipline in the research society (Campbell, 1976; Marans, 2014). Currently, there is no available, universally accepted QOL evaluation system for understanding and evaluating Uqol accordingly.

Internally, the perception gap owing to demographic differences hampers the understanding of QOL and its evaluation system; therefore, an incommensurable issue exists when we perform QOL evaluations of the developing and developed countries. In the evaluation system, the market gap and binary gap are needed to be heightened. *First, few studies integrating SUD and QOL study. Second, there is a binary gap between the government (top-down) and the individuals (bottom-up) because the two groups are viewed as opposite in the governance system (Wadley, 2010).* On the one hand, to the bottom-up subjective well-being stance, QOL is about a feeling of individual well-being (overall life satisfaction), which attributes are quite difficult to be defined and measured objectively because of their subjective nature. On the other hand, the policy-driven evaluation system generated by the government often lacks the consent of the residents. The one-sided approach does not uphold the supply-demand theory in the research market, that SUD requires cooperation between the city government and the residents. *Until now, how to define and evaluate QOL has been always a hot research topic for the concerned scholars and policymakers. However, adopting an integrated approach to neutralize the binary gap existing between the two ends has not been actively pursued.* In most cases, the two distinctive approaches for developing a QOL evaluation system are either policy-driven measurement or subjective well-being survey (SWBS):

1. Policy-driven measurement: indicators driven from different geographic or spatial elements (most of the secondary data from official governmental or institutional reports such as GDP, crime rate, unemployment rate, public green space/person, Wi-Fi speed, and the number of internet users).
2. Subjective well-being survey (SWBS) evaluation: survey collecting and processing primary data from individuals, which represents people's perception of their liveability of the environment (Serag El-Din et al., 2013).

As SWBS adopts a bottom-up approach for studying and evaluating QOL, SWBS cannot reflect the policy-driven QOL assessment if the top-down policy-driven approach is excluded. Diener, Marans, and Campbell suggested combining the policy-driven and SWBS approaches to form a more comprehensive and inclusive QOL evaluation system by reflecting the internal satisfaction of individuals from the external environment. The U2-CAS attempts to integrate the two approaches to the development of the QOL evaluation system to close the missing link of the concerned gaps, elements and parties.

1.8 RESEARCH NEEDS

Economy-led urban development research has been the focus of academia after World War II. Besides, due to the close link between the attraction of capital and QOL, QOL has become a part of city branding tools applied by strategic urban policymakers, planners, and marketers for attracting global capital and talents (Rogerson, 1999).

In the free market motivated by supply and demand, this phenomenon further drove in more economy-led research including QOL evaluation systems. Thus, capital-led urbanization becomes the norm, hegemonizing the urban landscape. Although there was some research focusing on human and social considerations in stock, unfortunately, it was just “a pro-human-centered city development slogan” of hollow words and a city branding tool used by the

marketers. The top-down-economic-driven QOL research, led by the elite groups, were/are profoundly neglecting the root of human essence and the origin of “ALL”. Under this backdrop, the current QOL evaluation tools tend to focus on indicators representing economic aspects driven by commerce, not oriented from the human needs, e.g., Cities in Motion Index, Mercer's QOL City Ranking, and Global Power City Index. Once, the Ex-Under-Secretary-General of United Nations written on her “Foreword” (ESCAP, 2015):

“Current economic models are not providing a sufficient basis for inclusive and sustainable development. Transformation of the urban economy requires new visions and partnerships spanning national and local government, as well as the private sector and civil society.”

Ms. Shamshad Akhtar (Ex-Under-Secretary-General of the United Nations and Executive Secretary of the United Nations Economic and Social Commission for Asia and the Pacific)

In the QOL evaluation, the subjective attribute of QOL undermines the accuracy and performance of QOL evaluation systems. The uncertainty of terms affects actions seeking to enhance the capacity of urbanites (Romero-Lankao et al., 2016). Under this system, the current QOL evaluation systems and tools are often one-sided, generated from either a top-down policy-driven approach or a bottom-up self-reported SWBS, which cannot reflect QOL objectively due to polarity. Only developing an open-ended working system to integrate the binary gap poised by the governments and the residents can aid in achieving the SDGs as planned. Thus, the U2-CAS was conceptualized to correct the fault. It embeds not only the external policy-driven indicators but also the embodiment of internal human needs as per the SUD policymaking market demand. The following core statement/argument was established to solve the issue, with hypotheses waiting for verification in Chapter 4 and 5.

“There is a need for developing an Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS), an urban evaluation system integrating the external top-down policy-driven indicators and the internal bottom-up subjective well-being evaluation.”

Hypotheses:

1. QOL is subjective due to demographic and geographical differences.
2. Well-being evaluation gap exists in the ranking result of the Sustainability-Uqol indicators (WoSu) between developed and developing countries.
3. SUD, TOD, ICT, and MHN of SHE-City are the main components for defining people's Uqol.

1.9 SIGNIFICANCE AND VALUE

The proposed new QOL evaluation system assists the relevant parties to develop, assess, monitor, and improve SUD policies and the designated projects. It contributes to balancing economic activities, social development, and environmental protection for effective governance. Through adopting the complex-adaptive system (CAS)⁴ validating by the mixed-methods-research technique, the U2-CAS and the WoSu were developed to improve the credibility and applicability of current QOL evaluation systems for fostering SUD projects. The theme-goal WoSu evaluation tool produced by the U2-CAS can integrate differences existing in the value system, enabling urban policymakers and the participants to rise above their differences for unified partnership and cooperation. It allows city planners/evaluators/policymakers to understand and assess the standard of living, and well-being of the urbanites where TOD-ICT is implemented as a sustainable urban planning strategy. The research has come to mean many things and contribute to different aspects. The study makes important contributions to the knowledge advancement in three levels:

1. In epistemology: it proposed a new approach (U2-CAS) to define an abstract “term” with a scientific method for easy communication and cooperation among the stakeholders.

⁴ A system of non-linear, dynamic, cell-based and causality-based, multi-method, multi-disciplinary, and multi-level attributes for understanding and evaluating the complex Uqol subject to urban conditions.

2. For future urban development, the new two-pronged WoSu can evaluate local well-being requests to inform urban-rural development policymaking in developing countries.

3. In application, the conceptual urban-ruralism (UxR) development framework acts as the primary foundation for encouraging a paradigm shift from the conventional economy-led urbanization practice into the post-industrial society where TOD-ICT become the critical driver for socio-economic-technological advancement.

1.10 SUMMARY

In Chapter 1, the introduction describes the global urban issues, the background of QOL, and the relevant materials relating to the development of the novel U2-CAS. Chapter 2 will present the organization of the thesis. By referring to the necessary literature, Chapter 3 will document research gaps and needs, and the redefinition of QOL. Chapter 4 will introduce the research methodology, explaining, analyzing, and discussing the validation of the argument and the relevant outputs meticulously. Chapter 5 will pilot test the WoSu evaluation tool. Chapter 6 will sum up the research of contributions, and future developments with an outlook. Here below is the chapter list for easy reference (Table 1.1).

Table 1.1 Chapter List of the Thesis

<p>Chapter 1 Introduction</p>	<p>Background of research: motivation, unsustainable global and urban issues needed to be solved, the background of QOL, research questions, research aim and objectives, research gaps and needs, as well as its significance.</p>
<p>Chapter 2 Organization of Thesis</p>	<p>Research design: introducing the overall research framework (ORF), the concept of thesis, and the U2-CAS.</p>
<p>Chapter 3 Literature Review</p>	<p>Discussing research gaps and needs, the definition of quality of life (QOL), and redefining the quality of life (QOL) into the urban quality of life (Uqol)</p>
<p>Chapter 4 Research Methodology</p>	<p>Adopting a mixed-methods research to reasoning and illustrating the first two logical research stages: theoretical base, and analytical illustration to confirm the proposed U2-CAS.</p>
<p>Chapter 5 Application</p>	<p>Presenting the last logical research stage of application to test the WoSu evaluation tool and conceptualize the TOD-ICT-based UxR development framework.</p>
<p>Chapter 6 Conclusions</p>	<p>Concluding the research and stating the original contributions and outputs of the study, the future development, and afterword.</p>

CHAPTER 2: ORGANIZATION OF THESIS

This chapter illustrates the overall research framework (ORF: Figure 2.1) of the U2-CAS. It outlines the three linear logical development stages to fulfill the three objectives in order to design, develop and confirm the Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS). Then, the WoSu evaluation tool is applied to generate the UxR development framework providing a new urbanization pathway for the developing countries.

2.1 RESEARCH DESIGN

As the proposed U2-CAS is not a linear model, instead it is made up of a series of microsystems initiating from the one philosophical Yin-yang ecosystem to form a dual-triple-quadruple-complex Human Ecological System (HES) for understanding and evaluating the Sustainability-Uqol, this chapter is dedicated to explaining the development of the hierarchical U2-CAS through the ORF, and concept of the thesis.

Research design is a plan to conduct the research, which guides the different key stages to reach the planned objectives by answering the research questions (Creswell, 2013) and translating a general scientific model into a series of research procedures. It includes a philosophical view of the researcher (Abowitz & Toole, 2010), the Yin-yang universal law, and a series of theories making up the HES. The based philosophy can help the researchers to locate the proper research strategy, and methods. In this study, the three logical research stages contain a theoretical base, analytical illustration, and application for achieving the three objectives necessary to develop, justify and demonstrate the novel U2-CAS. The thesis is organized by the three layers of “Reality” from internal to external aspects and from theory to application for illustrating the “Reality of Uqol” (Figure 2.4): (1) Theoretical HES, (2) WoSu evaluation tool and (3) UxR development framework.

2.2 OVERALL RESEARCH FRAMEWORK (ORF)

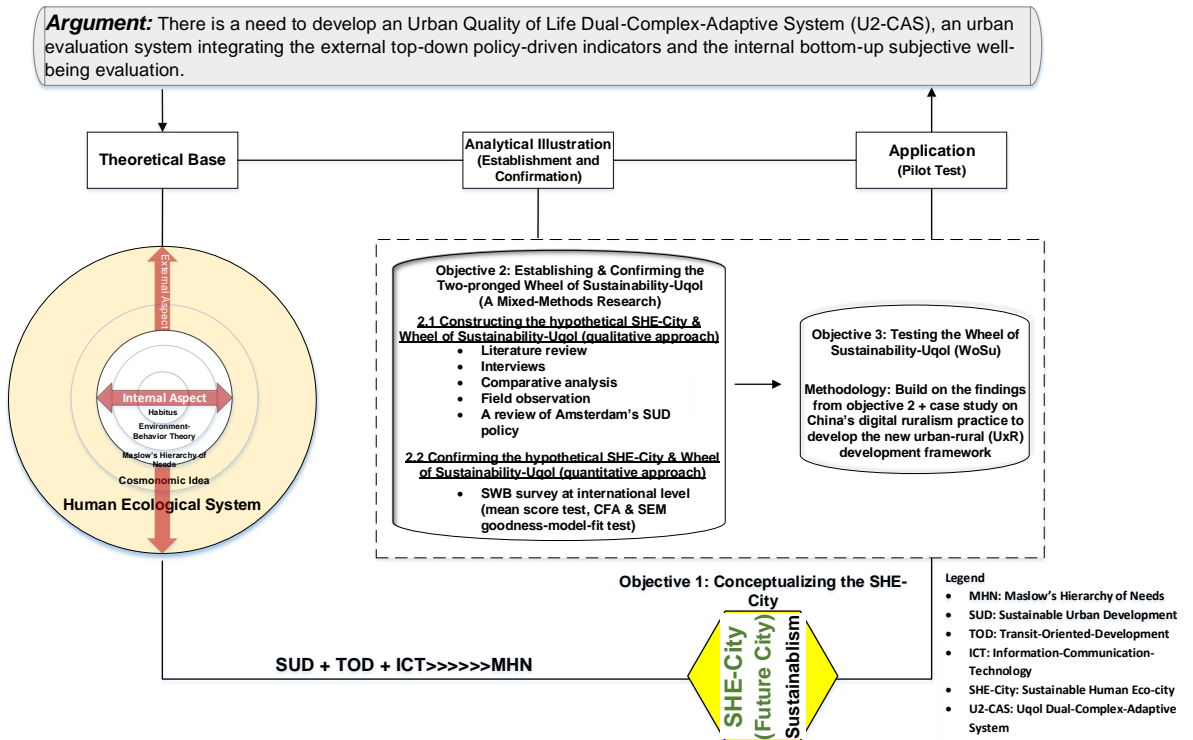


Figure 2.1 Overall Research Framework (ORF)

In the HES, Yin-yang universal law declares the initiation, evolution, and realization of the world's "Reality" philosophically. Confined by time-space, "Reality" emerges into the nested dimensions when the internal aspect inter-crosses with the external aspect, when vertical axel crosses over with the horizontal axel, when human interacts with the human-physical-contextual environment, motivating and facilitating by movement (transportation/TOD/ICT) to form the reality of our world, shaped in the individual human mind and combined collectively to form the reality of our society. In such a notion, the organized theme, and the origin of "ALL" one can recognize the ontology of a Human Ecological System (HES) in its philosophical interpretation and semi-tangible realization of the physical-contextual-human environment (Figure 2.2), ready for transforming the physical platform into the conceptual SHE-City.

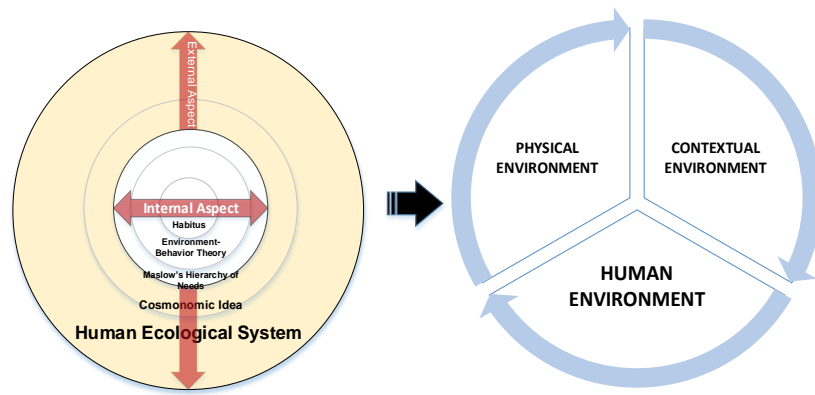


Figure 2.2 From Theories to the Human-Physical-Contextual Environment

In time-space: human reality was accumulated and evolved by movement (activities). Thus, the reality of Uqol has logically resorted to the causality of “transportation-TOD and ICT for serving the sustainability-SUD, and human needs (MHN)”, assuming all the means lead to the ultimate goal of reaching the state of equilibrium. As the interaction of the human-physical-contextual environment grooms motivation through time, naturally, this prevalent action affects the understanding, and evaluation of Uqol and the future urban-rural development trend, in which, the locomotive dynamic should be viewed, and organized as an organism

2.2.1 Three Logical Research Stages

The overall research framework (ORF) is furnished with three stages: theoretical base, analytical illustration, and application to achieve the primary goal, which is to develop the U2-CAS from a single nucleus to a duality⁵, to a plurality⁶ forming a nested nucleus for defining QOL into Uqol.

⁵ Duality is at the state of combining two different things: e.g. the duality of the reality of the Human Ecological System combining goodness and badness, the internal aspect and external aspect, the human and the natural environment, the Yin-yang law.

⁶ Plurality means the state combining many different types of things. (<https://dictionary.cambridge.org/dictionary/english/plurality>)

In the theoretical stage, an array of theories as the foundation conceptualizes the urban platform. Then the (WHOQOL Group, 1995) regarding the physical platform, a human ecosystem involves production, circulation, transformation, and storage of energy, matter, and information through biological, physical and social processes. In such an ecosystem, mobility is the critical engine that enables humans to carry out the above functions and activities for advancing the life cycle of urban development. Later, the theoretical reality becomes the human-physical-contextual environment and evolves into the conceptual future SHE-City.

In the analytical stage, a human ecosystem is organized of three concepts: human envired unit (personal feeling and aggregated collective feeling at a place such as neighborhood, village, city, or state), and interactions and transactions between and within the components and the backbone of the ecological framework is originated from the Environment-Behavior Theory many scholars all based on (Bubolz et al., 1980). In such a case, a core is a place or a society or a city ingrained by the cultural exchange of individuals and collective units affected and emulated by the physical environment. Thus in the contemporary world, the conceptual SHE-City urban platform is defined by a composite of four key Uqol components (TOD, SUD, ICT, and MHN) and further extended into a composite of eleven Sustainability-Uqol indicators (WoSu): health, human capital, social, governance, economy, environment, mobility, technology-ICT, lifestyle, culture, and smart living. The analytical stage developed and validated the SHE-City and WoSu while confirming the U2-CAS.

In the application stage, the WoSu is tested for informing future urban-rural development in developing countries. It transformed the classical MHN theory into the contemporary indicator-based MHN model to develop a new TOD-ICT-based UxR development framework contributing to narrow the well-being gaps between developing (rural-oriented) and developed countries (urban-oriented) while striking a balanced urbanization goal.

2.2.2 Three Objectives

The origin of reality provides a theoretical base for explaining and transforming an abstract idea into a physical urban platform: from theory to the conceptual future SHE-City driving through the concerned stages of urban development. The dual point-of-view, their interplay, and interdependent relationship are revealed. In other words, *the concept of “people (subject) and place (object)” morphed into “people and city,” which becomes the SHE-City, defined by TOD, ICT, SUD, and MHN, as well as measured by the eleven Sustainability-Uqol indicators.*

2.2.2.1 Achieving the Three Objectives

The first part of theory-based study forms the base to realize (objective 1) by defining a future Sustainable Human Eco-City (SHE-City): ordinarily, a nucleus of the reality of Uqol was initiated when Man intersected Nature (origin of reality) to form the human-contextual-physical environment.

Objective 1: Conceptualization of the Sustainable Human Eco-City (SHE-City)

How to define Uqol from a theoretical idea into a sustainable urban platform?

1.1: to conceptualize the main components of SHE-City by referring to an array of classical theories, and global sustainable concept suggested by the relevant literature reviews.

1.2: to identify TOD, SUD, ICT, and MHN as the four main components for supporting and building the SHE-City to construct the two-pronged WoSu.

The second part aims to realize (objective 2) by adopting a mixed-methods research to provide both qualitative and quantitative justifications corresponding to the argument.

Objective 2: Establishing and confirming the U2-CAS

What is the analytical justification for forming and verifying the U2-CAS?

2.1. to construct the WoSu by elaborating the four dimensions of SHE-City.

2.2. to validate the WoSu with a means score test, and the hypothetical SHE-City with a structural equation modeling goodness-fit-test.

2.3. to validate the U2-CAS based on the findings of 2.1 and 2.2.

The third part is to test the WoSu for informing the future urban-rural development path in the developing countries to reach (objective 3) while verifying the U2-CAS.

Objective 3: Testing the WoSu

How to apply the WoSu?

3.1. to explore and illustrate its functionality and contributions through developing the conceptual UxR development framework.

According to Aristotle, “ALL” in the world acts according to the objective with a planned or unplanned agenda. First, **objective 1** was achieved by identifying the four main components evolved from the human-physical-contextual environment to make up the conceptual SHE-City. The second part is the analytical illustration, together with the third part of the application to draw the logical discourse, outcome, and conclusion for the corresponding argument. **Objective 2** was released in the analytical illustration stage. Data and information were collected and analyzed to establish and validate the conceptual U2-CAS with a mixed-research method. In the application stage, **objective 3** tested and documented the applicability of the WoSu evaluation tool to verify the U2-CAS significantly.

2.3 CONCEPT OF THESIS

Philosophy needs to trickle down to the detail with specification for realizing its applicability, so it can contribute its true value to benefit society. The global urban issue is what we are facing; the past is the context conceived from cause-effect as the theme, and the future is the goal. How to identify the objective meaning of a term and/or a project? What is the purpose? What is the theme? Who are the main actors (people, groups, institutions, and society) and the

appointed perspective to decide on the stance of the study? What are the main components identified to support the theme and the purpose and their relationship? What is the parameter for limitation (space)? When is the validity of the definition (time)? What type of system is used to define the Uqol? This section presents the organizational concept for developing the innovative U2-CAS.

The two leading design processes of U2-CAS are "*conceptualization*" and "*evaluation*" for identifying the necessary context of the Uqol. "Conceptualization" is the process for serving people the capability of understanding. "Evaluation" is the function of merging subjective sentiment and objective measurement by incorporating the perspective of a subject into the urban environment. By following this notion, the two elements making up the urban quality of life (Uqol) evolve from the origin of (humans + nature) to (urban + QOL), and (urban condition + well-being evaluation). In such a notion linked by "conceptualization" and "evaluation", the ORF was organized from this line of thought, guided by the theme-goal identified in the study to develop the U2-CAS.

First, setting the purpose properly and reach it successfully, the purpose needs to be specific, measurable, attainable, realistic, and time-targeted being understood by the subject designers or planners. Second, the targeted readers are the urban policymakers (governments) and scholars, to complete the goal, participants' inputs such as suggestions and cooperation must be communicated effectively who are the operators (public or private developers) and the co-operators (the relevant residents). It is for upholding the scheme of sustainability by matching the supply side and demand side. *Worth noting, the effectiveness of an evaluation system is critically subject to its ability for communication, therefore, the U2-CAS is designed with a core sense of integrating the policy-driven supply-side indicators and the subjective well-being demand-side evaluation to enhance communication and cooperation between the two binary ends.*

Specifically, the theme was made up of four main dimensions: transportation-TOD, sustainability-SUD, ICT, and MHN, developing along the dual approach principle stated previously. A dual-complex-adaptive system powered the network (2-CAS), not only patterned by a top-down policy-driven approach and a bottom-up subjective well-being evaluation but also supported by a multi-dimensional cluster. The U2-CAS (Figure 2.5) was nested into three hierarchical layers reflecting the specific reality in different layers, from general to specification while demonstrating the collective reality as an ecosystem. The line of thought in organizing this research is “understanding”, “evaluating” and “improving” urban sustainability with a goal for enhancing people's livelihoods.

2.3.1 Structure of Thesis

This section presents an organizational structure denoted by the three layers of functions in epistemology, strategy (policymaking), and application striving for the common goal. The structure of the thesis is a complex ecosystem made up of six hierarchical dimensions from general to specification. They are ideology, overall research framework (ORF), and urban quality of life Dual-Complex-Adaptive System (U2-CAS) nested by Human Ecological System (HES), Wheel of Sustainability-Uqol (WoSu), and urban-rural development framework (UxR). They form a family tree of Uqol depicting the interrelationships of a hierarchical means-goal path. The ultimate goal of the thesis is to define an abstract term into its specific form which will be achieved when the three outputs of HES, WoSu, and UxR are developed, and validated for verifying and confirming the U2-CA (Figure 2.4). The three outputs will be highlighted in the study, while the U2-CAS works as a central system and the means for defining Uqol while guided by the ORF.

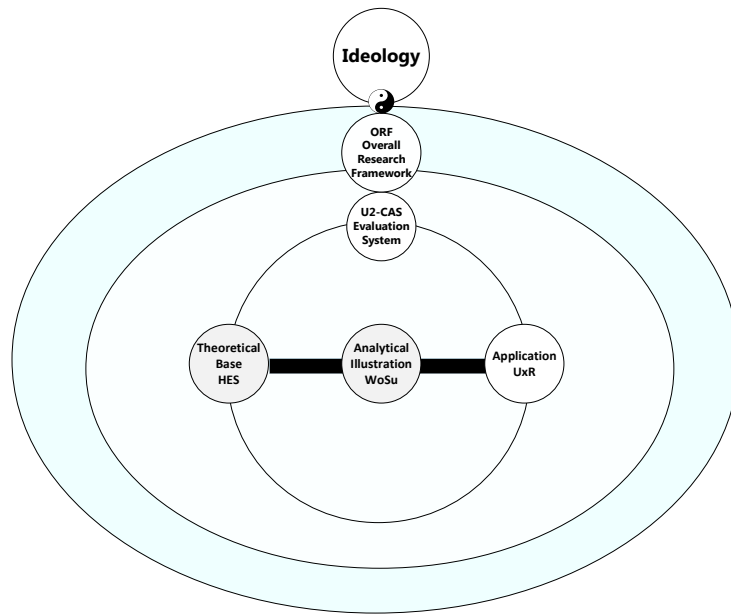


Figure 2.3 Structure of Thesis

(Figure 2.3) illustrates the hierarchical structure of the thesis networking by their means-goal relationships. *The world is orbited by duality through a time when people live in the space of idealism (a conceptual world) and realism (an evaluative material world), which the U2-CAS attempts to build a set of scientific footprints for understanding and revealing the links in between the two worlds in order to improve mutual understanding and cooperation in the human society.* The multi-functional ecosystem is a nesting layer broken into three parts: an ideology (thought), ORF (roadmap), and the three outputs of (HES+WoSu+UxR) to generate the U2-CAS (evaluation system) or vice versa depending on different time-space and standpoint of view. The nested structure functions like a traditional Russian Matryoshka Nesting Doll, without opening the outer layer, the inner layers of meaning cannot be seen and revealed. Once all the layers of “Reality” are revealed, the complicated world would be understood with mutual agreement when Yinyangism is objectified (Figure 6.1).

2.3.1.1 Ideology

The research was developed according to three steps of epistemology. In epistemology, seeing the unknown from the known is “*acquiring knowledge*”. Understanding the knowledge is about realizing “Reality”. Applying the newfound knowledge is “*experiencing reality*”. Sharing “new knowledge” is the process of transforming “individual realities” into “collective reality” which can be fulfilled by the redefinition of Uqol through the U2-CAS. This is also a process of seeking the unknown “Truth”. The study of Uqol requires defining the specific reality of the QOL, therefore, the below explains the meaning of *reality* and *definition* of Uqol, which must be understood first and foremost. (Chapter 3.4, 3.5 and 4.1) will further elaborate and discuss the subject.

A. Ontology of “Reality”

What and when does “Reality” begin? How to manifest it? The pursuit of knowledge is to seek the “Truth”. Although one’s personal experience is the closest to the “Reality”, but it is still not the “Truth”⁷. In human society, the “Truth” is just an unrealistic dream which belongs to the clan of idealism. *Therefore, one can say that “Truth” is the ongoing process of searching for the “Truth”, which time-space acts as the independent variable to define “Reality”.*

Time-space, energy, matter, life, and intelligence, from these, all else can be built and realized in different layers of reality, which means misunderstanding and conflicts can exist among people in different social groups who are categorized according to the different distinctive value systems characterized by the demographic backgrounds such as ethnicity, age, profession, education, religious, and cultures. However, when “individual realities” can be integrated into the “collective reality”, it can lead to realizing the common goal as close as

⁷ Absolute “Truth” exists in nature, without human; the “Truth” rules over the “Reality”. “Reality” exists when human interacts with nature in the Human Ecological System (HES).

possible, in which mutual understanding and trust among the stakeholders are encouraged, promoted, and acknowledged through a working framework to actualize the future SHE-City.

“Reality” signifies when conscious-being encounters nature in the HES where the “Reality” is being born. However, as stated previously, “Reality” is not the equivalent of “Truth.” Therefore, the reality of QOL is made and realized from the moment when human interacts with nature, morphing through different layers of reality along the urban development trajectory paved by industrialization, metabolized from the domain of a village to a community, then a city into a nation to formulate the world human conscious-being, finally to model the Uqol. As per Descartes's idea of reality: “I think; therefore, I am.” or “thinking is the only certain existence”. His reality of one's mind implies subjective reality being the norm undoubtedly in human society, which facilitates simulacra (Baudrillard, 1994). To Kant’s argument (apperception) on the subjective mind, the reality is shaped by the subject's cognitive style. His argument implies the importance of the *contextual environment* in influencing human thought and action. Applying this idea to the study of QOL, the forming of knowledge is the function of a need to undergo a self-conscious (understanding) process that matches the process of materializing the means or the functions (evaluation) for reaching the end through trekking along the U2-CAS. Such reasoning is the underneath concept for the thesis title: “Understanding and Evaluating Urban Quality of Life for Enhancing Sustainable Urban Development: A Dual-Complex-Adaptive System (U2-CAS). In other words, the structure of the thesis is a scientific illustration to seek knowledge, justify knowledge, experience, define, evaluate, and test new knowledge. (Table 2.1) is the hierarchical order of thought management: from the unknown “Truth” to the known external “Reality” and internal “Self”.

Table 2.1 Thought Management

Truth (Yin-yang)	Reality (Individual and Society)	Epistemology (Medium)
Is what the unknown “one”.	Is what “object (It/She/He/They)” perceived by the “subject (I/We)”.	The study of the nature and limits of knowledge involving <i>conceptualization, evaluation, implementation, and dissemination.</i>

As stated by the famous French philosopher René Descartes, the essential element of reality is driven from empirical experience, the human senses, “the knowledge and the recognizing”. Hence, “Reality” would be interpreted differently in the eyes of different individuals, and that there is undoubtedly a reality gap among human minds, which explains the ontology of the human mind is a subjective matter on its own. It is the reason why QOL is subjective as well. *This communication gap among people is the cause of disagreement and misunderstanding for possible conflict in the pursuit of social, economic, political, and environmental sustainability.* A communication gap can produce misunderstanding and conflict among people in the society according to the conflict theory⁸ suggested by the German philosopher Karl Marx. His suggestion can be interpreted as the embodiment of the polarization theory stated in the Yin-yang universal law from the Western perspective. Although nothing can escape the objective issue of the polarization theory, *with the development of U2-CAS, it is possible to bring the two poles together to prevent or ease conflict among the stakeholders, particularly in a working environment.*

⁸ Karl Marx stated that society is a state of perpetual conflict due to competition for limited resources, which is the duality nature of contradiction between the proletarian working class and the bourgeois ruling class.

At the core of reality is the intersection of humans and nature. Once “the status” got learned and understood by the human mind will form the next layer of reality subsequently through time-space. Then the known “Reality” evolved and evolving into different classifications and hierarchies to make up a complex adaptive system (CAS). The development of “Reality” is illustrated by a pattern like Dooyeweerd's Cosmonomic Idea. The dual-complex-adaptive system (2-CAS) manifests such realization: the more the people “understood” the confined “Reality”, the more the “Reality” got accepted, the less the misunderstanding and conflict, the more the mutual trust and cooperation materialized, and the stronger the unity for reaching the goal of enhancement sustainably and collectively.

This research contributes to a new path for defining QOL into Uqol through understanding, evaluating, and implementing for improving urbanism, especially tailoring to the developing countries. As a result, the ORF was constructed based on this progressive line of thought documented by the developing pattern of reality from ideology to application. The 2-CAS is based on the same ancient principles, refurbished well fit for serving the current and future needs and challenges.

Particularly, the two elements that make up the Uqol are urban + quality of life, which are the essences of the definition of Uqol. The concept of urban (supply side) is defined by the dimensions of transportation-TOD, sustainability-SUD, and ICT. The concept of QOL is defined by MHN (demand side), and the meaning of SHE-City is defined by integrating the two concepts (supply and demand). Accordingly, the concept of QOL: Human needs (MHN) is the “thing-itself”, which is evaluated by the eleven Sustainability-Uqol (SUD+MHN) indicators served by the TOD and ICT (Figure 4.18). In a complex system, the definition of Uqol can be interpreted by the U2-CAS supported by the HES, the WoSu, and the UxR. In terms of understanding, evaluating, and defining, the four components of SHE-City and the

WoSu are developed from the combined concept of “Urban” and “Quality of Life”. The concept of Uqol is elaborated into a formula: $F(TOD, SUD, ICT, MHN) = Uqol$.

2.3.1.2 Three Outputs Derived from the Overall Research Framework (ORF)

The overall research framework (ORF: Figure 2.1), a three-stage plan of action, shows the process of conceptualizing, establishing, confirming, and testing the U2-CAS: theoretical base, analytical justification, and application. The U2-CAS was conceptualized with a set of aspirations derived from the sustainability agendas and principles, theories, historical references, and subjective well-being survey (SWBS) results channelled by the ORF. The overall approach undressed the vital layers of reality built through human civilization to backtracking its origin of reality, the established ideas, and theories through observing the phenomena and studying the concerned literature. It is a chronological organization on its own with a function to rekindle people’s urge to search the origin for realizing their sustainable future.

(Figure 2.4) shows a sequential morphing mode of the ORF. It illustrates the establishment and confirmation of the U2-CAS reasoning through the means-goal, input-output, and cause-effect narratives corresponding to the three logical stages and objectives. The ORF produces the three outputs of HES, WoSu, and UxR, which make up the U2-CAS with a function to define the abstract QOL into Uqol. The findings and new knowledge generated can inform the future sustainable urban-rural development in developing countries.

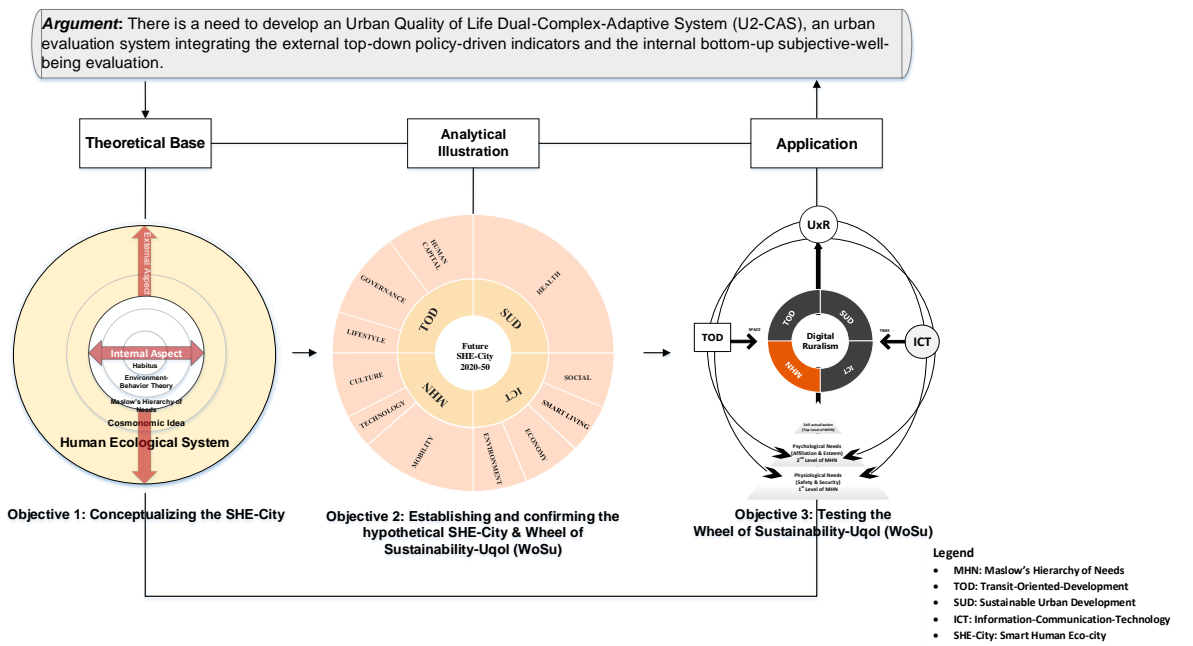


Figure 2.4 Overall Research Framework Outputs

2.4 INTRODUCING THE URBAN QUALITY OF LIFE DUAL-COMPLEX-ADAPTIVE SYSTEM (U2-CAS)

The U2-CAS is a multi-layer model to redefine QOL into Uqol for enhancing SUD policymaking and people's livelihood. Mumford (1970) once suggested a new type of living environment could allow people to live in cities without losing contact with nature, socialize without losing the means of good health, and the decent nurture of children in an organic life with flexibility, adaptability, and renewability. The U2-CAS explores and manifests his idea.

2.4.1 Complex-Adaptive System (CAS)

Why was Complex-Adaptive Systems (CAS) being adopted to perform the task? Many scholars like (McDonnell & Pickett, 1993; Holland, 1996; Marina et al., 2003; Salamon, 2011; Karakiewicz et al., 2015) mentioned that the cities as a complex-adaptive system, however, there is limited knowledge about human interaction with the dynamic living environment due to the lack of models that can integrate human, ecological, and urban system. The ecological cities evolved as the CAS, capable of articulating various cross-border processes and mutate into a new urban form often without centralized control (Holland, 1996; Sassen, 2010; Dovey,

2012; Fucà et al., 2019). The CAS can interpret the complexity and adaptability of urban development. With the consideration of the time-spatial factor, the CAS was commissioned to deliver the job because it has similar attributes as complex, hierarchical, and dynamic as the cities. Thus, the U2-CAS was conceived to understand and evaluate the residents' expected well-being, while reflecting the real urban conditions.

A complex-adaptive system is a system made up of many individual parts, used by the natural and social sciences, to develop a system-level model that becomes a suitable model for constructing the multi-faceted Uqol evaluation system with high flexibility for easy adaptation and application. The U2-CAS must be adaptive enough to manifest different theme-goal projects or different layers of realities confined by demographic, and geographical constraints because individual and collective behavior can mutate and self-organize to challenge the ever-changing environment, that forms the time-space-sensitive organic system habituated by humans. Regarding the nonlinear dynamic, highly interdisciplinary, hierarchical ordered, insightful, heterogeneous, transient, mutable, and self-organizable urban development, which resonates perfectly with the attributes of the complex-adaptive system (CAS). The new evaluation system can describe, evaluate and define urban quality through understanding the formation, adaptation, and evolution of societies in response to the underlying mechanism and inter-related patterns of changes that create cities and neighborhoods (Sanders, 2008). The U2-CAS is a wholly multi-disciplinary, nonlinear, and multi-scalar framework for studying, analyzing, and conceptualizing the future sustainable city (Sanders, 2008; Dovey, 2012; Karakiewicz et al., 2015). The multi-functional U2-CAS contributes to an innovative system by linking the ancient Yin-yang universal law to the current policymaking requests for achieving the SDGs.

Defining and developing the Quality of Life (QOL) evaluation system from the Yin-yang universal law is the first attempt. It should be supported by a systematic, hierarchical, categorized, autonomic, authoritative, highly interdisciplinary, and complex mechanism to reflect the diverse dimensions of QOL (Diener, 1995). The idea allows the study started from the theoretical base as its logic to further develop the U2-CAS, giving the meaning of Uqol from its general qualitative term to its quantitative illustration run by the common goal. It is not only a dualist, a top-down and bottom-up two-dimensional mechanism yet a three-dimensional human ecological model (a biopsychosocial model)⁹ with a function for serving the human needs (MHN). It is a highly adaptive model to conduct robust research. Its reality originates from a focal point to a line, continuously evolving into a dual-triple-quadrupled ecosystem and then a multi-layered ecosystem with an extended variation. The multi-functional U2-CAS can define Uqol in the context of sustainability beyond “text” with a composite of Sustainability-Uqol indicators (WoSu) for easy communication, furthermore, it can be tailored-made into the appropriate tool for enhancing urban policymaking.

Regarding the loop-liked structure, the integration of Yin-yang duality and the global concept of sustainability started at the central “origin of reality”, and then drive along the causality link in time-space to develop the U2-CAS for learning and reflecting the reality of the theoretical HES, SHE-City, WoSu, and UxR. The Y-vertical upward alignment represents the bottom-up subjective well-being approach for reflecting the human needs (demand side), inter-crossing by the X-horizontal alignment (the top-down policy-driven approach: supply side) to form the WoSu evaluation tool. The U2-CAS was designed to synchronize dichotomy. The two divisions (top-down policy-driven approach vs. bottom-up subjective well-being survey) are entangled and interdependent, materialized by a complex-adaptive system (CAS),

⁹ The Wheel of Sustainability-Uqol indicators is derived from the interplay of physical, psychological, and social factors.

with the customizable capability to fit into different theme-goals as a universal working system. In other words, all the themes, dimensions, indicators can be replaced subject to the project theme-goals.

To enhance sustainable development, sustainability aims to improve QOL as the policy goal (Marans, 2014; Štreimikienė & Barakauskaitė-Jakubauskienė, 2012). The future SHE-City was conceptualized as a sustainable place for improving liveability. TOD- ICT as the agents transforming a sustainable place into a hybrid of a physical and virtual community, and the enabler for enlarging people’s choices in social, economic, environmental, cultural, and political aspects, they serve the human needs (MHN). A virtual society can be networked on top of the physical urban domain, regardless of distance in the digital age. The possibility of digital rural-urbanism is destined for shaping the future balanced urbanization pattern.

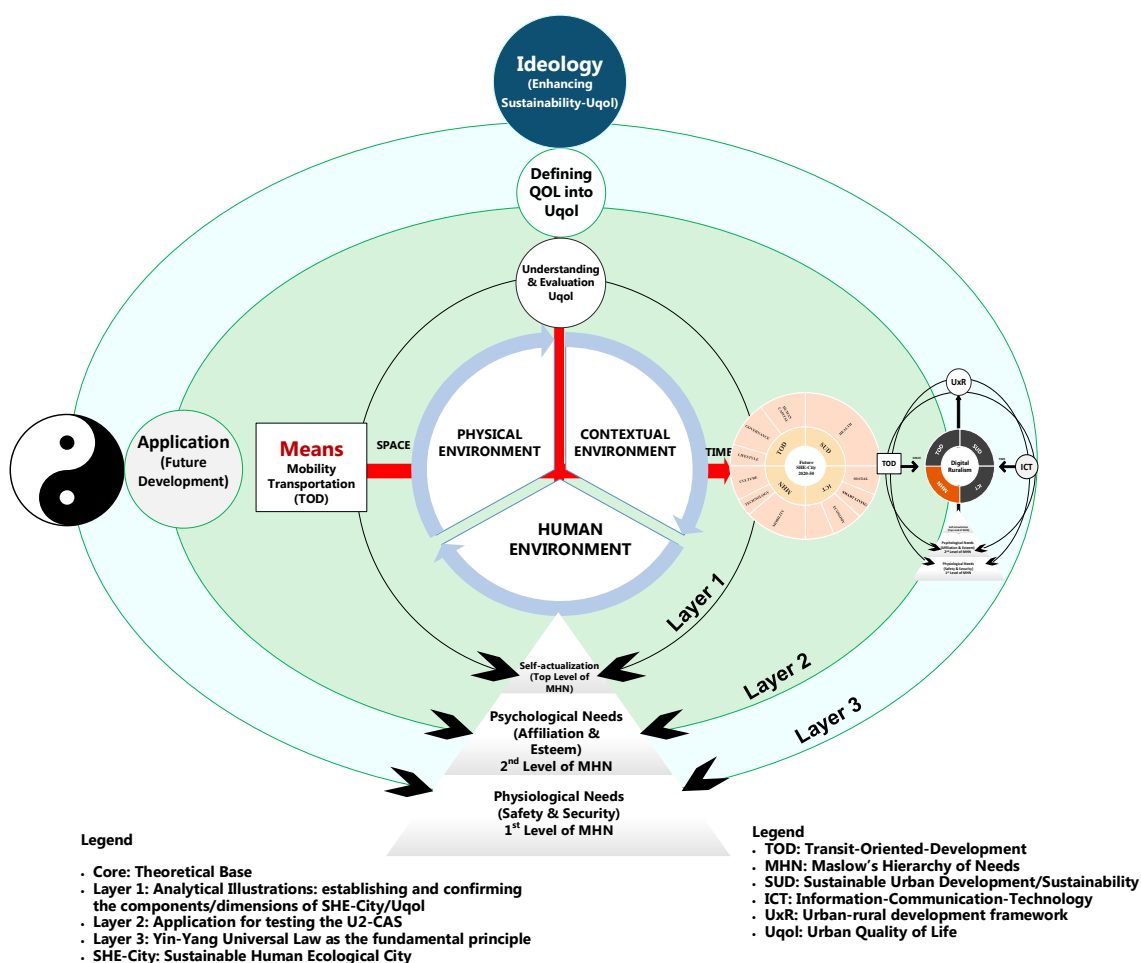


Figure 2.5 Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS)

To change the perspective and look at the cross-section (Figure 2.5), the nucleus is the origin of reality and the direction for reminiscing the past. *The core layer* - the rhetoric definition of Uqol was initiated from the origin of reality (man x nature) and developed into the contextual-human-environmental platform based on a series of theories. *Layer 1* - the four core components of SHE-City for developing the two-pronged WoSu were constructed and justified with interviews, a review of Amsterdam's SUD policy, a comparative analysis, and an Uqol survey. *Layer 2* - an UxR development framework was conceptualized with the application of the WoSu. *Layer 3*- the embodiment of the ORF sums up the ideas, relationships and outputs representing the central idea of Yin-yang universal law. It is the beginning and the end of the HES, in which everything lives within the Yin-yang ecological system, both Man and Nature with the common goal of creating a harmonious human civilization.

CHAPTER 3: LITERATURE REVIEW

Previous chapters have been dedicated to introducing the background and the concept of the study, the ORF and U2-CAS underpinning the narrative of QOL to the urban context, and the global concept of sustainability for a brief understanding. In this chapter, the issues of defining and evaluating QOL concerning sustainability are examined. It highlights the external and internal research gaps for developing the U2-CAS. It explains the redefinition of QOL into Uqol. It also provides a good understanding of the issues of QOL and Uqol evaluation systems and their critical role in affecting future SUD policymaking.

3.1 RESEARCH MARKET ANALYSIS

As the study is an investigation of redefining QOL into Uqol in the context of sustainability, the term “urban quality of life” involves two concepts; “sustainable urban development (SUD) and quality of life” is examined. A review of each term and the link between them are necessary for setting the rhetorical foundation of the “urban quality of life.” In the literature review, the keywords for retrieving the relevant peered review journals were “quality of life” or “sustainable urban development” or “quality of life” and “sustainable urban development” or “urban quality of life.” The SCI database was where all the primary data source for journal retrieval. The (Polyu, 2021) was the first and significant data source targeted. After reviewing the journal stock dated from 2000-2017, the journal stock of 2018-2019 was reviewed for updates on the topic. Papers selected for review might not be all cited because some of them only served as inspiration or aspiration. A specific search focusing on each essential subject was followed by selecting and reviewing the related articles from a pool of citations in the referencing list. Furthermore, articles from specific key authors were digested for extra support.

If there was a statement necessitating additional citation, searching from data sources beyond the normal route such as google scholars was conducted to strengthen the capacity of building up robust research. Whereas, a smart choice on selection affects the quality of the research holistically; therefore, benchmarking criteria were set on “relevance”, “justification and research methodology,” and “journal reputation”. For the groundwork builder, books for forming the original concept from theories including “The Republic” (Plato, 2009), “The Philosophy Book” (Reference, 2011), “Environment and Behavior” (Porteous, 1977), and “Space and Place: The perspective of experience” (Tuan, 2001) and “The Culture of Cities” (Mumford, 1970) were reviewed. Authors of the selected review articles from the general stock were identified for additional review. (Table 3.1 & 3.2) present an overview of the search result.

Table 3.1 Retrieving Outlook of Journal Profile

Key Words	Discipline/Subject	Number Selected: Peer-reviewed
Quality of Life	Health-related, Social indicator, Psychology, Science, Cities, Economic, Medicine & Human	35
Sustainable Urban Development	The assessment tool, strategic planning, policy, education/learning, urban planning, environmental management & sustainability	6
“Quality of Life” & “Sustainable Urban Development”	Sustainable Development, Sustainability, Economics & Urban Planning	8-many case studies in Europe, North America, <i>but Asia and Africa</i>
Urban Quality of Life	Quality of Life, Sustainable Urban Development, Social Sciences, Evaluation Tool/Social Indicators, Urban Study, Urban Policy & Planning, Ecology & Society, Environmental Psychology, Geography, Social and Behavioral Sciences, Landscape & Urban Planning & Remote Sensing	22 -most of the articles touch the concrete notion of QOL -rich in content and diversity in subjects -in lack of defining Uqol in a specific term - different type of indicator-based evaluation tools.
Collections attained: JSTOR Current Journals, Springer (CrossRef), Elsevier (CrossRef), ScienceDirect Journals, Social Sciences Citation Index (Web of Science), ProQuest SciTech Collection, SciTech Premium Collection, EBSCOhost & Environmental Science Collection		

Table 3.2 Overview of Relevant Journals

Journal Name	Number of selected papers
Social Indicators Research	7
Habitat International	6
The American Journal of Economics & Sociology	5
Quality Life Research	4
Cities	3
Procedia: Social and Behavioral Sciences	2
Journal of Environmental Psychology	2
American Journal of Economics & Sociology	2
Journal of Social Sciences	2
Environment Development Sustainability	2
International Journal of Geographical Information Science	2
Futures	2
Landscape and Urban Planning	2
Urban Studies	2
Journal of Intellectual Disability Research	2
Ecology and Society	2
Environment and Planning B: Planning & Design	2
Sociology Compass	1
Architectural Science Review	1
Cities, Productivity, and Quality of Life	1
Urban Policy and Research	1
An International and Interdisciplinary Journal for Quality-of-Life Measurement	1
Journal of the American Planning Association	1
International Journal of Remote Sensing	1
Psychological Review	1
Journal of Cleaner Production	1
Environment and Planning A	1
American Journal of Community Psychology	1
Journal of Urban and Regional Analysis	1
International Regional Science Review	1
Social Science & Medicine	1
Technological and economic Development of Economy	1
Sustainability	1
Journal of Socio-Economics	1
Geo Journal	1
Journal of Transport Geography	1
Building and Environment	1

(Table 3.1) indicates that plenty of QOL papers produced from the disciplines of health and medical, social science, and psychology independently as (Shek & Lee, 2007) stated, few relating to SUD. To the sustainable built environment journals, those papers seemed to focus on research studying the means (policy, strategic plan, models, and theories), not delivering the holistic research. As stated in the earlier chapter, “SUD aims for enhancing QOL” showing that SUD and QOL are related to each other in causation. Even though a few papers address QOL and SUD, they are mostly for case studies of the developed countries, not really for the developing countries.

(Table 3.2) shows that most of the related papers are scattered among many journals of different disciplines. The collected data indicates that the journals leading in publishing papers relating to QOL include Social Indicators Research, Habitat International, The American Journal of Economics & Sociology, and Quality Life Research. However, the literature is drawn heavily from economics, and social sciences, whereas geography and planning are mostly neglected in the study of QOL (Bartik & Smith, 1984; Gyourko et al., 1999). Before 2011, the topic of QOL and SUD was not attended. Only after 2011, it had a slight surge of papers linking the study of QOL and SUD, but the trend dropped in 2016. The findings indicate a lack of research integrating the disciplines of QOL and SUD.

As stated by the (Brundtland Report, 1987), an urban built environment has been planned for enhancing Uqol within the confinement of meeting the needs of the present without compromising the scarification of future generations. It means that the causality of QOL and sustainable urban development (SUD) are bonded with each other directly and naturally more research should focus on integrating the two disciplines. More research of this type in both qualitative and quantitative studies should be encouraged (Campbell, 1976; Marans & Stimson, 2011), while SUD has been well advocated by the world institutions such as United Nations (UN) and World Commission on Environment and Development (WCED, 1987).

3.2 IDENTIFYING RESEARCH GAPS

Since the introduction of capitalism in the 16th century, economic growth has dictated city development policies and agendas favored by free-market economists, scholars, and governments in the developed regions for the past centuries. Thus, research on the economic-driven city development paradigm for optimizing people's living standards became the favorite in academia.

Fanned by the supply and demand mechanism, this situation further produced many more economy-led urban studies affecting urban policymaking. Subsequently, the research market left very little room for the development of more human-oriented urban studies, and this explains why many economy-led cities developed throughout the world dominate the urban development market. The macro external gap in the research market mentioned has been ingrained historically. As a result, it has been challenging to change this cliché without cogently and to address and tackle the issues geographically. Apart from the macro research gap, the subjective perception gap (Lotfi et al., 2011) exists naturally in people for evaluating QOL due to differences in demographic and geographical backgrounds. QOL definition is rhetoric without a unified context, which is difficult to define for mutual understanding (Lotfi et al., 2011). Furthermore, it generates a well-being evaluation gap between the top-down policy-driven goal and subjective well-being survey in the evaluation system (WHOQOL Group, 1995; Wadley, 2010). Regarding the QOL evaluation system, these two branches of practice were employed often separately to help in decision making. The following are the two associated issues causing by the ambiguity of QOL definition and its difficulty in evaluation:

- a) Demographic and geographical differences are the cause of the evaluation gap between the top-down policy-driven Sustainability-Uqol indicators and the bottom-up subjective well-being perception.

b) Misrepresentation due to incommensurable¹⁰ measurement (developed countries vs developing countries).

3.2.1 Binary Gap

Often, the government-goal-oriented policy-driven sustainable urban evaluation neglects the input of the public. As a result, the top-down goal-oriented urban evaluation system designed by the government would be looked upon as opposing to the subjective well-being survey in terms of position (government vs. residents) due to lack of consent or mutual understanding. The binary gap is originally reflected on the subjective individual's perception caused by demographic and geographical differences. Subjective well-being refers to one's evaluation of personal happiness and the value he or she places on life at any given time, which has been influenced by one's demographic and geographical background relating to the urban environment one lived and is living in. Whereas, Veenhoven (2000) stated that subjective evaluations of life domains could be both internal and external to the individual. In such a case, policy-driven measurement is the external cause of the individuals' internal subjective well-being (SWB) evaluation. It signifies that an effective urban evaluation system for enhancing SUD must embrace the top-down goal integrating with the bottom-up well-being requests.

Campbell (1976) and Marans & Stimson (2011) supported that demographic characteristics affect the evaluation of the life satisfaction domain and that these characteristics were influenced by the objective attributes from the living environment. It pointed out the causation of the urban condition to well-being requests, which asked for a dual-approach evaluation system to deliver a more objective Sustainability-Uqol assessment for effective policymaking. For example, Campbell's overarching model framework incorporated a range of demographic, social, economic, and environmental relationships while considering satisfaction

¹⁰ Not able to be judged by the same standards, having no universal standard of measurement.

with different levels of living or domains of life, which sets the preliminary layout for the U2-CAS. Till today, due to the binary gap and the one-sided evaluation system (either the top-down policy-driven approach or the bottom-up subjective well-being survey), there is little consent between the residents and the government because of lacking an indicator-based communication platform capable of synchronizing and matching the supply goal and expected well-being demand.

Specifically, to the survey-informed indicator studies such as QOL indices, a uniformed QOL evaluation system cannot be universally applied to different theme-goal projects employed in the different geographical domains. Moreover, Uqol evaluation is directly affected by individual value, and the incommensurable measurement between the developed countries and developing countries yields the misrepresentation of judgment. It affects the distribution of our limited resources when the policymakers are misinformed by either the SWBS or the policy-driven indices. Given to this rationale, a multi-dimensional open-platformed Sustainability-Uqol evaluation system is critical for succeeding SUD.

For example, the United Nations should avoid judging the QOL of the developing countries and the developed countries in the same batch because we cannot use the same set of indicators to give a fair evaluation for apple and orange. People living in the less urbanized area in the world, such as Marrakesh, Tehran, and Lagos, might rank the importance of public transportation higher than the people living in developed Hong Kong, Paris, London, and Amsterdam due to the degree of relativity in the supply and demand system. Furthermore, by looking at the ranking system developed for measuring the QOL such as GDP, Social Progress Index, and Human Development Index, they all based on the same benchmark to rank both developed and developing regions in the past which could not reflect the actual QOL relative to local constraints. For example, GDP and Social Progress Index are in favour of the developed economy/countries. Therefore, countries in the two domains should not be put on the same

ballot for comparison because there are subjective elements only applied to the developed regions or the developing regions. We should treat QOL evaluation as a relevant matter among the concerned parties, not an absolute independent entity.

Along with the same discussion, views on how ‘quality’ should be assessed are rather diverse. Quality implies value judgments and ranking; consequently, QOL might be ranked from high to low, and from improving to deteriorating. Theoretically, the ranking of quality should allow for longitudinal or cross-community comparisons, and conclusions such as “the QOL in community X has been improved in the past decade”, or “the QOL in community A is better than that in community B”. However, the subjective urbanites making the evaluation, hence, comparisons between communities or periods often prove difficult. Therefore, it is not possible to use the same evaluation tool to judge the QOL of the developing and the developed regions. For this reason, the open-platform U2-CAS has a function allowing evaluators to design a tailor-made WoSu evaluation tool subject to their project theme-goals and domains.

The lingering gaps can be revamped by the two-pronged WoSu evaluation tool (an output of U2-CAS), which is intended to rectify the current fault in the sustainable urban evaluation system. U2-CAS contributes to neutralizing contradiction, powering urban policymakers, builders, and the public, allowing decision-makers to distribute the limited resources economically and efficiently. The novel U2-CAS is designed with high flexibility for alteration based on any theme-goal of the projects. It is an enhancement of Campbell’s model framework in terms of practicality and applicability, a model directly serving the human needs while addressing the demographical and geographical impact, the binary gap as well as misrepresenting issues.

3.3 RESEARCH NEEDS

Quality of Life (QOL) has the implicit character: QOL includes both objective and subjective indicators as a measurement. On the one hand, objective indicators are taken from the utilization of institutional data and statistics in the country, city or neighborhood levels (Sedaghatnia et al., 2013). On the other hand, subjective indicators are contributed by the people's perceptions, evaluation of subjective well-being (Potter et al., 2012). Thus, utilizing a two-pronged approach in defining Uqol and evaluating urban quality can be a suitable way to inform future SUD policies.

In subjective well-being evaluation, the whole life satisfaction domain is generated from *individual QOL* (subjective satisfaction with the human environment for social life from family, friends, and associates), and *environmental QOL* (subjective satisfaction with the physical-human-contextual environment) for fulfilling the physio-psychological human needs in the complex and multi-scalar city, region, community and neighbourhood (Zebardast, 2008). Since the core U2-CAS function is for informing urban policymaking, missing either side of the QOL aspects is incomplete. For example, leaving out the environmental QOL causes the evaluation system incapable of reflecting how well performed an urban development policy is and what needs to be improved and in which areas in policymaking.

Likewise, Mukherjee (1989) described the two prevailing perspectives in QOL research: One focuses on indicators determined by policymakers; the other pertains to expected well-being needs. Thus, the definition of QOL must be a marriage of objective policy-driven indicators and the subjective well-being evaluation for pursuing SUD. To (Compbell, 1976; Mukherjee, 1989; Marans & Stimson., 2011; Sadaghatnia et al., 2013; D'Acci, 2014; Marans, 2014; Low et al., 2017), policy-driven indicators and subjective well-being evaluation are the two distinctive approaches in studying and evaluating Uqol, respectively. Accordingly, a two-pronged Uqol evaluation system should be designed to collect data in a real situation for

investigating subjective well-being (SWB) served by the urban environment. The strength of the links between broad objective indicators and subjective evaluations of urban environments represent an ongoing research challenge for detecting how planning and other policy interventions might contribute to improving the Uqol (Low et al., 2017).

Although the mismatching of supply and demand in the QOL enhancement market would be detrimental to future urban development, the gap between the government and the citizens is still the normality because of the subjective reality and research gap. According to Marans (2014), the two separate approaches which are the policy-driven monitoring QOL through a set of indicators and the use of sample surveys for measuring people's SWB should be combined for examining QOL, but few studies exist that use both approaches to study QOL (Marans & Stimson, 2011). Moreover, Diener (1995) and Marans (2014) stated a need for developing a systematically measure conditions in cities using a variety of approaches constrained by time so that policymakers and planners can improve the urban condition for enhancing Uqol, which is also the common goal of all the stakeholders including the government and the individuals (Cavric et al., 2008; Van Assche et al., 2010).

By referring to the comparative analysis of six world-famous Sustainability-Uqol indices, in most cases, QOL is measured by indicators of the economy, human capital, innovation, infrastructure, opportunity, basic human needs concerning different themes set by different developers. Most of the time, the world QOL indices are divided into two distinctive clans, which are either policy-driven objective measurement or individual-driven subjective well-being survey. The users (urbanites) and the providers (government), confined by local constraints, are supposed to be the main actors/evaluators involved in defining and evaluating the real QOL for urban policymaking. As a result in the current QOL ranking systems, the quality and objectivity of the score gained by different cities under different stages of urban development lifecycle might not stand well in terms of comparability and practicality for either

the developed or the developing countries, e.g. the same QOL evaluation system or indices cannot be applied to both the developed urban living and the developing non-urban living. Since the evaluation of QOL is utilized to distribute limited resources and capital perfecting SUD while serving human needs, an urban sustainability evaluation tool must be equipped with tailoring capability for delivering sound results.

To Yin-yang universal law, the top-down and bottom-up parties (government and citizens) would be mutually inclusive if they are driven by the common goal, which is to improve people's QOL. The duality issue existing in the QOL evaluation system can be resolved by the Urban Quality of Life Dual-Adaptive-Complex System (U2-CAS), which was conceptualized with both approaches to perform an objective urban quality evaluation for informing better SUD policymaking. The objective and realistic evaluation report can facilitate resource allocation between the developed and developing regions to fight the global climate change problem.

3.4 DEFINITION OF QUALITY OF LIFE (QOL)

Quality of life has different meanings depending on what disciplines and who defines it. The multi-disciplinary U2-CAS is designed to uncover the definition of QOL of the critical hierarchical levels. The definition can be identified in different forms and affected by the adopted theory, concept, theme-goal, context, function, framework, system, tool, and human activities. It is determined by the subject human, whose value systems have been shaped by different demographic and geographical backgrounds, interacting inside the human-physical-contextual environment of the HES and the conceptual future SHE-City. Whereas, human values are defined as desirable goals, affecting the QOL evaluation and urban development, that serve as guiding principles in people's lives (Kluckhohn, 1951; Rokeach, 1973; Schwartz, 1992). Hence, the WoSu and the conceptual UxR become part of the definition of QOL.

An accurate evaluation of QOL helps urban development policymakers plan and assess the effectiveness of their urban projects (Kemp et al., 1997; Marans & Stimson, 2011). A better urban policy leads to better QOL and better human behavior is the key to enhancing governance. Given the context, the study and evaluation of Uqol are extremely helpful in enhancing the prestige of a government and its image locally and globally if an open-platform urban evaluation system can be successfully constructed and implemented.

Quality of life (QOL) by nature is abstract and subjective. Examining and understanding the definition of QOL becomes the agenda for developing the U2-CAS. After discussing the context of QOL, we can investigate the different aspects for definition. The review shows that the major portion of QOL research is from the discipline of Social Sciences (Marans, 2014; Sirgy et al., 2006), Economics (Phipps, 2002; Sen, 1999), Marketing (Peterson & Malhotra, 1997; Sirgy et al., 1995) and Psychology (Diener, 1984; Diener et al., 1985), and others. Sirgy (1986) defined QOL as the satisfaction of human developmental needs in a community or society, which can be interpreted as subjective personal overall life satisfaction (Huynh & Peiser, 2016). According to Marans 2014, QOL is a composite of an individual's psychological and physical well-being and closely linked to concepts like satisfaction, human development, happiness, and wellness. World Health Organization (WHOQOL Group, 1995) defines QOL as individuals' perception of their position in life in the context of culture and value systems in which they live for their goals, expectations, standards, and concerns. Although, the different interpretations of QOL lack consensus on the definition, especially, the SWB definitions of QOL are quite challenging to be quantified and assessed.

From the top-down policy-driven approach, Sirgy et al. (1985) defined QOL as a reflection of “value” in the market in which long-term satisfaction would be collected to reveal the overall QOL. What if this approach only includes measurement in the commercial market, then how about the social market and environmental market? Especially in the age of promoting

sustainability, "value" embeds social, economic, and environmental cost, and benefit cannot be excluded, and "it" should be included in the definition of QOL. Hereafter, the definition of QOL could not be defined by one or two disciplines, and it is indeed a multi-disciplinary system.

Fox (1974) argued that economic terms would be used to define QOL. The monetary value of compensation reflects the aggregate level of QOL. However, according to the finding of a SWBS conducted in this study, a ranking of the eleven Sustainability-Uqol indicators in descending order (health, environment, mobility-transportation, governance, people, social, economy, technology, ICT, smart living, and lifestyle), with the health ranked at first, and economy at seven place rejects Fox's argument. GDP figures can only reveal one domain of overall QOL and fail to address other crucial factors affecting people's QOL (European Commission, 2009; Stiglitz, 2009) cited by (Pinter et al., 2012). Only addressing income to define QOL is not adequate because monetary satisfaction can only reflect the standard of living, but not the overall life satisfaction residing in Maslow's Hierarchy Needs-MHN, particularly the psychological needs. Apart from material needs, non-material elements are also required to create happiness (Diwan, 2000). According to Kahneman et al. (1999), subjective well-being (SWB) has three dimensions: 1. Pleasant affect (joy, contentment elation, or indeed happiness as a feeling); 2. Unpleasant affect (shame, sadness, and anxiety); 3. Life satisfaction (either overall life satisfaction or satisfaction in specific life domains). Mainstream opinions in more advanced societies tend to differentiate 'quality of life' from 'standard of living.' The standard of living refers to the level of achieved satisfaction in basic materialistic needs. In addition to life satisfaction in basic physiological needs, QOL also covers satisfaction in emotional needs, such as being satisfied with freedom, justice, and opportunities for the complete development of individual capabilities. QOL research is concerned with an extensive range of topics, amongst which are: individual physical and mental health, well-being, satisfaction, family, work, housing, social relations, political and cultural lives, social ethics,

and others. In the context of MHN, if the 1st and 2nd levels of human needs (physio-psychological needs) are satisfied, Hedonistic happiness is fulfilled, which the SUD policies address presumably.

Bubolz et al. (1980) defined QOL as the quality of an interacting relationship with the environment. They viewed QOL as an environment providing enough resources to fulfill human needs (MNH). Together with the definition stated by (Marans & Stimson, 2011), QOL is the satisfaction that a person receives from the surrounding human-physical-contextual conditions (urban amenities, culture, and social services established by the government). It states the direct impact of the urban condition on residents' well-being growth, drawing the causality of sustainable place and well-being requests.

In such a notion, where people live will influence their QOL (Marans & Stimson, 2011), especially in the context of sustainable development (Van Assche et al., 2010). Logically, the cause-effect relationship between QOL and SUD is irrefutable, corresponding to the theme-goal of U2-CAS stated in the previous chapter. Long before, it has been acknowledged that sustainable development enhances QOL. Brundtland's definition of sustainability is "Sustainable development meets the needs of the present generation without compromising future generations' ability to meet their own needs" (Brundtland Report, 1987). Furthermore, the World Commission on Environment and Development (WECD, 1987) defines sustainable development in the context of QOL: "A global process development that minimizes the use of environmental resources and reduces the impact on environmental sinks using processes that simultaneously improve the economy and the QOL, including the proper distribution of QOL between groups and with other parts of the world" (Brundtland Report, 1987). By further elaborating the causality of SUD and QOL, the definition of QOL could be evolved from (urban + QOL) to Sustainability-Uqol indicators = (SUD-MHN).

Visibly and plainly, a healthy environment and the wise use of natural resources are vital for sustainable development, which provides the basis for long-term QOL. Echoed by (Brundtland Report, 1987; Budowski et al., 2015), the study concludes that QOL depends on the interplay between objective living conditions and subjective well-being because opportunities generated by the environment, such as the city, mobility, technology-ICT, labor markets, families and communities, employment and education, construct the meaning of QOL. This combined meaning demonstrates that QOL can be defined in a sustainable urban context, the future SHE-City linked by transportation-TOD, sustainability-SUD, technology-ICT, and MHN, and a Sustainability-Uqol evaluation generated by the WoSu. It is this narrative, the hypothetical model for validating the SHE-City (Figure 4.18) resides its rationale at.

3.5 REDEFINING QUALITY OF LIFE (QOL) INTO URBAN QUALITY OF LIFE (UQOL)

There are very few empirical studies aiming to examine the role of place and space in happiness and well-being, whereas living space is the main contributor to the QOL (Ballas et al., 2011). Besides, a definition based on different disciplines coming from different orientations is dictated by “who” defines the concept with what purpose (Lloyd et al., 2016). Also, the previous descriptive definitions of QOL have not been comprehensive yet specific enough to deliver the means-goal, function, and the different multitude of life satisfaction domains. In such a case, what is the utility and practicality of this type of definition if it lacks reality for further build-up because its existence draws no purpose and function in practice? Thus, an anchor point of the domain for redefining QOL was necessitated to increase the clarity and applicability of this study after a general revision of the selected literature in the first round. With further addressing and examining the concerned issues, sustainable place (goal) and transportation (means) were identified as the two added components to the preliminary framework of QOL definition due to their causation relationship. Whereas, Sustainability-SUD was adopted as the anchor parameter (a proxy of sustainable place) for easy communication

and implementation in the entire development process of the new proposed Uqol evaluation system.

In the case of sustainability, the public transportation network is no exception regarding its initiatives and core mission to support SUD. Transit-Oriented-Development (TOD) is the potent, sustainable urban planning tool that has been benchmarked and praised for its effectiveness in shaping the sustainable urban form by imposing a major impact on serving the needs of city users (urbanists). TOD is effectively connecting people to people, to business, to home, to work, to shops, to play, as well as to the rich culture and nature of the world augmented by ICT (Kahneman et al., 1999) in current and future cities, endorsed by United Nations (UN) and the relevant world institutions. In responding to the scheme of sustainability, the refined human-centric sustainability model as the core notion for conceptualization and illustration of a causal relationship between the four key components (TOD, SUD, ICT, and MHN), to investigate and understand the empirical implications of a future Sustainable-Human-Eco-city (SHE-City), while interpreting the “collective reality” through an urban evaluation system (U2-CAS). It is the subtle differences between the definition of QOL and Uqol in either with or without the urban context. QOL has less confinement in scope or level by comparing it to Uqol. However, noting that the terms 'QOL' and 'Uqol' have been interchangeably used whenever it suits in the context of studying.

The relationship between QOL and MNH by indicating a holistic definition of QOL should emphasize the social, emotional, and physical well-being of patients after treatment to those on their ability to lead a fulfilling life (Carr et al., 2001). It elucidated that without health, which is the fundamental QOL dimension and the 1st basic need level of MNH, there is no solid ground to define QOL. It subsequently concludes that without a sustainable environment such as fresh air, food, water, shelter, clothing, and mobility to support personal health, the

physiological and psychological needs will not be reached (Smith et al., 1997). Therefore, not only healthy life but also a sustainable place plays a decisive role in the overall QOL domain.

Regarding urban development on the impact of human development, Abraham's MNH theory denotes that developed urban areas in Europe, Australia, Italy, and the USA mostly expect satisfaction derived from higher-order needs (social, esteem, and self-actualization). Less-developed urban areas such as Sudan, Nigeria, Vietnam, and Pakistan mostly forged for satisfaction from lower-order hierarchical needs (biological and safety needs), in such order, the progression of satisfaction of needs in individual and social development is dictated and directed by the pace (time factor) of urban development. Furthermore, space and place are fundamental components of the lived world; particularly, men organize space for serving their biological needs and social relations (Tuan, 2001). Time concerning social needs: “trust”, “social cohesion”, “belonging”, and “social well-being” is nurtured through time-space-movement in the place which shows the importance of social capital, social well-being, and local community networks to our QOL (Ballas & Tranmer, 2011). This urban living system is established by the causation between the physical environment and the contextual environment to personal choices and QOL. The higher the choices, the greater the human development and the better the QOL or vice versa, by assuming the absence of equilibrium and economies of scale. In this sense, the relationship of time-space-urban place, MNH, and the human-physical-contextual environment is documented, and the essence of QOL is stated. More to this, the territory attributes of QOL are understood, and its subjective and objective nature is depicted accordingly.

The above source reinforces the validation for placing SUD as the vital component for redefining QOL into Uqol. Since Uqol is constrained by time and space; transportation becomes the locomotion and facilitator in moving people and goods in the human-physical-contextual environment (SHE-City) while SUD is the interactive agent impacting QOL directly

through leveraging between economic, social, and environmental sustainability, catalyzed by ICT. In terms of MHN, associating the relationship between physical urban platform and socio-economic, physiological, and psychological needs as the context to provide for the functional meaning of Uqol.

At this stage, the human-physical-contextual environment is derived from the theoretical base, which forms the urban platform for building the SHE-City. The SHE-City is made up of four identified components, which are Transportation/Transit-Oriented-Development (TOD), Sustainability/Sustainable Urban Development (SUD), Information-Communication-Technology (ICT), and Maslow's Hierarchy of Needs (MHN). (Figure 3.1) is a visual presentation of transforming QOL from its rhetoric narrative to its physical urban platform, the SHE-City. It is continuously evolving into a Wheel of Sustainability-Uqol (a composite of Uqol indicators) for evaluating Uqol.

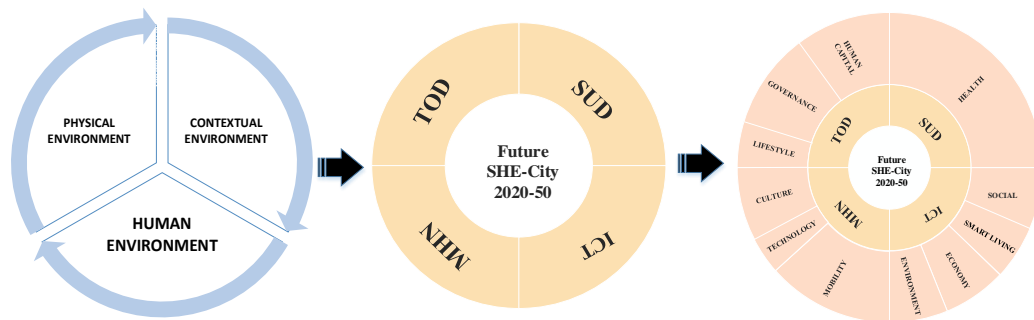


Figure 3.1 Redefining QOL into Uqol

According to Plato and Aristotle, everything has an essence: a certain set of core properties that are necessary, or essential for a thing to be what it is. Then the essence sets the purpose and function. In this section, the essence of Uqol has been identified. Correspondingly, the formula for defining QOL is revised along this reasoning and materialized by proposed U2-CAS. QOL can be defined as the $Uqol = F(SUD, TOD, ICT, MHN) = SHE-City = Sustainability-Uqol (TOD-ICT \Rightarrow SUD-MHN)$. Worth noting that, the variables can be replaced subject to the theme-goal of study. The next chapter is to illustrate the formulation.

CHAPTER 4: RESEARCH METHODOLOGY

The mixed-methods research practiced by (Manee et al., 2013; Montserrat & Casas, 2006; Nzeadibe et al., 2012; Wren et al., 2006) was adopted to develop, review, examine and validate the proposed U2-CAS. Both qualitative and quantitative justifications were selected as the suitable means to coordinate complementary outcomes with the main principles of developing and verifying the proposed new system. The mixed-methods research strategy can ease systematic bias to achieve better research results (Creswell, 2009). It allows utilizing secondary data as the means to explore and understand social or human issues while collecting primary data for testing the theory-based model and examining the relationship among the critical variables. The methods have been used to process the investigation with a two-round balance and check triangulation technique involving a diverse range of methodological tools such as literature review, field observation and visual verification, comparative analysis, interviews, survey, and pilot test to answer and interrogate the questions raised corresponding to the research aim, objectives, and hypotheses. This chapter documents the theoretical and analytical stages of the ORF and ratifies the two objectives for certifying the U2-CAS. The theoretical base defines the future SHE-City (objective 1). The analytical illustration constructs and validates the SHE-City, and WoSu (objective 2). (Figure 4.1) outlines the mixed-methods research to achieve the two objectives for confirming the proposed U2-CAS.

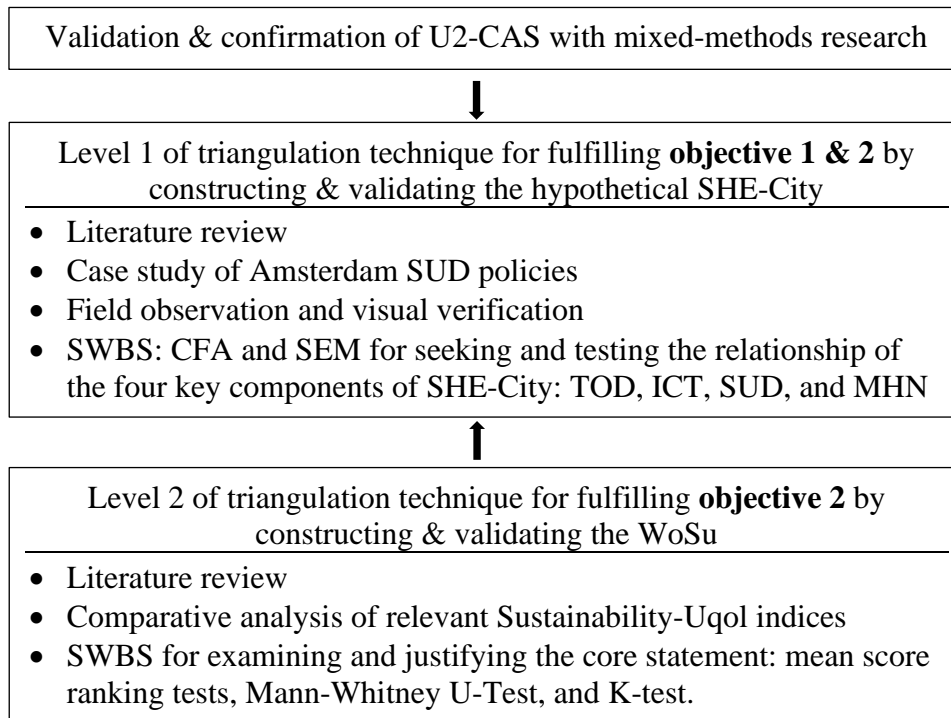


Figure 4.1 Hierarchy of Research Methodology for Confirming the U2-CAS

A. LITERATURE REVIEW

A literature review is the crucial qualitative research methodology to study, examine, investigate a research subject so that research aims, gaps, needs, contributions, and themes can be identified, and systems, models, or frameworks can be conceptualized. It is a conventional method for research involving the review of academic journals and books, as well as collecting secondary data for analysis, to provide a context of the research subject for the readers. Citation is highly employed to establish theoretical and conceptual support for justifying the construction of the proposed SHE-City, and WoSu.

B. INTERVIEWS

An interview is a qualitative research method used to explore and describe the meanings of central themes of the investigating subject. The main task in interviewing is to understand the meaning of what the interviewees say to reveal both a factual and a meaning level (Kvale,1996). Interviews are particularly useful for getting the story behind a participant’s experiences, which

is insightful information around the topic. Interviews may be useful as follow-up to certain respondents to questionnaires, e.g., further to investigate their responses (McNamara,1999). The informal, conversational interviews were conducted to seek the insightful opinion of the impacting QOL factors perceived by the international interviewees (Appendix I). 12 face-to-face interviews of international respondents conducted in 2018/2019 revealing that the hidden critical factor for urbanization is generally job opportunity disregarding geographical factor. The findings of the interviews serve as a supplement to the concepts identified by the literature review.

C. CASE STUDY

It is an in-depth examination of the studied subject, an effective way of gathering the type of relevant information and qualitative data with extensive detailing of conditions and events. It is a progressive study, that data can be collected through reviewing official secondary materials, field observations, questionnaires, and interviews to explain the present situation or verify the core statement. In this research, an overview of Amsterdam's SUD policy was treated as a supplement to the fundamental research methods. It reinforced the four key dimensions of the future SHE-City: TOD-ICT-SUD-MHN defined in the theoretical base stage.

C1. Field Observation and Visual Justification

Field observation is a social research technique applying for direct observation of phenomena in the field and collecting information on the site, which is extremely important for empirical study. Methods include interviews, case studies, on-site observations, etc. This qualitative research method aims to observe, analyses, interact and understand people and their surroundings. It is the means to collect primary resources for analysis. In this study, visual justification is supplemented for easy communication. For example, pictures taken from the

field trip of Amsterdam were utilized as a supplement for increasing the reliability of the claim from the case study.

D. COMPARATIVE ANALYSIS

Comparative research is a research method for comparing two or more subjects with the purpose to locate similarities or patterns about the compared items or cases for studying the prescriptive nature of things. Although quantitative analysis is often used than qualitative, in the Sustainability-Uqol indices review, the WoSu was constructed through a comparative study.

E. SURVEY (DESIGN AND CONDUCTION)

Although there are many different types of descriptive research, the focus is often on survey research. The essential tool used in survey research is the questionnaire sampling and pilot interview: collecting opinions from foreigners/locales/professionals/professors/students. A survey is a prevalent and effective research methodology to collect primary data to study a human research subject such as this one. It is an effective instrument to detect people's perceptions. So, the subjective evaluation of QOL is reflected by primary data collected through sample surveys responded by individuals about their self-evaluation of life satisfaction or living environment, including psychological factors (Carley, 1981). Survey data collection often depends heavily on the design of the questionnaire. A survey can generate a general view, examination, or description of the studied subject, such as the definition of Uqol or the performance of urban development policy. In this research, the subjective well-being survey (SWBS) provides the critical data to support the scientific investigation of the proposed U2-CAS.

E1. Focus Group

The focus group is for verifying the SWBS questionnaires. The ten members focus group was carefully selected who were/are the experts from the sustainable urban development faculty of Politecnico di Torino, including the vice president, green team coordinator, architects, professors, and Ph.D. students. The preliminary survey questionnaire was tested and discussed in the focus group twice to improve its feasibility and credibility.

E2. Sampling

It is a low-cost and faster data collection method to estimate the representation of a whole population. Sampling is the selection of respondents from within a statistical population to estimate the whole population's representation. It is a popular and effective survey method. Simple random sampling embeds sampling error because the randomness of selection might not represent the composition of the statistical population. Although it has been mentioned that accidental sampling cannot scientifically generalize a case study because of a lack of representation, for the global SWBS, accidental sampling was adopted due to its ready availability through the internet. Studying QOL is a universal reality concerning each person's fundamental well-being in the society, sharing the common needs of DNA; thus, this sampling method is the suitable sampling technique for conducting the Uqol survey with the least time and cost. One must know that the rule is fixed, but our daily life runs constantly, and the way we initiate, learn, investigate and manage each matter should accommodate the real situation with flexibility.

F. PILOT TEST

A pilot test is a preliminary study conducted to evaluate the feasibility, duration, cost, and adversaries of the studied subject, system, model, or framework. Through conducting a pilot test, the practicality and challenges of U2-CAS could be explored and learned for further

development and improvement while creating the conceptual UxR development framework for developing countries.

4.1 THEORETICAL BASE

Articulating the theoretical assumptions of a research study allows researchers to address why and how (e.g., the relationship within the nucleus and sub-nucleus, why are those substances being included, and how do they interact with each other?). The theoretical based stage explains the rationale for conducting the research. It permits the researcher to intellectually transform from merely describing a phenomenon that has been observed to generalize various aspects of that phenomenon. In reality, if the city policymakers expect a practical urban evaluation tool for evaluating and improving urban planning policies, then the definition of Uqol must include both subjective (human-contextual environment: needs of the users) and objective (physical environment: urban facilities) dialogue to secure practicality and effectiveness of the tool (Rapley, 2003), as much as established and confirmed by the literature review, case study and SWBS conducted in the study. The theoretical threads support the practice of a theme goal of “SUD enhances Uqol”. The working framework (U2-CAS) should be identified, understood, prioritized, categorized, and incorporated according to the specification of principles, approach, parameter, theme-goal, and local context (Sharifi & Murayama, 2014). The path could be connected by economic, social, and environmental characteristics of urban living (different schemes of sustainability and satisfaction with different living domains or human needs) in a real situation (Marans & Stimson, 2011). A theoretical framework identifies which key variables influence a phenomenon of interest and enriches the study’s context. Basically, we need to understand the origin in order to identify the components to define the subject matter.

4.1.1 Rationale

In the beginning, Chinese Yin-yang universal law from the Book of Changes was premised as the fundamental principle for reasoning the overall research framework (ORF) because all information whatsoever can be translated into terms of Yin and Yang according to the well-known British philosopher, Alan Watts. The concept of Yin-yang lines at the basis of Taoism advocating balance. But the profundity of its principle goes beyond that. The idea behind Yin and Yang is kind of paradoxical. The black and white stand for two opposing forces that are also complementary. Due to time-space, the mutual attraction and repulsion of the binary ends trigger constant mutation of all matters existing in the universe, such as life and death, winter and summer, as well as femininity and masculinity. The Yin and Yang pattern is the essence of binary code, consisting of “one” and “zero”. Their relationship is managed by the constant gravitation of the two ends like a seesaw, which is exactly the impetus for reaching the state of equilibrium cherished by the scheme of sustainability, and the supply-demand theory. To Yin-yang, everything is a complementary manifestation, create, support, and regulate each other for transforming the old to the new constantly by merging both ends in a hierarchical order transporting in time-space.

Being regarded as the essence of ancient Chinese philosophy, Yin-yang advocates harmony in development, same as the scheme of sustainability. In the period of globalization, industrialization has been fanned by modernization for economic growth and livelihood enhancement while threatening the harmony between Man and Nature. The economy-led urbanization comes across as abusing our power by depleting the natural resources since the 1st industrialization. Before it is too late for Man to recourse to the sustainable path, Yin-yang as the guiding principle is adopted for restoring harmony in the HES. In the meantime, the global concept of sustainability can be translated as the modern sense of harmony. In such a notion, we can easily notice that this research is a discourse of the past-now-future.

We need to explore an innovative way to readjust the human power of balance allowing us to behave responsibly to the world and strike a balance between development, technology, and human needs attaining to nature. Here I resort to the Yin-yang universal law, which is upheld by balance and compromise, mirroring the attributes of sustainability. Yin-yang law can be used to categorize the different layers of reality in the world. Its central idea is to interpret the intrinsic characteristics and laws of natural operation and interpret the alternation of Yin and Yang dualism to describe and explain everything in the world. With the core principle of “seeking common ground while embracing differences”, Yin and Yang exist within each other for encouraging communication and cooperation, not exclusive from each other. Only through each pole’s interaction to produce and form a new scenario of the event or a new state of the world. *The core principle allows ambivalence to be neutralized with movement in time-space, which provides the primary theoretical base for developing the U2-CAS*, together with the theme-goal of “SUD enhances Uqol” to guide the development of U2-CAS.

To the action-based evaluation system, the concepts of understanding and enhancing are the two acts reflecting and encouraging people in learning knowledge and recognizing reality for improvement in life. Through evaluation, "individual realities" can be communicated and merged into the “collective reality” so that mutual understanding and trust can be developed for cooperation among stakeholders in urban policymaking, developing and operating with a fair outcome. For understanding, the U2-CAS is developed to identify and define the context of urban quality of life (Uqol). For improvement, evaluation is performed by the theme-goal WoSu to aid in developing, monitoring, and improving SUD projects for uplifting people's livelihoods.

The rationale for developing the U2-CAS is built to improve understanding, evaluating, implementing, and living. As the basic idea stated before, human interacts with the natural environment created/creates the human-made world, the reality of “All”. The Environment-Behavior (E-B) theory explains that human being (the subject) and the environment (the object) are the two key "Actors" making up the HES, in the form of 2 in 1 (Symbol of Yin-yang) interacting with each other regularly for manifesting the meaning of existence or reality (Cosmonomic Theory). In language, the definition of any word is quite general and uncertain because the same word can be changed in meaning if it is being used in different domains or tiers of reality or likewise, interpreted by people with different demographic backgrounds residing in different areas. However, the origin of reality and the meaning is relatively the same because it is the closest to the "Truth." This idea enables U2-CAS to draw its rationale from the Yin-yang universal law (the law of reality and the definition of “ALL”) along with a series of Western classical theories to aid in understanding our surroundings and well-being needs.

Reality is an ever-changing story with time-space as the pre-condition, expanded into a complex-adaptive system to form the Human Ecological System (HES), which can also be viewed as the rhetoric interpretation of reality. The theoretical HES is a hierarchical system built in a movement of classifying and ordering, a nested circle made up of a list of theories. The theoretical base consists of an internal aspect, identified as the “subject” (Habitus idea, Environment-Behavior theory, and MNH model) and an external aspect of the “object” (Dooyeweerd's Cosmonomic theory). The theoretical definition of reality (HES) starts from the inception of “Reality”, which is the origin of the research being morphed into the human-contextual-physical environment of the

SHE-City. This nested circle illustrates the fundamental definition of QOL, where the reality of “All” originated (Figure 4.2).

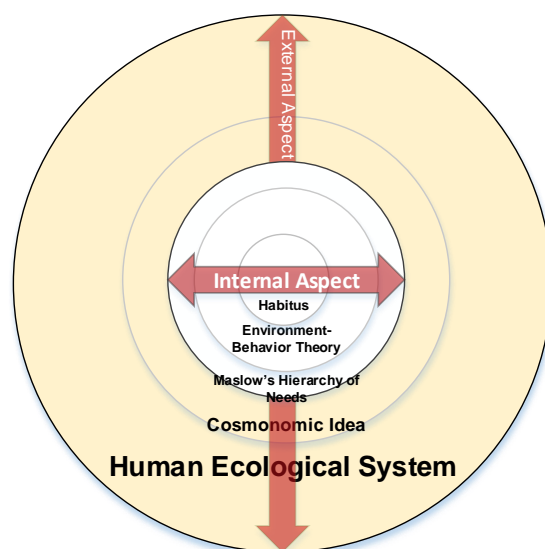


Figure 4.2 Human Ecological System (HES)

4.1.1.1 Internal Aspect (Subject)

Habitus

Habitus idea (Bourdieu, 1990), introduced by the French sociologist Pierre Bourdieu, stated a social group affected by its human-contextual-physical environment to form a distinctive set of values, ideas, and practices categorized by habits, skills, and dispositions, distinctively grouped with similar backgrounds (ethnicity, nationality, education, profession, and social class). His idea explains why human values and behavior are essential in defining the nature of society and the rooted reasons for the distinctive disparity of Sustainability-Uqol rankings between the developing and developed countries.

In urban studies, Lefebvre’s argument implied that the shift of research perspective from space to process of its production; the embrace of the multiplicity of spaces that are socially produced and made productive in social practices; and the focus on the contradictory,

conflictual, and, ultimately, the political character of the processes of production of space (Lefebvre, 1991) manifests the same principle as the urban complex-adaptive system (CAS). Both ideas depict a world made up of human value and behavior where is evolved with constant contraction. At the same time, conflict is the objectivity of progression in society in line with the Yin-yang law.

Environment-Behavior Theory (E-B)

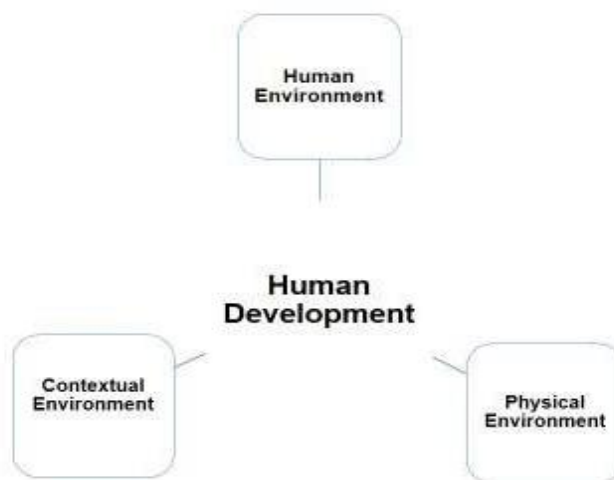


Figure 4.3 Environment-Behavior Theory

In the individual, household, and community levels, Environment-Behavior Theory (E-B) was supported by Habitus idea (Bourdieu, 1990). It is the next level of reality evolved in time-space. Environment-Behavior Theory (Figure 4.3) describes the relationship between urban landscape to human behavior and the interplay of the human environment, contextual environment, and physical environment (human-contextual-physical environment), which is the integral part of the living environment for humankind (Evans, 1956; Porteous, 1977). This idea was further developed into the discipline of environmental psychology, a field of study that examines the interrelationship between environments and humans, cognition, and behavior (Bechtel & Churchman, 2002; Gifford, 2007. Stokols & Altman, 1987). As a living organism, this network is built through daily ways of living to form a sub-network called “choices”, which is the crucial factor for defining human development. *Importantly, freedom of choice is*

governed by urban policy, which signals a cause-effect relationship between ways of living and urban policy, drawing up the link of SUD and MHN.

Environment-Behavior Theory (E-B) explains why there are different images generated by different world cities because of the fluid nature of activities (economic and social) generated by human interaction within the physical-human-contextual environment through time. Thus, one can state that a different city has different societal characters contributed by the inhabitants. Reconfirmed by *The Production of Space* (Lefebvre, 1991), it indicates that space is a social product, a complex social construction (based on values, and the social production of meanings) that affects spatial practices and perceptions. Given the significant support from the above scholars, the interrelations in the physical-human-contextual environment linked by human activities, a living space, a society, a community, and a city are justified, so as the SHE-City. Subsequently, the synergy of the physical-human-contextual ecosystem shapes the attributes of QOL, and its subjective nature is authenticated. The narrative is elaborated into hypotheses 1 & 2. The importance of spiritual and cultural elements manufactured by collective human behaviors is the theoretical base for addressing the human-contextual environment, together with the physical environment provides the rationale for hypothesis 3.

1. QOL is subjective due to demographic and geographical differences.
2. A disparity exists in the ranking result of the Sustainability-Uqol indicators/criteria between developed and developing countries.
3. SUD, TOD, ICT, and MHN of SHE-City are the main dimensions for defining people's Uqol.

The contextual-driven society manifests the power of cultural evolution, which firmly becomes the theoretical base for the claim of “cultural influence in urban development decision making is significantly prominent.” Indeed, well-being has cultural roots (Christopher, 1999). Maybe, addressing the contextual environment in the process of socialization and urbanization is the best way to lead to socio-economic prosperity and security through sustainable human development. In the theoretical aspect, the reality is made up of any interaction of human to the physical environment¹¹, contextual environment¹², and human environment¹³, morphed from its original nucleus into a complex-adaptive system (CAS), to its extreme, simulation can dominate the operation of a real-world process or system over time, losing its link of origin (Baudrillard, 1994).

Maslow’s Hierarchy of Needs (MHN)

To Aristotle, "happiness is the meaning and the purpose of life, the whole aim, and end of human existence." According to Psychologists David Myers and Freud, happiness is a long-term meaningful and pleasant feeling of life contributed by inborn needs (Myers & Diener, 2018). The feeling of happiness is subjective and depends not only on external factors (Susniene & Jurkauskas, 2009). The Maslow’s Hierarchy of Needs (MHN) is not only the appropriate idea to state human needs in different tiers but also categorizes motivation in people to reflect the hard to define context of happiness, whose collective motivation and movement are the impetus for building a prosperous, sustainable place that can sum up by the definition of Uqol in the U2-CAS. MHN is one of the four critical components for making up the future SHE-City. Maslow arranged human needs for growth into five ascendant stages (Figure 4.4), they are basic physiological needs (health, food, sex, water, and shelter), safety needs (security

¹¹ The physical environment is the urban fabrication made up of nature, transportation system, open public spaces, buildings, and matters in the economic and environmental domains.

¹² The contextual environment is the cognitive stock made up of tradition, language, culture, and history in the society.

¹³ The human environment is made up of humans and management in society.

of body, health, finance, and shelter), a sense of belonging (friends, family, social communication and community), esteem (confidence, recognition, and respect) as well as self-actualization (justices, creativity, and fulfillment) (Maslow, 1943). To make sense of the study in real life, the five levels of needs were modified into three levels of physiological needs (physiological and safety), psychological needs (love/belonging and esteem), and spiritual needs (self-actualization). In this study, the U2-CAS aims to improve MHN in the context of SUD, which generates the theme-goal for the development. MHN depicts that the impact and importance of each level of needs are subjectively viewed by individuals with different backgrounds (life experience) and different cities experiencing according to different city development stages. For example, in some developing cities, the economy is the nuts and bolts for securing their people's safety and physiological needs. For those developed cities like Hong Kong, Shanghai, Taiwan, London, New York City, Tokyo, Seoul, and Paris, the needs for belonging, esteem, and self-actualization are more important than the basic needs because people living in the developed cities have been satisfied with the basic needs level as the pretext.

According to the revised MHN, "QOL Reality" is categorized into hierarchical order of human needs in physiology, psychology, and spirituality. According to Maslow's theory, only fulfilled the lower level needs can allow the upgrade. It means that "level 3 physiological needs" being satisfied is the pre-requisite for reaching "level 2 psychological needs"; subsequently, reaching "level 1 spiritual need" is subject to the fulfillment of "level 3 and level 2 needs". The MHN hierarchical advancement system leads to dividing the two distinctive Sustainability-Uqol ranking groups (developing countries vs developed countries). The former tends to value the basic "level 3 needs" over "level 2 needs", but the latter tends to value "level 2 needs" after satisfying basic "level 3 needs".

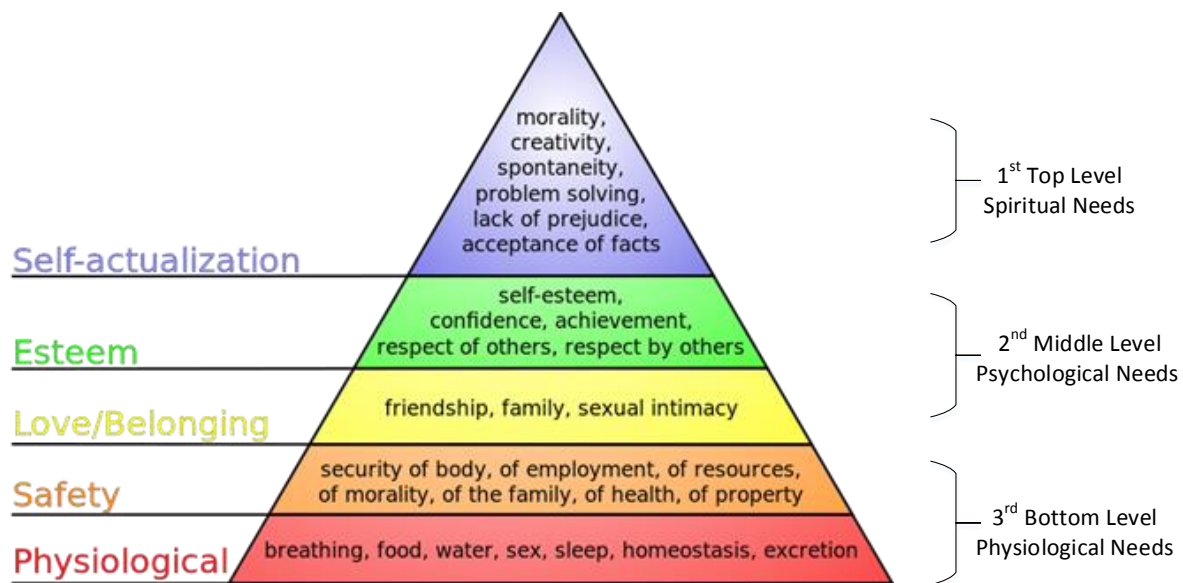


Figure 4.4 Maslow's Hierarchy of Needs (MHN)

Source https://commons.wikimedia.org/wiki/File:Maslow%27s_hierarchy_of_needs.svg

4.1.1.2 External Aspect (Object)

Dooyeweerd's Cosmomic Idea

Theory of the Cosmomic Idea of Reality introduced by the Dutch philosopher Herman Dooyeweerd formulates the interrelationship between environment, humans, and technology by nesting 15 modalities within each other, the greater the distance between each modality, the less the influence on each other in abstract discourse. In the post-truth era, people have been further driven away from the origin of reality (Baudrillard, 1994). For example, people from the developed countries have been habituated to think that chickens are from the supermarkets because they do not have the concept of "chicken is raised on a farm". Misunderstanding between people is enlarged, and more likely, conflict grows due to the enlargement of distance from the origin of reality. The Cosmomic Idea (Herman, 1997) is a framework to illustrate the meaning of reality categorized and defined by substance of the 15 modalities: things exist by reference to each of 15 modalities: e.g., a car exists *physically* as a load of steel, plastic, etc.; *kinematically* as a mode of transport; *socially* as a status symbol; *economically* as a dent in our

finances; *aesthetically* as a thing of beauty; *biotically* as a pollute. The being of things is multi-aspectual, the same as the definition of Uqol and the hierarchical pattern of the U2-CAS. Aspects are the ways of being meaningful and are the “law side” of created reality. Each modality proliferates and implies that the layers of reality are multi-disciplines-dimensions as a CAS. The multi-disciplinary-dimensional U2-CAS was developed echoing the principle of Cosmonomic Idea. With an attempt to define the Uqol from its abstract context to the specific composite of Sustainability-Uqol indicators, the U2-CAS was created to facilitate mutual understanding among the stakeholders, that has been stated. Based on the same practice, the two models are shaped almost identically (Figure 4.5) in principle, but the U2-CAS is filled with a series of unique microsystems subject to its theme-goal.

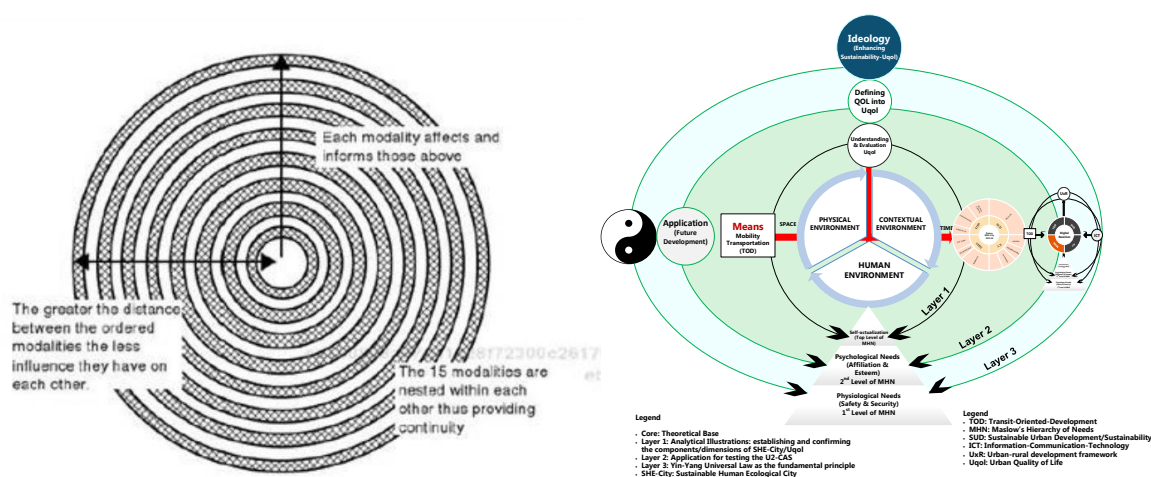


Figure 4.5 Dooyeweerd’s Cosmonomic System and the U2-CAS (Source: Herman, 1997; Author’s Own)

Internally, urban space is shaped and molded by individual demographic and geographical backgrounds, value, thought, and behavior to create the “collective reality” consistently. Externally, according to Kevin Lynch: the image/identity of a city is an organic body, every city should have its city image through the collective characters of its people, not the physical structures like the tallest building in the world or the most intrigue development complex constructed (Lynch 1960). In society, the “object” has won, and the “subject” has

been lost in postmodernity¹⁴ (Baudrillard, 1994). In such ideas, *a positive city image shaped by its positive social context and ways of living is a metaphor of a prosperous city (SHE-City)*. The SHE-City must be built by positive human development strategy driven by motivations, which can be explained by the Habitus, Environment-Behavior theory, and MHN theory. Indeed, a city is created and built by the inhabitants' contextual reality, more precisely the "collective reality" in society, not the physical skyscrapers, which is only the superficial layer of reality. If people's value system is nurtured with positivity, a sustainable and prosperous place would be built. However, *the gap of "objectivity" and "subjectivity" is a challenge for development policymaking, at the same time, whoever can create, define and neutralize "individual realities" into the "collective reality" for unity, whoever can succeed in building the ideal habitat/society which would be a visual representation of the inhabitants' mind and soul*. In such logic, improving urban conditions can enhance Uqol and vice versa, which is the theme-goal of U2-CAS drew from.

According to the internal and external theories, the theoretical Human Ecological System (HES) was set for conceptualizing the future SHE-City. Introduced by (Bubolz et al. 1980), an ecosystem built on the E-B theory is the interaction of humans, the envired units (e.g., buildings, transportation, and commercial market) with their interrelated environments (a fluid state), which would be understood as the effect imposed by the cause and the process of development. The ecological system considers humans as an integral part of the co-evolution of nature, the physical and virtual environment in the 21st century. Bubolz's framework recognizes the role of the human as an agent to transform nature into human-made objects such as landscape, economy which city becomes one of the outputs. Such a notion draws out the inter-relationship and central role of human well-being, the living environment, and the

¹⁴ The economic or cultural state or condition of society is said to exist after modernity.

economy. Hence, if urban policymakers want to plan for SUD, then they need to assess subjective well-being and urban living quality.

In the secular world, Bubolz's idea indicates that reality equals the production of humans (subject) interacting with the substance (object: both natural and human-made; tangible and intangible). Nothing can escape from human intervention if the human is the subject. In daily practice, mobility becomes the locomotion for producing and manufacturing society, an urban place, or a city for enhancing human interaction and liveability. Thus, an Uqol evaluation can reflect the aspects of the envired units, environments, and their interaction motivated by transportation-TOD. To apply Bubolz's ecosystem idea into this research and design an evaluation system, a common platform (human-physical-contextual environment) must be justified theoretically before identifying the critical components of the SHE-City. Undeniably, TOD becomes one of the critical components to make up the SHE-City.

4.1.2 Future Sustainable Human Eco-City (SHE-City)

Nietzsche once said: “The world is beautiful, but has a disease called man.” To cure the disease and grow a sustainable city, should humans be focused as the main actor in designing, executing, evaluating, and monitoring sustainable urban development policy? If all human-made systems are created for people to use, logically, any issue is caused by the people and should be solved by the people (解鈴還需系鈴人). Since the introduction of industrialization, urban living becomes the aspiration and the norm of the world population, especially in the demand of developing countries nowadays. Unfortunately, the more the people living in the cities, the faster the acceleration of city problems such as crime, unemployment, racial tensions, an influx of immigrants, inequality, congestions, pollution, and so on. SUD becomes the key challenge of urban development policy in many governments. According to the UN's current advocacy, the agenda 2030 lists 17 Sustainable Development Goals (SDGs) and 169 targets for

transforming the world into a sustainable and resilient place. The top 5 goals are human needs-based including 1) no poverty, 2) zero hunger, 3) good health and well-being, 4) quality education, 5) gender equality and goal 11) building sustainable cities and communities.

Moreover, the redefined five dimensions of building a prosperous city by the (UN-Habitat, 2013) are productivity, infrastructures, quality of life, equity, and environmental sustainability, it clearly states that the human factor itself plays a vital role in developing a sustainable, prosperous city, not limited to an economic goal. Human elements and content are looked upon as the protagonist during SUD. Along with the Paris Climate Change Conference (COP21, 2015), in December 2015, a human-centric city paradigm was recognized more effectively and efficiently in combating adversaries. If we look into the fundamental cause of all the urban and global problems human are facing is the “quality of human,” the human factor (internality) is indeed the initial solver, not necessarily the externalities physical or economic offerings (state-of-arts sustainable buildings, open spaces or smart living...). The global sustainable agenda prioritized the human environment, accompanied by the physical-contextual environment providing a foundation for developing the conceptual SHE-City of TOD, ICT, SUD, and MHN, which will be elaborated into the eleven Sustainability-Uqol indicators for enhancing policymaking while improving people’s livelihoods.

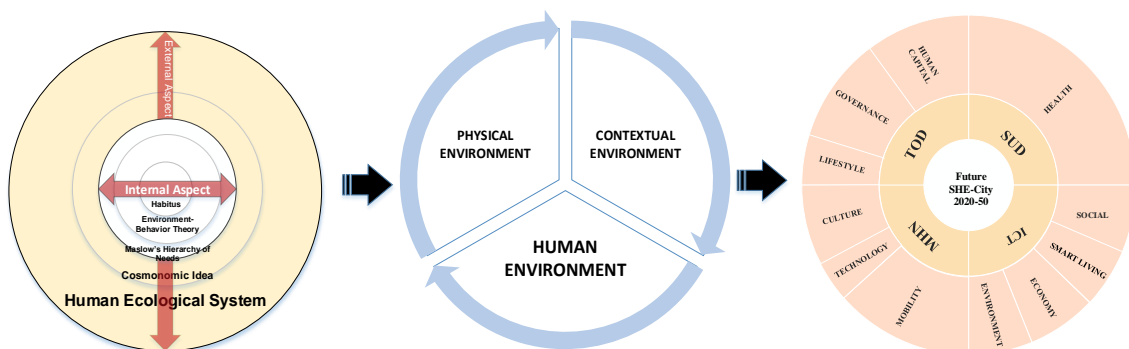


Figure 4.6 Evolution of SHE-City from Theories to the Two-Pronged Wheel of Sustainability-Uqol

(Figure 4.6) illustrates the development of SHE-City from a series of theories evolving into an urban platform motivated and activated by mobility/transportation-TOD, sustainability-SUD, information-communication-technology (ICT), and Maslow's Hierarchical Needs (MHN) on the urban human-physical-contextual environment (H-P-C) to form the two-pronged Wheel of Sustainability-Uqol (WoSu).

The future SHE-City is defined by TOD, SUD, ICT, and MHN because they are the main drivers to secure productivity for economic and social advancement. Since the city is the physical urban platform where socio-economic-ecological systems interacting among the physical and virtual infrastructure confined by the limited resources, in which the urban development policies aim to enhance human development. Historically, productivity dictates the growth of urban development driven by economy-led urbanization. The Industrial Revolutions allows economic growth while unleashing our current environmental crises (Romero-Lankao et al., 2016). For example, the three times of Industrial Revolutions were initiated from the West, enabling the once undeveloped countries to transform into developed countries with the help of technology in the USA, UK, Canada, Japan, Germany, and France. However, the overexploitation of our limited resources endangers future sustainable development at an alarming rate, requiring immediate solutions for actions. Therefore, pursuing SUD must involve the rethinking of the future urbanization paradigm, providing the theme-goal in the application stage of the study.

SHE-City offers the physical parameter for constructing the WoSu and confirming the U2-CAS ultimately. The human-centric sustainable place was endorsed by belief, theories, the idea of harmony, and sustainability. *The development of a city would be shifted from only focusing on external materialistic needs to embracing internal human needs and the enhancement of the economy-driven urbanization path to the somewhat meaningful, ecological, and practical, sustainable human-centric city.* It is the original concept, which the U2-CAS

argument is based on. It encourages people to actively act upon the SUD agenda and become self-motivated environmentalists following the EU's sustainable agenda, eventually contributing to a healthy urban way of living.

Why SHE-City?

The topic of "What is the sustainable model of a future city and how the future sustainable city can be realized with collective efforts from city leaderships, urban planners, developers, institutions, a city agency, and community residents/urbanites for securing environmental sustainability as the condition and the goal at the same time, in both the developed and developing regions?" has been discussed and headlined in major world forums organized by United Nations (UN), European Union (EU), World Economic Forum (WEF), Association of Southeast Asian Nations (ASEAN), Asia-Europe Meeting (ASEM), Asian-Pacific Economic Cooperation Council (APEC), African Union (AU) and Arab League (AL). Alkadhim (2016) and Shamsad Akhtar (Ex-Under-Secretary-General of UN) advised that the world cities must undergo a strategic review process and consider what kinds of cities they want to be, their priorities, partnerships, and where they stand now. Whereas, most policymakers in the world still use GDP as the key index to design and assess urban policy because it is the indicator to measure the performance or effectiveness of economic policy in the country. Since 1934, GDP has been developed into the sole indicator in reflecting the growth of the country's economy and the improvement of QOL in the developed countries. For the past decades, severe attacks by academics have been placed on the economic-driven approach to evaluation systems. Economists from Italy, France, and Canada have criticized the GDP's lack of reflecting the well-being of 21st-century society. However, leading global political objectives have been skewed toward the pursuit of economic growth (The New York Times, 2010) because most cities were built upon the ideology of capitalism as per Henri Lefebvre. This contest has been a dilemma in urban development.

Evidently, cities do not always present a rosy picture, and many cities are facing social, economic, environmental, and political problems generated by rapid urbanization. Pressing issues like overflow with informal dwellers in Paris, Beijing, and Mumbai, the high crime rate in New York City and natural disasters like Tsunami and Earth Quake, enormous gap between rich and poor, the high unemployment rate in Spain and Italy, segregation and immigration, stress on environmental protection (raise water level) and poor urban management, are waiting for solutions in many cities around the globe. All these city problems directly or indirectly affecting the quality of urban life and urban sustainability.

Although many city governments claimed that their urban development policies were human-centric and oriented around the scheme of sustainability. Unfortunately, the whole deal was only marketed as a "slogan" to support its city branding strategy, mostly not an action-based project effectively implemented and followed by city planners and policymakers. It is quite difficult for anyone or any authority to challenge the ideology of capitalism, which has been deep-rooted in capital-led urbanization for many centuries. Given time, urban issues mentioned previously have been deepened historically, economically in the market, mentally in public, and swiftly in space. We, humans, are the agitators to intensify the unsustainable situation by interacting with the environment habitually daily, monthly, and yearly in an abusive manner. It has been quite challenging to change this cliché without cogently addressing the issues to raise public awareness in the community.

On the other hand, in the field of SUD study, there is a wide array of literature reviews discussing and analyzing social, economic, and environmental issues. However, the problems grow faster than the rate of mitigation. Even though the trendy urban development heavily focuses on the sphere of economic, environmental, and technological development, such as eco-city and smart city, they have not been capable enough to solve the pressing urban struggles.

Here, the future Sustainable Human Eco-City (SHE-City) was conceptualized as the alternative urban development model for improving urban sustainability.

Indeed, economic growth without social progress cannot be the way of future city development. In recent years, advocating social progress has been a trend for many developed countries like the USA, Switzerland, Finland, UK, Germany, and New Zealand. Social progress is defined as “the capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential” (Social Progress Index 2014).

At present, the multi-polar world, economic globalization, cultural diversity, and information advancement are the reality of living. However, the instability and uncertainty of the international situation have become more prominent. Global challenges such as climate change, social unrest, and trade war, have overwhelmingly destroyed the balance of global sustainability, especially the social and environmental pillars, and even endanger the world order. Only when humans can work together in a trustworthy manner can humans leap over the obstacles and move towards a better future where an ideal city can be built, a living environment for promoting equal dialogue, exchanges, and mutual understanding, trust, and cooperation for the betterment of human civilization.

In the socio-economic context, the social system is the structure of society, which is the creation and maintenance of a culture through the socialization of individuals, agitated and motivated by economic activities mainly. As stated, people are the reason, the problems and solutions for global urban problems and societies are the product of people’s cultures, behavior, and well-being in terms of human quality. Spatial relations exist only because social processes exist. The spatial and social aspects of a phenomenon are inseparable (Massey, 1995). Robert

argued that separation of social and space is not sensible: to “explain why something occurs is to explain why it occurs where it does” (Robert, 1980). Massey and Robert clearly explained the vital role of contextual environment to human-physical environment, in which is the aggregate attributes of human-environment besides physical environment for composing a “City” facilitating by the sustainable development strategies of TOD and ICT.

In a dilemma of sustainability, as people have unlimited “want”, and they will not be satisfied with the limited resources, should people only take what they need instead of what they want? In human history, the city has been a place for living, production and a place for trade, finance, politics, education, labor supply, and leisure. Since the human civilization, cities have been the centre for global economic development, employment creation, and ending poverty. According to the UN’s prediction, there are over half of the world’s population lives in urban areas, by 2025, 65% of the world economic growth would come from about 600 cities and among them, 440 cities belong to the emerging economies (UN Report, 2013).

Put in perspective, we cannot talk about urban transport until we know what type of city we want. Furthermore, to talk about the city we want is to talk about how we want to live based on Maslow’s Human Need Hierarchy (MHN) in this research. Therefore, the way cities are going to be built affecting people’s daily livelihoods, which would be interpreted by their quality of life in decades and hundreds of years. What kind of city do we want to create for which groups of people: the poor, the children, the rich and famous or the elderly, or for everyone or automobiles? What are the elements and functions of a city to be equipped for optimizing the quality of life? In rhetoric, human development is the core drive for leveraging and achieving the scheme of sustainability, which means urban policymakers need to take Uqol evaluation seriously if their agenda is to succeed in SUD. Charging to the future, by taking an internal perspective of the urban system at the city level, with the intention and mission for healing the root of urban degradation caused by human and the stagnant system, a concept of

developing a Sustainable Human Eco-city (SHE-City) is assumed as the progressive urban development paradigm to depend on for a prosperous future. In the future, the function of a city will be enriched to serve not only the necessary physical and biological needs of human beings but also psychological and spiritual needs in the digital age.

Human, living in the SHE-City of a digital age, ICT¹⁵ becomes the indispensable technology for speeding up the performance of Transit-Oriented-Development (TOD)¹⁶ and Sustainable Urban Development (SUD)¹⁷ as the means to serve Maslow's Hierarchy Needs (MHN)¹⁸, with the common goal for enhancing the urban quality of life (Uqol). Undoubtedly, humans are the non-disposable builders, drivers, users, and protectors in developing, evaluating, monitoring, maintaining, and improving our living environment in the coming decades. Along with other reasons, the TOD, SUD, ICT, and MHN were identified to compose the conceptual SHE-City.

4.1.2.1 Transportation-TOD for Sustainability-SUD

An international scientific and operational conference on TOD held in Paris 16/17 April 2012 stated that the future of city transport involves researching how cities evolve, transport, and the relationship between the two. Since the introduction of Fordism by Henry Ford, developed cities have been depending on automobiles as the main transportation mode; now, the developing cities are racing in the same lane of "auto-mobilization". However, automobile is not a sustainable mode of transportation, but public transportation is. Sourcebook (2005)

¹⁵ Proxy of Technology: Information-communication-technology (ICT) is the means and an integral part of technology. ICT is a catalyst to TOD and SUD, as well as the main actor for building a virtual communication network, transmitting intangible context 24/7 with almost no cost for the contextual environment.

¹⁶Proxy of Transportation/Mobility: Transit-Oriented-Development (TOD) is the means and practice for the concept of transportation. TOD is a sustainable urban development strategic plan depending on the public transportation system, can be for local and global integration, in general, to build a vibrant urban area by connecting the industrial towns, residential areas, CBDs, touristic spots, cities, nations, and regions through public transportation network connected by Mass Transit Railway (MTR), inter-state railway and cross-country railway developments.

¹⁷ Proxy of Sustainability: Sustainable Urban Development (SUD) is the means and practice for the concept of sustainability. SUD is the embodiment of sustainability geared for the healthy growth of people in the Human Ecological System by creating sustainable cities and towns.

¹⁸ Proxy of Human Needs: Maslow arranged human needs for growth into five ascendant stages. They are basic physiological needs (health, food, sex, water, and shelter), safety needs (security of body, health, finance, and shelter), a sense of belonging (friends, family, social communication and community), esteem (confidence, recognition, and respect) and self-actualization (justices, creativity, and fulfillment) (Maslow, 1943).

reminded developing cities to avoid making the same mistake as the developed cities that have been depending on automobiles as the primary transportation mode for urban development. Thus, TOD was adopted as the sustainable strategy for developing the SHE-City.

Cities across the world are racing to cope with rapid and often uncontrolled urbanization. Developing the ideal city plays a vital role in understanding and enhancing the QOL within the urban context. What is the means or the vehicle to facilitate connectivity and mobility of the advocated multi-cultural, multi-dimensional and multi-temporal living places from megacities to intermediate cities, to towns, to rural communities, and to individual human settlements in order to achieve the planned objectives in social, economic, political and environmental sustainable development? Governments have an obligation to promote a new urban development model that can integrate all facets of sustainable development to promote equity, welfare, and shared prosperity, such as the TOD-led SUD. It has been proved that TOD is the engine for economic, social, environmental, cultural, and political sustainability with references to the urbanization history of Tokyo, Hong Kong, Paris, NYC, London, Switzerland, and Amsterdam. Therefore, the public transportation driven, TOD-led SUD plan has been advocated as an active urban development policy in many city governments.

In the environmental aspect, according to the recognition of TOD as a means for solving urban problems such as traffic congestions, affordable housing shortages, air pollution, and persistent sprawl (TOD, 2002), which negatively affect the health of people. To understand and solve these pressing city issues, TOD impacting Uqol in social, economic, political, and technological context is addressed.

In the economic aspect, it does not matter how good and fast one can produce a commodity, without efficient and affordable transportation to deliver them to the global and regional market, all effort goes to the drain, or a huge portion is wasted far from the idea of sustainability. The “One-Belt-One-Road Initiative” (BRI) central idea, infrastructure is the backbone of any economy (Zanabria Ruiz, 2015). The TOD-led BRI has been proved as a vivid example to foster local smart growth and global urbanization for improving people’s livelihood.

In the social aspect, humans are emotional social species, and they exchange culture, friendship, and knowledge through technology, logistic, and people-people activities to satisfy their psychological needs. TOD facilitates social activities and movement. Overall speaking, the advancement of economic, social, and environmental sustainability can be effectively materialized through TOD planning and implementation to serve those human needs identified by the MHN model. Conclusively, the benefit of TOD contributes to develop a sustainable city/living place where one can live, work, and play (TOD Benefits).

What is TOD?

TOD stands for Transit-Oriented-Development which is a practical and effective urban development plan to build a vibrant urban area by connecting the points of interest in the region, such as industrial towns, residential areas, CBDs, touristic spots, cities, nations, and regions through public transportation network connected by Mass Transit Railway (MTR), inter-state railway and cross-country railway developments. Transit-Oriented-Development (TOD), a sustainable urban development strategic plan depending on the public transportation system, can be for local and global integration in general. It creates a market for new business, capital investment, and talent pool. TOD is the impetus for developing an urban place where there are job opportunities and more freedom of choices offering to people for improving liveability locally and globally.

At the community level, TOD is commonly defined as high-density, mixed-use development within walking distance (a 1/2 mile) of a transit station. TOD provides a range of benefits, including increased transit ridership, reduced regional congestion and pollution, and healthier, more walkable neighborhoods (MITOD, 2016). A transit-node planning strategy supports mixed-use residential and commercial areas, access to public transport, affordable housing, and a range of mobility options like cycling and walking for creating a sustainable, liveable, and vibrant urban community. Since the city is opting for smart growth, the future urban planning objectives are to create compact, well-connected cities with accessible public services (CIMI 2016), which TOD becomes the most suitable urban planning tool to realize the objectives. In the post-industrial society, TOD is facilitated by ICT for providing mobility and information accessibility to support the lives and livelihoods of residents, often recognized in the digital-enabled urban areas.

For many decades, cities across the world are racing to cope with rapid and often uncontrolled urbanization in developing and developed countries. Therefore, TOD has been advocated as a useful tool for planning and developing a sustainable city universally per se. Moreover, TOD's core function is to facilitate people's choice domain at local, regional, and global levels. The three levels of TOD operation are explained and illustrated (Figure 4.7, 4.8 & 4.9). For example, in the city level, the developed Hong Kong SAR, TOD urban development plan is reinforced by an efficient public transportation network of multiple mass-transit-rail (MTR) lines running through Lantau Island, Hong Kong Island, Kowloon and New Territory (Figure 4.7). At the regional level, the Hong Kong MTR system is connected to the inter-state-city railway and road system in Mainland China (Figure 4.8). In a developing country such as Indonesia, the 1st MTR line built by a Japanese company in Jakarta was just put in service in 2019. It seems that TOD-led SUD policy has always been the sustainable strategy for uplifting poverty, particularly to the developing countries.

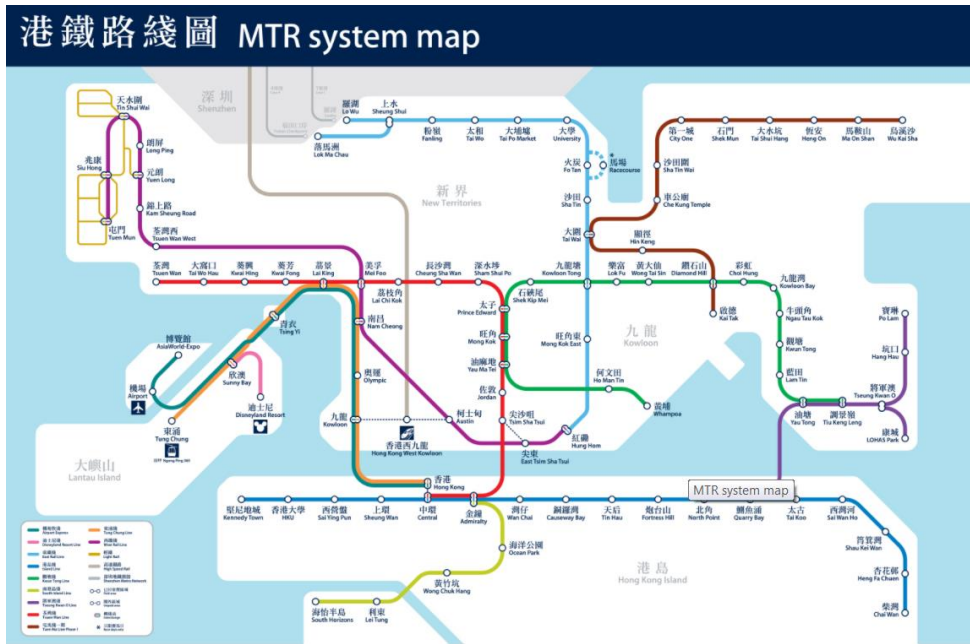


Figure 4.7 Hong Kong Mass-Transit-Railway System Map
 Source : http://www.mtr.com.hk/en/customer/services/system_map.html

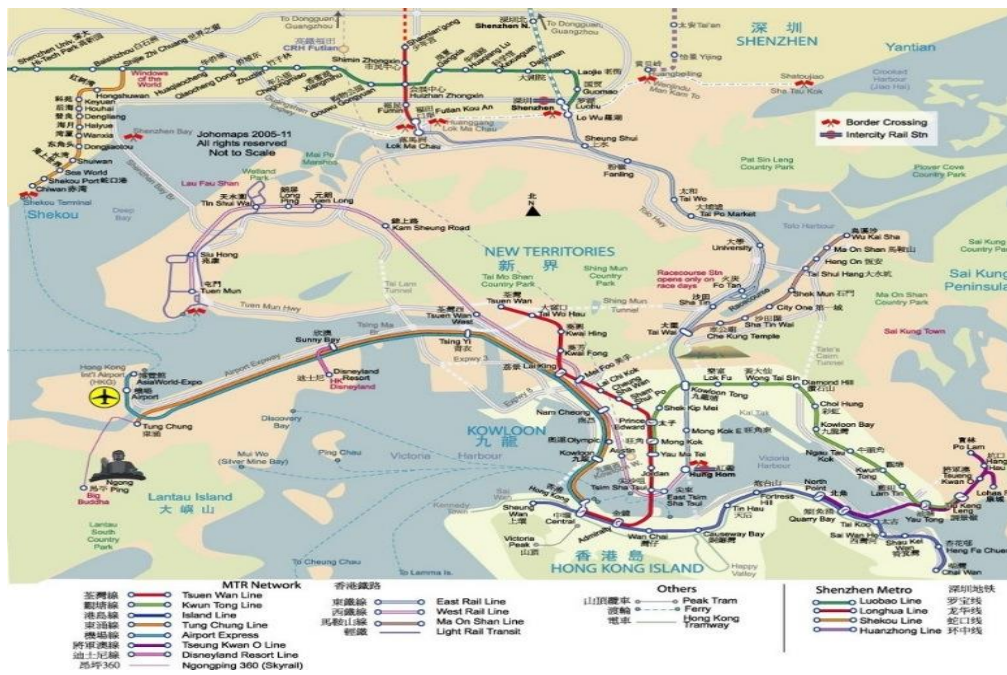


Figure 4.8 Inter-City-Railway System from Hong Kong MTR to Shenzhen (SZ)
 Source : <http://www.chinatouristmaps.com/travel/hong-kong/mtr/detailed-map.html>



Figure 4.9 Belt and Road Initiative

Source: <http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/The-Belt-and-Road-Initiative/obor/en/1/1X000000/1X0A36B7.htm>

Needed by the developing countries in the beginning stage of urban development, TOD is for economic development first and foremost. TOD brings in people traffic, central business centers, a complementary chain of industrial supply and demand from manufacturing to wholesaling and retailing, overall speaking, the SUD strategy of TOD increases human productivity, social activities, economic growth, and environmental sustainability.

In 1978, infrastructure started to build in developing China. There were 90% of Chinese work in the countryside, by 2025, the figure will be down to 35% because higher salary in the cities attracts more migrant workers moving into the urban area. These people need transportation to support their ways of living, and at the same time, the agglomeration of people can contribute to both internal economic growth and external trade. Through infrastructure development, China moves most of its 1.4 billion population out of poverty. According to the United Nations (UN), China alone accounts for 80% of world poverty reduction and creates the world's largest middle-class per country. TOD transforms low-income status class to mid-income class. In China, the high-speed railway network has been planned to cover the whole

country, from the well-developed capital city Beijing to the less developed landlocked region Ningxia for enhancing people's standard of living. In such success, the positive cause-effect relationship of TOD-SUD for enhancing Uqol in urbanization is manifested.

The Global-BRI-TOD plan implemented by the Chinese government is a global development strategy with a theme-goal “to construct a unified market and make full use of both international and domestic markets, through cultural exchange and integration while enhance mutual understanding and trust of member nations, ending up in an innovative pattern with capital inflows, talent pool, and technology database” with a mission to enhance global QOL, focusing on the needs of developing regions. It is the unprecedented effort of encouraging financial and labor investment by building an intensive public transportation network locally and globally. Belt and Road Initiative (BRI) has the tasks for building land and maritime routes (Figure 4.9) connecting Africa, Middle East, Eastern Europe, South East Asia, and South America. Since its inception in 2013, already today, 150 countries and international organizations have signed up with BRI including Greece, Turkey, Spain, Malaysia, Italy, France, Portugal, and many other EU members from the developed regions, as well as Kenya, Cambodia, Sir Lanka, Iran, Indonesia, and Pakistan from the developing regions. The new transport corridors between Europe and Asia, supported by the BRI are the opportunity for economic revitalization and a necessity recognized by many EU leaders such as Mr. Giorgi Gakharia (Prime Minister of Georgia). In Africa, one of the BRI projects, the Addis Ababa-Djibouti Railway linking Djibouti and Ethiopia commercial Centre has started its operation in 2019. On the global level, TOD fosters globalization by opening the worldwide market, which helps improve local economy and living standard in many developing, developed, and even underdeveloped countries. When economic integration and globalization are in action, BRI can help close the economic gap between urban and rural areas and improve state-to-state cooperation on a global scale (developing and developed countries). Not only beneficial to the

economic section, but it also has a butterfly effect spreading the fruity effect to social diversification, cultural exchange to enhancing mutual understanding and trust for global cooperation and political security. Frankly, TOD's primary function for economic growth, strengthening connectivity, and communication among different cultures for uplifting liveability has been recognized by many countries. BRI has been reshaping the 21st-century urban landscape via sea and land routes, along with the virtual global network. The next challenge is to further extend the positive impact of the BRI along the development route, which is crucial to our ecological system's well-being.

4.1.2.2 Sustainability-SUD for MHN and its Relationship to Urban Policymaking

All conflicts of human society can be traced to the fight for limited resources. Normally, the conventional economy-driven city development contributes significantly to economic growth (Vos, 2007), but also shared social-environmental unsustainability: poverty, inequality, and climate change so on. Sustainable Urban Development (SUD) is the embodiment of sustainability geared for the healthy growth of people in the Human Ecological System (HES) by creating sustainable cities and towns. In the global concept of sustainability, SUD is a process of synergetic integration and co-evolution among the great subsystems making up a city (economic-social-physical environment) to enhance the QOL of local people in the long run, without sacrificing the well-being of next generations (Camagni, 2017). Moreover, at the center of every development is people. To improve people's QOL, the governments need to have policies that should be human-oriented first and foremost.

This section explains why sustainability-SUD was identified as one of the critical development components in the future SHE-City, and the difference between developing and developed countries in prioritizing social, economic, and environmental pillars. To SUD, QOL affects people's behavior, life satisfaction and happiness, regional migration patterns, regional

economic-social growth, and environmental sustainability. In such a case, the relationship between QOL, SUD, and urban policymaking is stated.

Early in the 1970s, there was a consent of SUD at the international level. Only when Uqol is improved, then societies were to flourish (Bulkeley & Betsill, 2005). Thus, SUD's concept underpins much current thinking on the positive cause-effect relationship between SUD and Uqol. Since the late 1980s, many countries have committed to developing a sustainable environment for their citizens, but they are still struggling with achieving it. In the Brundtland report *Our Common Future* (WCED, 1987), sustainable development is defined as a redirection of social development in ways that combine prosperity, environmental protection, and social cohesion, which is also the concept cherished by the conceptual SHE-City. However, most of the concerned urban development policies were only a “talk on paper”, lacking substantive action and support from the local community, which has been mentioned by the EU and other international institutions.

The dominant SUD paradigm depicts the inter-relationships among the economy, social equity, and the environment promoting the ideal scheme of sustainability when the three pillars are balanced equally (Cowley, 2015, Wolch et al., 2014), often being called the “triple bottom line”, or: “three-legged stool”. Whereas this ideal model only exists as an idea, rarely in real practice because there is little agreement on how to transition the economy-led urbanization to sustainability and resilience in practice (Romero-Lankao et al., 2016), but with the active support of human action would be a goal for reaching in the future. For practicing in real society, a nested model was introduced to advance its practicality (Figure 4.10). Each pillar's size and position are often readjusted according to the theme-goal of a project in correspondence to the different phases of the urban development life cycle. The nested model illustrates a co-dependence of the three sustainability pillars overall, not so independent from each other's as the classical ideal model stated (Thatcher, 2014). The nested model also addresses the

supremacy of the environment in the HES. On the upside, Basiago (1998) defined economic sustainability as "the potential to achieve a new level of socioeconomic, demographic and technological output which can reinforce the foundation of the urban system in the long run." On the flip side, urban policymakers and planners must be reminded that rapid economic growth can hinder sustainability if environmental sustainability is overrun. Therefore, only when the natural resources are used and managed in a sustainable manner can sustainable economic growth be secured on earth (The World Bank, 2012). In such a case, a dual approach urban sustainability evaluation system aiming at balancing the well-being supply and demand can allocate the limited resources effectively for the most mutual benefit among the stakeholders.

The three sustainability pillars are emphasized with different degrees of importance depending on their different stages of urban development referencing the MHN theory. Therefore, it is necessary to understand, differentiate, and present the different compositions of sustainability schemes regarding the local conditions because of the different pace of the urban development life cycle. For the developing countries, socio-economic development is most crucial to secure basic human needs such as food and shelter (the basic level of MHN), which means that the environmental pillar is often ranked second by people living in the developing regions. A vivid example is "the recent 2019 protests happening in the developing countries like Chile and Ecuador were triggered by demanding affordable subway fare and fuel subsidies". For the developed countries, social and environmental needs (2nd level of MHN) are equally crucial as perceived by the public, although still anchoring around the economic pillar for growth but with less demand by comparing to the stance of the developing countries. For example, the Occupy Wall Street protest in New York City aimed at fighting for economic equality, and the lately Extinction Rebellion protest in London was a global environmental movement. These protesting events reveal that there are two groups of

sustainability schemes represented by the developing and developed countries, respectively. The two distinctive groups provide different underlying factors such as Sustainability-Uqol indicators for composing the SHE-City. The narrative is a prelude showing disparities in people's well-being requests between the developing and developed countries, which will be proved in the SWBS. Once again, seeking a balance between economic, social, and environmental developments remains a challenging task in urban policymaking. Importantly, a distinctive composition of the three pillars from the developing countries/cities to the developed countries/cities must be understood and recognized by the urban policymakers. Here below are the two conceptual versions of sustainability schemes for developing countries and developed countries (Figure 4.10):

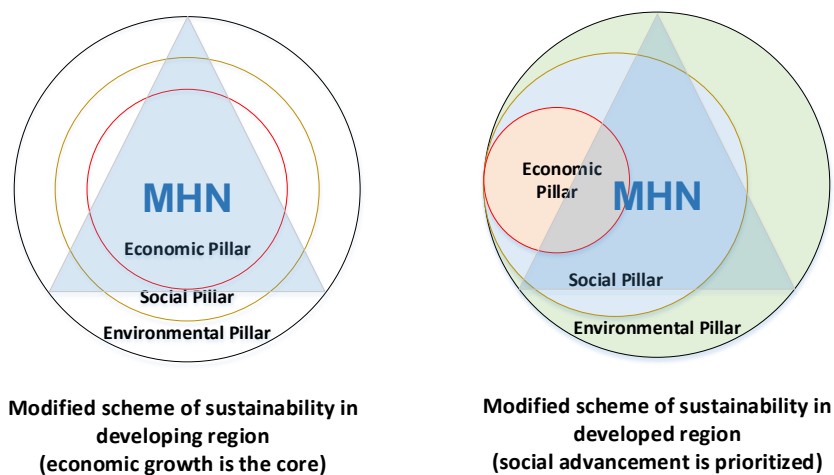


Figure 4.10 Human-Centric Scheme of Sustainability

The two modified schemes of sustainability models for the developing region and developed region are the extension of a nested model introduced by Thatcher (2014), which indicates that the natural environment constrains both the economy and society. The MHN theory is added in the nested model to increase its feasibility.

The principles of sustainable development are considered within the EU as the guiding principle for policy actions in general and actions in the realm of the built environment (Basiago, 1998). The concept constitutes a considerable enlargement of the predominantly economic preoccupations, which characterized urban development and planning since the Second World War. In the future, the principle of sustainable development must consider the interests of the present and future generations. Current thinking about sustainable development must simultaneously consider economic, environmental, social, and cultural objectives in political decisions for regional and urban planning. Policies, methods, and tools are necessary to pave the path to SUD. Cities have been considered the ecosystems for people to understand the problems of urban sustainability, and urban policymakers need to be pragmatic about solving them with the appropriate evaluation system. The concepts of physical ecology can also be applied metaphorically to cities' social dimension – to think of each city as a social ecosystem. The city is a complex system made by continuous processes of change and development motivated by people, energy, natural resources, transportation, and output. The human ecosystem sums up the acts of people for maintaining, restoring, stimulating, and closing cycles contribute to human development and sustainability if the proper SUD policies can be designed and executed effectively.

In other words, urban policies for increasing urban life quality are essential because they allow better progression in SUD for enforcing the notion of “quality of life”, which is the evaluation of living and working conditions in one holistic concept. These days, the core areas of QOL surveys include employment, economic resource, family and households, community life and social participation, health and health care, knowledge, education, and training. Sustainability in the environmental aspect has been proved to be the direct factor for affecting the quality of urban life by the UN and WHO, which urban policymakers must consider significantly.

4.1.2.3 Information-Communication-Technology (ICT) for TOD, and SUD

Information-communication-technology (ICT) is a catalyst to TOD and SUD, and the main actor for building a virtual communication network, which can transmit intangible context 24/7 with almost no cost in the world. It is a sustainable and efficient transportation mode. The faster the internet accessibility and the wider the coverage, then the higher the human productivity released. ICT is the key to value creation and competitive advantage, especially after labor, and land capital among the factors of overall productivity in the developed countries. ICT facilitates the output generated from human capital, monetary capital, E-cash, and natural resources; the power of ICT on affecting Uqol has been unprecedented in post-industrial countries. ICT can facilitate the movement of commodities from one country to another and transmit capital and cultural context constantly. Its power in dictating, monitoring, and even manipulating people's ways of living should not be overlooked and must be addressed notably in the coming decades. Most importantly, *ICT might be the key to unlock the highest human potential, which would enable the significant leapfrog of sustainable development in developing countries.* If ICT is utilized effectively, then the vast economic gap between developing and developed countries would be narrowed significantly.

TOD can build physical connectivity, and ICT can link up the virtual network. SHE-City is a conceptual future city developed for the year 2020-50. Certainly, ICT is the core technology for paving the way towards an advanced society. To transport facilitation, ICT can connect traffic data and predict traffic patterns. For example, AI technology, DiDi, and Uber, driverless vehicles, can be facilitated by the 5G network to increase productivity in the city. To economic growth, ICT fosters globalization because it provides cost-effective and time-efficient communication and mobility of labor forces and goods. Overall speaking, people around the world can exchange intangible ideas and knowledge, financial activities, entertainment, and social activities in the digital world without the constraint of time-space.

Soon, the world would become a community of shared economy and destiny realized by flattening thoughts and living environments.

Since the 5G network can speed up the exchange of communication, logistics, management, transportation, medical services, education, the internet of things, entertainment, and the social-economic-environmental-political system. ICT advancement can serve all levels of MHN faster and better. For the Internet of Things (IoT), one can buy an air ticket from Hong Kong to Australia in 5 mins or purchase a Made-In-China 5G phone paid by WeChat pay or Alipay in the virtual Tmall. Nowadays, in Mainland China, without applying ICT, one literally cannot survive. IoT revolutionizes the way we live and enhances our Uqol in terms of choices (quality and quantity). At the speed of light, intangible items can be transferred through data and clouds, followed by the transportation of tangible goods. The snowball effect triggered by ICT is unimaginable and unmeasurable. Profoundly, ICT is in favor of activities for business, civic, cultural, and social advancement, especially E-commerce. The advent of 5G technology is poised to raise liveability while boosting the country's economy by adding value to people's living standards, stated the Malaysian Communications and Multimedia Commission (MCMC). Vertical Industries also benefit from 5G technology with a positive impact," said Lim (Chief Officer of MCMC) in a statement. Among the vertical industries are health care, media, and entertainment, smart cities, automotive, manufacturing, public safety, agriculture, and education; even self-driving cars are supported by 5G technology. ICT's contribution has been remarkably documented (Brandon et al., 2017). Thus, ICT becomes one of the four key components making up the future SHE-City. Most likely, ICT's future role would become the main actor, no more a catalyst recognized in the SHE-City. Noting that ICT reaches its equilibrium in the future, the side-effect of ICT cannot be neglected. Future problems by ICT will be a significant challenge to the sustainable growth of cities. ICT will get more and more

significant in terms of speed and context impacting people's daily life, by then, a well-balanced mechanism addressing ICT and Humans must be intended in policymaking with global effort.

Apart from the conventional value development courses such as parents and friends, schools, and mass media, social media properly becomes the most effective medium in shaping the next generations' value system. ICT's capacity in shaping individual reality and worldview is unpredictable, and the potential to tilt the balance of SUD from social unrest to a depressive economy in a country should not be left unattended.

4.1.2.4 Relationship of MHN, TOD, SUD, and ICT for Improving Uqol

The previous sections illustrated the underlying theories for explaining how human interaction with the surrounding environment shapes the development of one's expectations through a constant thought process of learned experiences. Thus, one's need for satisfaction in life displays the subjective side of QOL. Whereas to the ecologists, prioritizing nature over human economic value is the preach (Naess, 1973). This section identifies the contributory factors of TOD, and ICT to achieve SUD while serving MHN (Uqol). Their causal relationships will be tested in Chapter 4.2.5: Validating the Hypothetical SHE-City.

In SUD, accessibility is the key for increasing individuals' freedom of choices in "economic opportunities" and "service and cultural opportunities" (Chan & Lee, 2007) which are supported by TOD and ICT across the platform of human-physical-contextual environment for serving the well-being needs stating on the MHN. The whole Uqol system is directly related to the economic goals: access to workers, customers, suppliers; social goals: access to employment, goods and services, social contacts; and environmental goals: resource-efficiency of the associated activity and mobility patterns (Bertolini & le Clercq, 2003). In short, Uqol involves the physical environment providing opportunities for humans to meet their needs and desires (Smith et al., 1997). The interaction between the physical environment, contextual

environment, and human environment is facilitated by transportation to enable the movement of goods and people. This network builds a sustainable place for enhancing Uqol, targeted by both the governments and individuals.

In general, well-being depends upon good health, positive social relationships, and accessibility to basic resources such as shelter and employment (Ballas et al., 2011). QOL is a kaleidoscope with all these ever-evolving segments inside, whereas, Maslow's Hierarchy Need (MNH) is the alpha principle, vaulted by the human-physical-contextual environment, the sound synthesizer upholding all the relevant disciplines contributing to the overall QOL. QOL experience of individuals is embedded in the evaluator's social and cultural context, which sits at the psychological level of MNH (Kahneman et al., 1999). The authors also suggested that the objective characteristics of society – such as poverty, crime rate, and pollution- contribute predominately to peoples' judgments of their lives, which is explained by MNH's physiological level. Needs categorized by MHN are satisfied through activities fulfilled in different life domains, including health, residential/food/safety, work, and home, leisure, education, social, friendship/family/love, and spiritual (Shek & Lee, 2007; Sirgy et al., 2016).

As stated by Maslow (1943), the cognitive capacities (perceptual, intellectual, and learning) would be looked upon as an agent to either deprive or enhance the satisfaction of the basic needs and fulfill the highest need, namely self-actualization. In such a context, MHN provides a fundamental model for categorizing and analyzing users' needs to identify the quality of life issues (Maslow & Boeree, 2006; Renne et al., 2009; Felce & Perry, 1995 cited by Harifah et al., 2014). MHN is the different levels of motivation and human needs evolving and correlating along the city development life cycle, which can be adopted for distributing the resource and labor equitably in the pursuit of SUD. MHN is essential as the vital base for developing the hierarchical U2-CAS for analyzing, sorting, and identifying the Sustainability-Uqol indicators. Is the better-faster the TOD plan and the better-higher the local QOL? The

ideal city with a goal for enhancing QOL depends on the urban policymakers' supply side to serve the human demand-side sustainably. Upholding the global concept of sustainability, supply, and demand meet at the equilibrium point where perfection is realized without wastage. (Figure 4.11) depicts the relationship of MHN, TOD, SUD, and ICT, which also states how a human-physical-contextual environment is evolved into a composite of the future SHE-City.

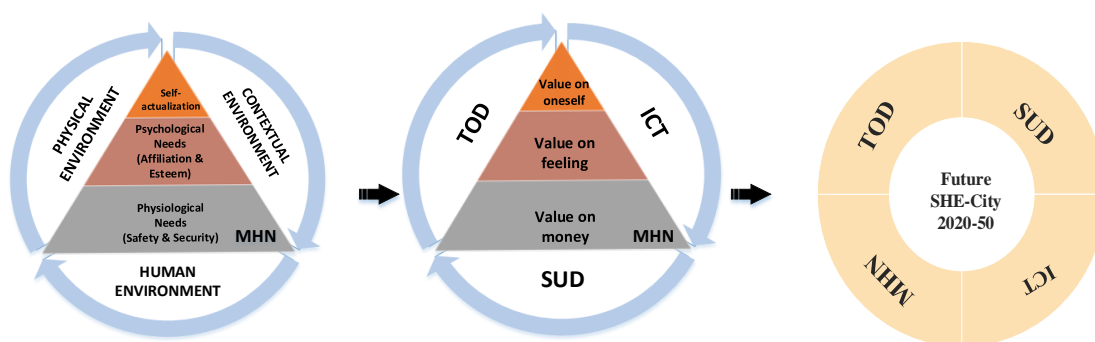


Figure 4.11 Relationship of MHN, TOD, SUD and ICT

A city is prosperous when movement, interaction (physical-human-contextual environments), and activities are promoted (Trancik, 1986). TOD-ICT is an effective SUD plan to improve local MHN by expanding and linking human forces (labor and talent) and commodities for economic and social growth that is the impetus for development. ICT can facilitate the transmission of information to speed up transporting knowledge, capital, labor, and commodities for optimizing productivity, all for improving inhabitants' livelihoods. Thus, businesses and jobs can be created to offer better Uqol and improve social inclusion.

After understanding the context of Uqol, the next question is “What is good Uqol and what is bad Uqol?” Thus, an evaluation system to reflect the urban conditions in terms of Uqol is needed for SUD improvement. In this research, the multi-dimensional U2-CAS was suggested and developed for creating a user-friendly urban-QOL evaluation tool (WoSu), which can be customized to suit the theme-goal of a project pursued. Once the SHE-City is

equipped with TOD, SUD, and ICT, which needs human capital to run, maintain and monitor the function and operation of the governmental, social, and economic engines, then an objective, practical evaluation tool can promote the sustainable growth of the city. In the SHE-City, transportation-TOD, sustainability-SUD, and information-communication-technology (ICT) are the means to uplift urbanites' life satisfaction, which defines the SHE-City.

The rationale is furnished with the theoretical stage to form the conceptual U2-CAS: a multi-disciplinary top-down (objective environment) and bottom-up (subjective well-being survey) system, connected by four main components (mobility/transportation-TOD, sustainability-SUD, technology-ICT, and MHN), which was also endorsed by (Rodriguez de la Vega, 2015; Shin et al., 2003). The U2-CAS can redefine QOL into Urban Quality of Life (Uqol): a reduction process for transforming its rhetoric statement into the real meaning or a trajectory of qualitative interpretation to quantitative representation, in which, the WoSu is the tool for understanding and evaluating Uqol. The proof of urbanites' needs is served by the external living environment, which is the central link to establish the U2-CAS.

4.2 ANALYTICAL ILLUSTRATION

After accomplishing the theoretical base stage, this section aims to confirm the proposed U2-CAS by constructing and validating the WoSu and SHE-City to achieve (objective 2). The triangulation research technique was employed with a 2-level validation procedure for balance and check. The parameter was set on the urban platform with the specific theme-goal of "SUD enhances Uqol." Based on the theme-goal, the two-pronged WoSu was constructed upon the conceptual Sustainable Human Eco-City (SHE-City = TOD + ICT+SUD + MHN) and defined by the eleven Sustainability-Uqol indicators. Here below are the three milestones arranged for establishing and confirming the innovative U2-CAS:

- To construct the hypothetical SHE-City model based on theories, literature reviews, and a case study of Amsterdam's SUD Policy.
- To construct a composite of Sustainability-Uqol indicators (WoSu evaluation tool) with a comparative analysis of the relevant literature, and Sustainability-Uqol indices.
- To conduct an Uqol survey for validating the WoSu and SHE-City with mean score test, Kruskal-Wallis H-test, Mann-Whitney U-test, CFA and SEM goodness-fit-test while confirming the U2-CAS.

The analytical illustration needs to achieve the three milestones by cross-examining the three hypotheses: (1) QOL is subjective due to demographic and geographical differences proving the claim of subjective QOL; (2) A distinctive evaluation gap of the identified Sustainability-Uqol indicators (WoSu) between developed and developing countries indicating the cause-effect relationship of hypotheses 1 & 2; and (3) SUD, TOD, ICT, and MHN of SHE-City are the main components for defining sustainable Uqol.

Therefore, sections 4.2.1 – 4.2.4 analyze, identify, and verify the proposed WoSu. (Figure 4.12) illustrates the necessary steps of the methodological approach to validate hypotheses 1 and 2: (A) defining indicators' context (qualitative findings), (B1) constructing a composite of Sustainability-Uqol criteria (qualitative findings), and (B2) validating the WoSu (quantitative justification). The WoSu was constructed along with the fundamental idea of 'duality' built along the two-level logical path with the SHE-City verified in section 4.2.5. A triangulation research technique, including a desktop literature review, a comparative analysis, and a SWBS form the robust research (Patton, 1999).

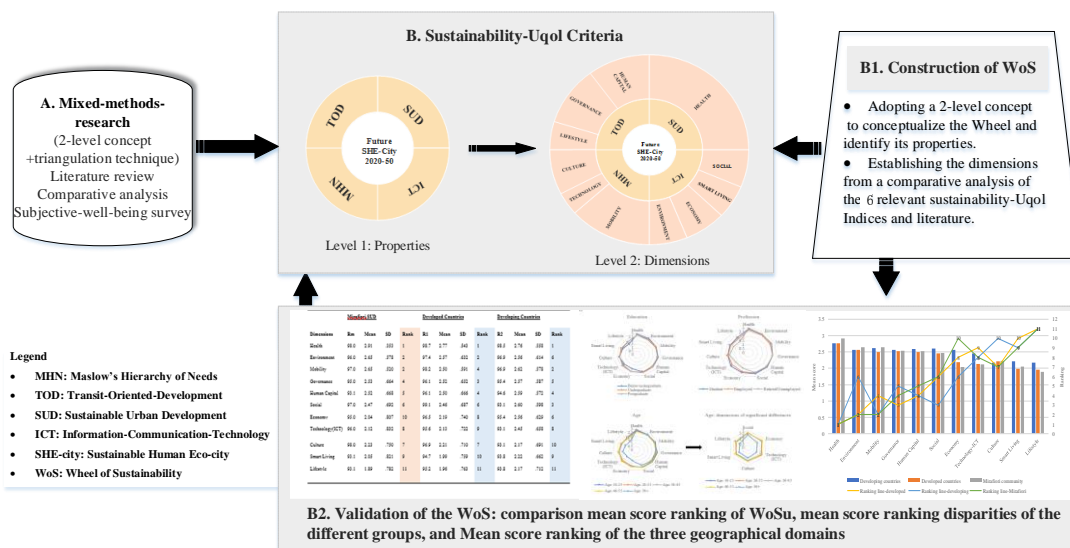


Figure 4.12 The Methodological Approach for Constructing and Validating the WoSu

4.2.1 Two-Level Approach for Developing the Wheel of Sustainability-Uqol (WoSu)

(Figure 4.12) outlines the design process for developing the WoSu evaluation tool. This part highlights the two-level (2L) concept for constructing the two-pronged WoSu. The WoSu was built on the conceptual SHE-City (TOD + SUD + ICT + MHN). The axiom¹⁹ development takes a layered approach where the specific application is defined in terms of the foundational ontologies such as class and instance (Niles and Pease, 2001). SHE-City is a conceptual future urban platform motivated and activated by the transit-oriented-development-TOD, sustainable urban development-SUD, information-communication-technology (ICT), and Maslow's Hierarchy of Needs (MHN) as the core layer to form the WoSu. The future SHE-City sets at the first level of the WoSu evaluation tool, merging the will of urbanites and the expected urban living conditions. At the second level, the two-pronged WoSu integrates the top-down policy-driven indicators with the consent of a SWBS. It can assess and reflect environmental and human issues, which is essential to understand how cities perform (Newman, 2006).

¹⁹Axiom is the logical way to define and constrain the interpretation of the classes and their properties, allows us to define the WoSu as the subset of SHE-City intersected with the set of properties in urban areas.

4.2.2 Constructing the SHE-City: Qualitative Approach

A case study for reviewing Amsterdam’s SUD policy reiterates the composition of SHE-City identified from the literature review. Why Amsterdam? The bicycle-friendly city has been ranked very high in transportation, sustainability, and ICT for social progress and livability (Table 4.1 panel data²⁰) for its urban development policy. Amsterdam exceptionally performed well as a sustainable TOD-led city. Noticeably, Amsterdam is a human-scale metropolis with a policy theme of transportation enhancement; sustainability supported by technology, resident’s collaboration, and green space improvement (Figure 4.13) as the way to balance its goal for enhancing Uqol in the community (Sharifi & Murayama, 2014).

Table 4.1 Related Urban Quality of Life Ranking List for Amsterdam, Netherlands

Year	Happiness Index (Netherlands/countries)	Sustainable Cities Index / *Sustainable Cities Mobility Index (Amsterdam/cities)	Cities in Motion Index (Amsterdam/cities)	Social Progress Index (Netherlands/countries)
2019	5/156	-	3/149	11/149
2018	6/156	12/100	10/165	7/146
2017	6/156	*11/100	10/180	7/128
2016	7/156	11/100	-	8/133
2015	7/158	4/100	5/148	9/133

(Source: source list on the references section)

Amsterdam is a world livable city full of vibrancy from its dynamic economy, thriving cultural life, and plenty of opportunities, a relatively small city served, and thrived by its sophisticated transportation system since the mid-1970s. However, in recent years, pressed by rapid urbanization, Amsterdam is facing the challenge as similar as some other world cities, caused by the continued population growth mainly from the influx of tourists (short-term) and immigrants (long-term), in the economic (business and tourism), social (transportation and

²⁰ Panel data: a multi-dimensional record of multiple categories obtained over a period for the same or relevant topic.

employment) and environmental (congestion and pollution) aspects. Currently, the city is often crowded with increasing pressure on traffic, housing, and public spaces. Degradation of urban living becomes the issue urgently waiting for a solution, more residents and visitors are demanding efficient transportation to serve their daily needs, and thus, the city puts forward a 10 billion euros to improve transportation throughout the region by 2020, documented in the Mobility Plan for Amsterdam in 2030 and the Ambitions and Implementation Plan 2019 to expand the route for solving the urban issues. The central theme of the urban policy focuses on improving traffic flow by relocating heavy traffic to the city's outskirts. Simultaneously, the City in Balance program was introduced to maneuver the balance between local Uqol and economic growth for the city (Amsterdam, 2018-2022). Its urban development theme-goal was applied by the U2-CAS. Here below are the illustrations.

A. Policy: Traffic and Transport

Urban mobility is essential for supporting and activating the functionality of a city, the 2040 master plan of Amsterdam (Amsterdam, 2019) aims to build a smart city supported by the Mobility Implementation Plan with innovative solutions and new technologies. It is designed to meet people's mobility needs and businesses in cities and the outskirts of communities for a better quality of life. Amsterdam is developed with a TOD sustainable strategic plan, with high connectivity globally, nationally and locally, the most sustainable city in Europe and the most bicycle-friendly city in the world.

By referring to the fact sheet, since April 2018, commuters can take Eurostar traveling to and from London directly almost every day, and there are three international coaches (bus) services, namely Flixbu, Ouibus, and Eurolines which serve as another option for traveling in Europe. Nationally, the Netherlands has developed a highly efficient electric-powered railway network linking all the major towns and cities, the main public transportation mode used in the country. Locally, there are 15 tramlines with 500 stops throughout the city (Trams in

Amsterdam, 2019). The 4-line metro connects the city to the suburbs, facilitated by the 35 city buses and a 7-line ferry. Purposely, the mobility of a city determines people's productivity and socio-economic sustainability for enhancing people's QOL (Bertolini & le Clercq, 2003).

B. Policy: Sustainability and Green Energy Supported by Technology

The Sustainable Amsterdam Plan has an overarching theme of sustainability for developing the future Amsterdam. The city sets several goals, such as reducing waste and transitioning to a circular economy to build a sustainable place as the city agenda for all. For the public, a series of sustainability measures have been encouraged, such as recycling waste, cooking with electricity, and installing solar panels on roofs, with the introduction of the Structural Vision Amsterdam 2040 (in Dutch) which layouts the strategic map in how to offer the proper amount of green spaces including parks and forest for preserving the right balance in the city. Besides, as part of the plan to discourage car traffic while facilitating economic growth, more public transportation routes, public parks, and bicycle lanes would be built. The ICT related project, an interactive map of Amsterdam's ferry routes (GVB, 2021), is provided as well as the City-Zen pilot program is a virtual gaming network to allow neighborhood sharing the surplus green energy. Furthermore, green electricity will be generated by windmills, solar panels, and biomass power stations to power 60-90% of all car travel in Amsterdam by 2040. In the record, Amsterdam has been integrating sustainability in its policy for years with a plan to incorporate energy efficiency, circularity, ease of public transport, and other sustainable measures into daily life. Such testimony provides an empirical support for composing the future SHE-City.

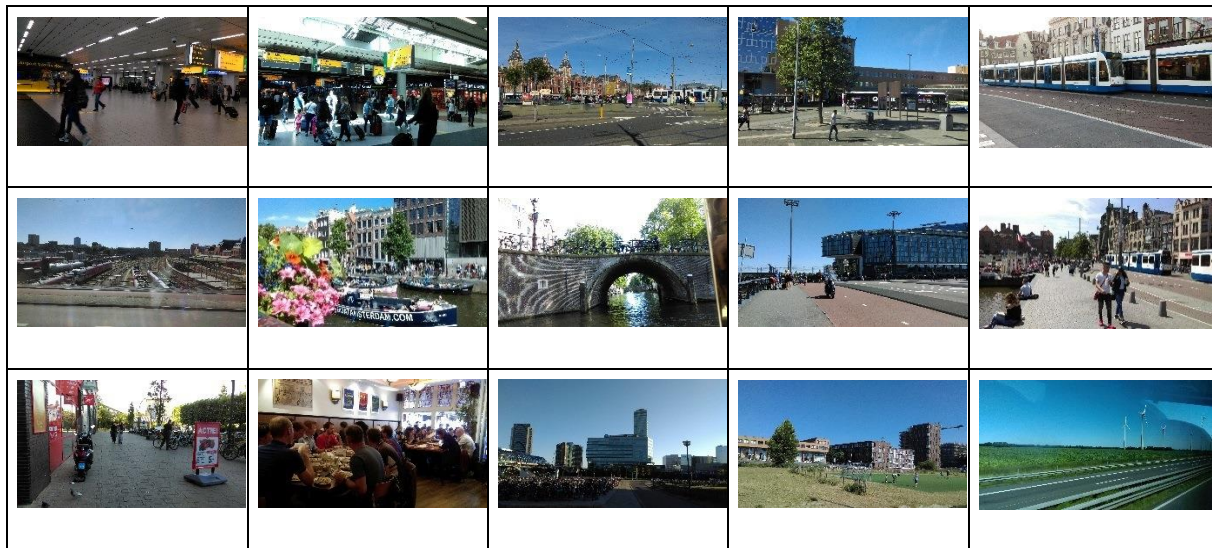


Figure 4.13 A Snapshot of Amsterdam from a Field Trip in July 2019

4.2.3 Constructing the WoSu: Qualitative Approach

This section documents the construction of the WoSu. First, twelve face-to-face semi-structured interviews were conducted for advising the Sustainability-Uqol criteria selection. Second, based on the interview findings and the theme-goal identified earlier, six recognized Sustainability-Uqol indices were picked for a comparative study. The comparison focused on the relevance, reliability, balance distribution of social-economic-environmental pillars, and operability.

4.2.3.1 Interview Findings

To understand the demand side well-being of average people, I interviewed twelve people from the developing countries and developed countries regarding reasons for relocation. The interview findings (Appendix I) show that Uqol perceptions are subjective to demographic and geographical profiles divided into two distinctive groups: developing and developed countries. *The employment, quality of people, and transportation were perceived as essential for satisfying well-being needs of interviewees from the developing countries.* It might imply that transportation can support employment for seeking a better living environment resided by good

people. Besides, *lifestyle, nature, culture (architecture, art, and music scenes), and sense of belongings are crucial to the interviewees from the developed countries.* The findings support MHN’s argument regarding people from the developing countries tend to prioritize the physiological needs, and people from the developed countries prioritize the psychological needs. It suggests that a well-being evaluation gap would occur between the two geographical domains due to the demographic differences. Therefore, it needs the multi-dimensional U2-CAS to conduct a multi-scalar evaluation and report the different local needs subject to demographic and geographical variables. The findings provide the perceived Uqol for cross-referencing with the six relevant indices to construct the WoSu.

Table 4.2 Comparative Analysis of the Relevant Sustainability-Uqol Indices

Sources	Key attributes (policy-driven indices)	Gaps improved by WoSu	Contributions to the WoSu
Cities in Motion Index (CIMI, 2018)	<ul style="list-style-type: none"> The evaluation can analyze the future Uqol and sustainability of the world’s main cities for economic growth. Economic-centred 	<ul style="list-style-type: none"> Lacking the ability for localization because it is a general application, without the flexibility applied in any scales of the domain (nation, city, and community to developing and developed countries). 	<ul style="list-style-type: none"> A relatively complete and objective urban evaluation tool to provide a general framework for the WoSu: human capital, social cohesion, the economy, governance, the environment, mobility/transportation, urban planning, international outreach, and technology.
Global Power City Index (GPCI, 2018)	<ul style="list-style-type: none"> Evaluates and ranks major cities of the world according to their comprehensive ability to attract people, capital, and enterprises from around the world. A highly economic-driven index 	<ul style="list-style-type: none"> Little or no considerations of social and human sustainability: governance, health, and social requests. 	<ul style="list-style-type: none"> Offers critical indicators needed for smart urban development: economy, research and development, livability, cultural interaction, environment, and transportation.
Sustainable Cities Index (SCI, 2018)	<ul style="list-style-type: none"> Presents an in-depth review of how different cities meet their citizens’ needs. 	<ul style="list-style-type: none"> No mentioning of governance and culture criteria. 	<ul style="list-style-type: none"> Features a dual perspective (government and citizens) of Uqol criteria: human capital, health, social, education,

- The sustainability-based index is a comprehensive evaluation tool covering the whole human-physical-contextual environment quite evenly in a contemporary fashion.

economy, environment, mobility/transportation, and technology.

Sustainable Cities Mobility Index (SCMI, 2017)

- A mobility evaluation of the 100 cities across the world through three sustainability pillars - social (people), environment (planet), and economic (profit).
- Mainly focuses on mobility for facilitating sustainable urban development (SUD)

- Places very little attention to human conditions such as human capital, social, culture, and health.

- Integrates existing infrastructure with new technology for enhancing Uqol: social, environment, mobility, international outreach, technology, cultural interaction, and tourism.

- Highly mobility-driven

Mercer's QOL City Ranking (MQCR, 2018)

- A highly economic-driven quality of living index for recruiting international companies.
- Developed countries with strong economic background have been ranked in the top tier of ranking.
- Serves the middle-class managerial individuals, indeed not entirely in favor of the mainstream in the developing countries.

- Unable to apply to the developing countries due to the incommensurable issue.

- Features critical criteria of a prosperous business environment which is a pivotal need for growing a sustainable society with enough employment: governance, research and development/innovation, health, social, stability/safety, education, entrepreneurs/talent, economy, environment, mobility, livability, green space, natural assets, international outreach, cultural interaction, tourism, historical/heritage/tradition and cultural/social diversity.

Social Progress Index (SPI, 2018)

- Provides concrete implications for a national policy by stating differences across countries in their social performance and the different strengths and weaknesses of individual countries.

- Over-concentrates on the social-driven factors without mentioning the supply side of economic sustainability.

- Features critical social requests to serve basic human needs, foundations of wellbeing, and opportunities (food, shelter, safety, knowledge, information, health and wellness, communications, and environmental quality, personal rights, personal

- A need-based evaluation scheme

freedom, and choices, advanced education, and inclusiveness).

The review concludes that the proposed WoSu should contain the following attributes:

- The WoSu should adopt an integrated approach to assess urban quality from the aspects of mobility, social-economic-environmental sustainability, human resource, governance, and technology advancement.
- The Sustainability-Uqol criteria should reflect the local context to increase the evaluation tool's effectiveness by considering demographic and geographical backgrounds.
- The proposed WoSu is a phase-by-phase application, which is only a fundamental tool to aid in the stage of policy drafting. It should be modified according to the theme-goal of the developing project for informing sustainable policymaking.

4.2.3.2 Result of the Comparative Analysis

Second, the WoSu was composed of the eleven critical Sustainability-Uqol indicators (Table 4.3) derived from the seventy-two indicators of the six Sustainability-Uqol indices. Noting that “lifestyle” was added because it is the missing Uqol indicator recommended by the “Benchmarking the Future World of Cities” (BFWC, 2016). “Smart living” was added because it is ICT-related and one of the six key components of a smart city (Cohen, 2014) for embracing future SUD. The comparative analysis potently identified the health, environment, mobility, governance, human capital, social, economy, technology-ICT, culture, smart living, and lifestyle for constructing the WoSu to undergo a mean test and Mann-Whitney U-test.

Table 4.3 Result of the Comparative Analysis: Frequency Distribution

Selected Sustainability- Uqol Indices	1.Health	2. Environment	3.Mobility	4.Governance	5.Human Capital	6.Social	7.Economy	8.Technolog-ICT	9.Culture	10.Smart Living	11.Lifestyle
Cities in Motion Index 2018		x	x	x	x	x	x	x	x		
Global Power City Index 2018		x	x		x	x	x	x	x		
Sustainable Cities Index 2018	x	x	x		x	x	x	x	x		
Sustainable Cities Mobility Index 2017		x	x			x		x	x		
Mercer's QOL City Ranking 2019	x	x	x	x	x	x	x		x		
Social Progress Index 2018	x	x			x	x		x			
BFWC 2016	x		x	x	x	x		x	x		x
World Happiness Report 2012-17	x			x		x	x				
The Smartest Cities in the World 2015	x	x	x	x	x	x	x	x	x	x	
Total Count	6	7	7	5	7	9	6	7	7	1	1

Total count sets at 5 as the benchmark for indicator selection, except for smart living and service of lifestyle because those two indicators are significant for future development.

4.2.4 Validating the WoSu: Quantitative Approach

The conceptual WoSu explains and represents the new criteria for fulfilling life satisfaction in the future. This section illustrates the research methods of data collection and validation of the proposed WoSu. Convenient sampling was conducted via online and offline channels for six months in 2018-19. The questionnaire design (GNH, 2015) was modified for eliciting both demographic and attitudinal data in this study. The modified questionnaire (Uqol Survey, 2019) includes two parts: (a) demographic and geographical profile, and (b) mean score (MS) rankings of the WoSu. The questionnaire was discussed and tested by a professional panel composed of Professors / Scholars and Ph.D. Students are the experts in sustainable urban planning, sociology, environmental, architecture, and design engineering from the Interuniversity Department of Regional and Urban Studies and Planning in the Politecnico di Torino, Italy twice.

4.2.4.1 Demographic and Geographical Profile

(Table 4.4) is the demographic characteristics of the sample listed in categories, distribution of respondents based on the demographic and geographical backgrounds. The sample demographic data are gender, education, profession, and age. The sample geographical data are developed countries and developing countries. Up to 85% of samples are from an online survey; the rest are hard copies from an off-line survey. Descriptive statistics define the data characteristics setting the parameters of the investigation.

Table 4.4 Respondents' Profile

Category	<u>All Countries</u>		<u>Developed Countries</u>		<u>Developing Countries</u>	
	No. of respondents	Relative frequency	No. of respondents	Relative frequency	No. of respondents	Relative frequency
Gender: Female	204	57.0%	142	60.9%	62	49.6%
Male	154	43.0%	91	39.1%	63	50.4%
Total:	358	100.0%	233	100.0%	125	100.0%
Education: 1	55	15.4%	44	18.9%	11	8.8%
2	105	29.3%	73	31.3%	32	25.6%
3	150	41.9%	69	29.6%	81	64.8%
4	48	13.4%	47	20.2%	1	0.8%
Total:	358	100.0%	233	100.0%	125	100.0%
Profession: 1	128	35.7%	53	23.2%	75	57.7%
2	20	5.6%	15	6.6%	5	3.8%
3	137	38.3%	100	43.9%	37	28.5%
4	15	4.2%	7	3.1%	8	6.2%
5	26	7.3%	25	11.0%	1	0.8%
6	22	6.1%	18	7.9%	4	3.1%

	7	10	2.8%	10	4.4%	0	0.0%
Total:	358	100.0%	228	100.0%	130	100.0%	
Age:	16-25	72	20.1%	44	19.3%	28	21.5%
	26-35	136	38.0%	60	26.3%	76	58.5%
	36-45	61	17.0%	46	20.2%	15	11.5%
	46-55	50	14.0%	43	18.9%	7	5.4%
	56-65	19	5.3%	16	7.0%	3	2.3%
	66+	20	5.6%	19	8.3%	1	0.8%
Total:	358	100.0%	228	100.0%	130	100.0%	

Sample size: 358; Developed countries: 233; Developing countries: 125

Education: 1=High/secondary school; 2=Undergraduate; 3=Post-graduate; 4=Other

Profession: 1=Student; 2=Employed - work from home; 3=Employed - work in office; 4=Unemployed; 5=Retired; 6=Entrepreneur/
Freelancer; 7=Other

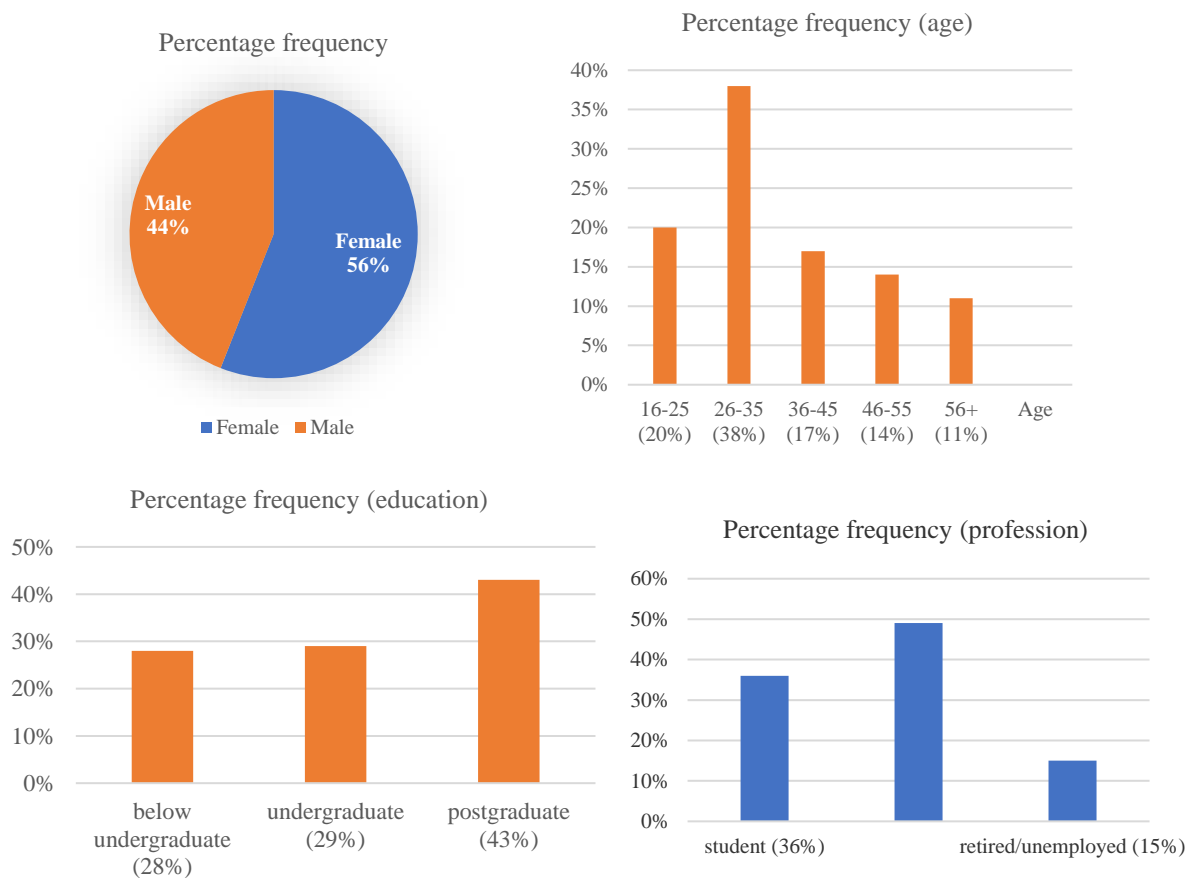


Figure 4.14 Sample Demography

The sample total is 358 (64% from the developed countries and 36% from the developing countries) of 47 countries. (Figure 4.14) states that female respondents (56%) are more than male respondents (44%); age 16-35 occupies the highest portion (58%) of the sample, followed by age 26-55 (38%), and age 56+ (11%); 72% have a high level of education, and 28% below undergraduate. In the profession, 36% are students, 49% are employed, and 15% are either retired or unemployed. The sample profile reflects a young diversified and well-educated group of representation, which is the fit sample to predict future SUD requests. (Figure 4.15) shows that their relocation reasons include work, education, family, and better quality of living. The respondents are mainly from Italy, Spain, Canada, U.K., Japan, Brazil, Argentine, Croatia, China, Nigeria, India, Iran, Ghana, Pakistan, and Mexico. etc.



Figure 4.15 Reasons for Living in the City and Nationality of the Respondents

4.2.4.2 Macro Results: Mean Score (MS) Rankings of Sustainability-Uqol Criteria

This section adopted the two-level methodological approach to present the macro MS prioritization result (Table 4.5) generated from the geographical domains and the micro MS score-weight prioritization and distribution produced by the sample demographic groups. IBM SPSS Statistics 20 English version software was hired to run the raw data collected from the survey. The main question presented to the respondents was: “Which factors/indicators are important in your IDEAL living environment?” in a 3-point Likert scale set. First, Descriptive Statistics, Cronbach’s Alpha reliability test, and normality test were conducted. The

Cronbach's alpha reliability test (Likert scale bigger than 0.7) justified that the chosen scale was suitable, the data collection instrument was strongly reliable, and the responses were consistent with the survey (Nunnally, 1978; Shen et al., 2011). Subsequently, the collected data was undergone a mean score test and non-parametric Kruskal-Wallis H-test and Mann-Whitney U test to reduce the bias of results (Kingsford et al., 2019, Sullivan & Artino, 2013; Gokdemir & Dumludag, 2011).

Table 4.5 Comparison of Mean Score Rankings of Sustainability-Uqol Indicators

Indicators	Developed Countries				Developing Countries			
	R1	Mean	SD	Rank	R2	Mean	SD	Rank
Health	98.7	2.77	.543	1	98.5	2.76	.558	1
Environment	97.4	2.57	.632	2	96.9	2.56	.614	6
Mobility	98.2	2.50	.591	4	96.9	2.62	.578	2
Governance	96.1	2.52	.652	3	95.4	2.57	.587	5
Human Capital	96.1	2.50	.666	4	94.6	2.59	.572	4
Social	99.1	2.46	.687	6	93.1	2.60	.598	3
Economy	96.5	2.19	.740	8	95.4	2.56	.629	6
Technology-ICT	95.6	2.13	.722	9	93.1	2.45	.658	8
Culture	96.9	2.21	.710	7	93.1	2.17	.691	10
Smart Living	94.7	1.99	.759	10	93.8	2.22	.662	9
Lifestyle	95.2	1.96	.763	11	93.8	2.17	.712	10

Total sample size: 358 (developed countries: 228; developing countries: 130) Respondent rate: R1 & R2; Reliability test for the eleven indicators: Cronbach's Alpha (all countries = .845) (developed countries = .848) (developing countries = .825). P-value: 0 < 0.05

Developed countries: Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czechia, Finland, France, Germany, Greece, Ireland, Italy, Japan, Latvia, Netherlands, Poland, Republic of Korea, Romania, Spain, Sweden, UK, and USA; Developing countries: Argentina, Azerbaijan, Bangladeshi, Benin, Brazil, China, Colombia, Egypt, Ethiopia, Ghana, India, Indonesia, Iran, Kazakhstan, Lebanon, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Philippines, Russia, South Africa, and Sri Lanka.

Source : https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf

In (Table 4.5), the fundamental technique mean score (MS) was hired to justify the identified eleven policy-driven Sustainability-Uqol indicators. The 3-point Likert scale (1=least important to 3=most important)²¹ set the MS threshold at 1.5, which means any indicators with a mean score >1.5 justified as the significant Sustainability-Uqol criteria of the WoSu. The

²¹ The three-point Likert scale is adopted instead of a five-point Likert scale because it is more realistic to provide an evaluation range on Uqol, which people can understand and sense the meaning to evaluate the grading accordingly.

MS illustrated the level of significance of each indicator impacting on Uqol perceived by the respondents. The higher the mean value showed, the more vital the respondents' indicator perceived within the group. All the proposed eleven indicators fall into the significant slot ($MS > 1.5$) with a frequency rate of over 90% and a p-value: $0.000 < 0.05$. Next, the set of data were ready for a micro check.

4.2.4.3 Micro Results: Score-Weight Prioritization and Distribution

In micro, an in-depth investigation of the latent variables based on demographic groups can better inform urban policymaking.

A. Comparing Mean Scores by Demographic Groups

Respondents age 16-25 has the highest MS (2.89) > 56+(2.87) > 36-45(2.81) > 26-35(2.77) > 46-55(2.67) for health; male has MS (2.84) > female(2.76); below undergraduate has MS(2.87) > postgraduate(2.77) > undergraduate(2.76); retired/unemployed has MS(2.93) > student(2.86) > employed (2.71). Age 56+ ranked economy (1.65), technology-ICT (1.52), culture (1.74), smart living (1.55), lifestyle (1.45) lower than the rest of the groups. MS of economy, technology-ICT, smart living, and lifestyle falls below MS (2) for the retired-unemployed and the elderly 56+. The mean scores (MSs) of all the demographic groups are higher than the benchmarked MS (1.5), reconfirming the macro verification of the WoSu. At some points, it reveals that demographic attributes (subjective perception of well-being) are related to the geographical presentation (objective policy-driven urban condition), but further quantitative verification is needed to support the claim.

Table 4.6 Mean Score List of Sample Demographic Groups

Demographic	1	2	3	4	5	6	7	8	9	10	11
Gender: Female	2.76	2.56	2.53	2.60	2.52	2.51	2.34	2.21	2.13	2.03	2.05
Male	2.84	2.61	2.63	2.50	2.60	2.57	2.39	2.32	2.28	2.14	2.01
Education: 1	2.87	2.69	2.58	2.62	2.58	2.45	2.06	2.07	2.24	1.98	1.81
2	2.76	2.48	2.49	2.58	2.47	2.51	2.45	2.26	2.22	2.17	2.13
3	2.77	2.58	2.61	2.50	2.59	2.60	2.49	2.37	2.14	2.08	2.11
Profession: Student	2.86	2.63	2.65	2.55	2.60	2.63	2.50	2.45	2.24	2.18	2.19
Employed	2.71	2.53	2.50	2.55	2.54	2.48	2.37	2.26	2.21	2.10	2.03
Retired	2.93	2.64	2.62	2.56	2.51	2.47	1.96	1.78	2.02	1.73	1.67
Age: 16-25	2.89	2.64	2.57	2.66	2.62	2.61	2.38	2.30	2.21	2.07	2.16
26-35	2.77	2.55	2.63	2.51	2.52	2.55	2.43	2.41	2.23	2.17	2.12
36-45	2.81	2.63	2.48	2.59	2.59	2.54	2.46	2.26	2.24	2.11	2.09
46-55	2.67	2.58	2.47	2.56	2.58	2.58	2.51	2.29	2.31	2.16	1.98
56+	2.87	2.55	2.65	2.45	2.45	2.26	1.65	1.52	1.74	1.55	1.45

Indicators: 1=Health; 2=Environment; 3=Mobility; 4=Governance; 5=Human Capital; 6=Social; 7=Economy; 8=Technology-ICT; 9=Culture; 10=Smart Living; 11=Lifestyle; Education: 1=Below undergraduate; 2=Undergraduate; 3=Postgraduate

This section illustrates the pattern loading of mean score (MS) disparities by gender, education, profession, and age groups, which provides a detailed analysis of the macro MS ranking results by geographical groups. The study utilized the MS reports of sample demographic groups (Table 4.6) to examine the independent factors' relationship to the dependent geographical groups while removing the systematic and random errors principally.

By referring to the MS results listed in (Table 4.5 & 4.6), an array of radar diagrams (Figure 4.16) were generated to illustrate the loading pattern of Sustainability-Uqol evaluation for discussion. In general, all groups perceived health, environment, mobility, governance, and human capital with similar MS. However, a greater disparity in the economy, technology-ICT, culture, smart living, and lifestyle was highlighted. The “below undergraduate” perceived the importance of the economy, technology-ICT, and lifestyle relatively less significant than the “above undergraduate” in the education group. In the professional group, the “retired-unemployed” perceived the value of the social, economy, technology-ICT, culture, smart living, and lifestyle relatively less significant than the “students” and the “employed”. Visibly,

age 56+ perceived social, economy, technology-ICT, culture, smart living, and lifestyle are less critical than the younger groups in the age group. Seemingly, the loading pattern of the demographic groups is consistent with the country (geographical) groups.

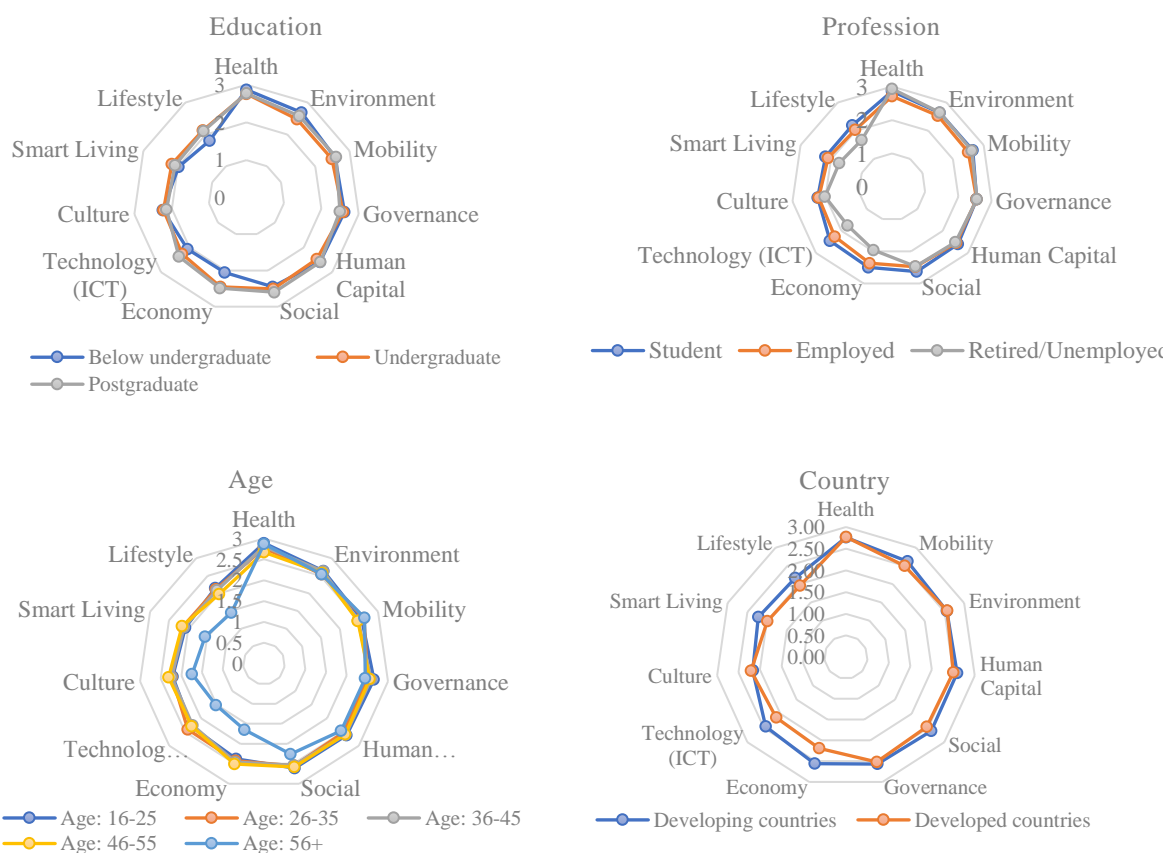


Figure 4.16 Mean Score Disparities of Different Demographic and Geographical Groups

The above illustrates that the micro MS results of education, profession, and age play a crucial role in shaping the macro MS ranking results implying that well-being ranking garnered by demographic groups dictate the geographical domains. The findings provide quantitative support for hypothesis 1 and 2 with a specific interpretation by revealing that demographic attributes are the factors contributing to the Sustainability-Uqol evaluation gaps. It concludes that demographic background affects Sustainability-Uqol evaluation represented by geographical groups. However, to predict the future urban development beyond the sample

representation, Kruskal Wallis H-Test and Mann-Whitney U Test were conducted to estimate the expected urban supply for informing future urban development policy.

4.2.4.4 Determination of the Significance of the Sustainability-Uqol Criteria

Further to the previous quantitative verification, the skewed distribution of sample sizes needs to perform non-parametric testing methods. Kruskal-Wallis H-test and Mann-Whitney U-test were applied for comparing two or more independent samples of equal or different sample sizes to reduce systematic errors. They detected which Sustainability-Uqol criteria were with significant degrees of differences within the demographic and geographical groups.

Table 4.7 Kruskal Wallis H-Test and Mann-Whitney U-Test of Demographic and Geographical Groups

<u>Dimensions</u>	<u>Kruskal-Wallis H-test</u>			<u>Mann-Whitney U-test</u>	
	<u>Age</u>	<u>Profession</u>	<u>Education</u>	<u>Gender</u>	<u>Country</u>
Health	0.754	0.012 ^a	0.163	0.137	0.872
Environment	0.940	0.388	0.201	0.623	0.677
Mobility	0.327	0.217	0.511	0.11	0.051
Governance	0.472	0.975	0.081	0.174	0.622
Human Capital	0.653	0.399	0.303	0.241	0.358
Social	0.004 ^a	0.023 ^a	0.093	0.983	0.080
Economy	0.000 ^a	0.000 ^a	0.000 ^a	0.434	0.000 ^a
Technology-ICT	0.000 ^a	0.000 ^a	0.018 ^a	0.076	0.000 ^a
Culture	0.037 ^a	0.195	0.610	0.148	0.583
Smart Living	0.002 ^a	0.005 ^a	0.147	0.087	0.007 ^a
Lifestyle	0.000 ^a	0.001 ^a	0.002 ^a	0.605	0.015 ^a

P-value^a< 0.05 shows a statistically significant difference in those indicators. Country: developing countries vs. developed countries

The Mann-Whitney U test highlights a significant difference (SD) between developing and developed countries in the ranking of economy, technology-ICT, smart living, and lifestyle with a p-value^a < 0.05. It means that this finding reflects the population result. Thus, these four criteria are significant enough for developing countries' policymakers to investigate the latent factors. More empirical studies on the SD indicators should be conducted because

discovering the rooted reasons for disparities is critical to predicting and planning for the future sustainable urban development policy.

P-value^a < 0.05 from the Kruskal-Wallis H-test shows a high degree of ranking difference among each demographic group (SPSS, 2006). Six significant differences (SD) were found among different ages: social, economy, technology-ICT, culture, smart living, and lifestyle. Five SD were identified between different professions: health, social, economy, technology-ICT, smart living and lifestyle, and three SD from different education levels include economy, technology-ICT, and lifestyle. The three groups' common denominators are economy, technology-ICT, and lifestyle, while gender shows no significant difference. The findings depict a pattern loading of MS ranking disparities by sample demography to explain the disparity findings in the geographical groups. *It proves that demographic attributes are the independent variables affecting the dependent geographical groups. It signals that location' might become insignificant if any place can serve the eleven expected well-being needs corresponding to the theme-goal of study. The inferential statistics indicate that Sustainability-Uqol evaluation is affected by demography and exhibit geographically, ranking disparities between developed and developing countries providing verifications for hypotheses 1 and 2, with the mean score above the benchmark 1.5. At this point, the WoSu is validated.* To make the two-pronged model more robust, a model-fit-test for the hypothetical SHE-City will be performed in section 4.2.5.

4.2.4.5 Implications

The study indicates that the demographic groups of education, profession, and age are the hidden factors for causing the MS ranking disparities between developed and developing countries. The possible evaluation gap between the two domains is analyzed and presented by comparing the MS score and MS ranking lines (Figure 4.17).

Overall MS score is 2.48, and 2.35 out of 3 for the developing countries, and developed countries, respectively. *The relevantly higher MS score garnered by the developing countries over the developed countries might imply that people from the developing countries are more eager to seek better living than the people from the developed regions in general.* The former group is more driven and tends to relocate to places where they can find jobs to improve their living standard. It suggests that local constraints affect the prioritization between people who live through different stages of urban development. In particular, the developing countries perceive the environment as less critical than developed regions but with higher MS (2.57 vs. 2.56). Still, environmental quality affects personal health while contributing to a pleasant living environment. Causality between environment and health explains why health is ranked at the top out of the eleven indicators by all the demographic groups across the two geographical regions.

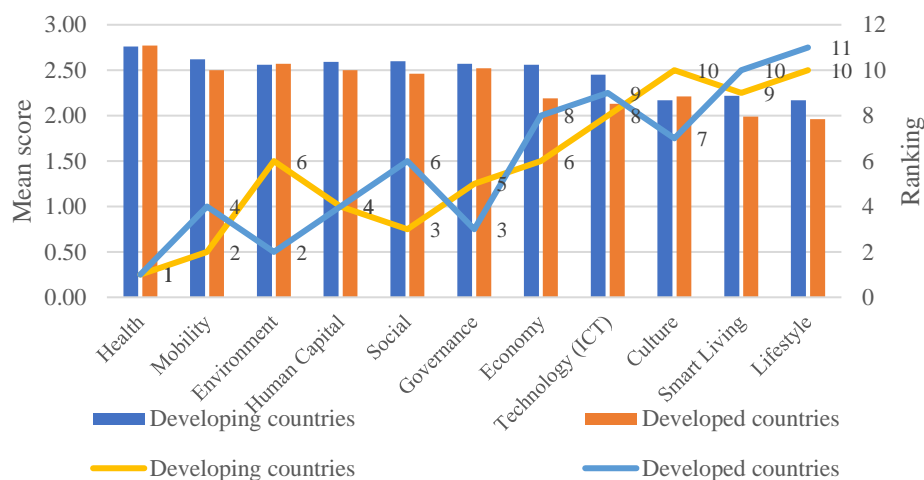


Figure 4.17 Combo Chart of the Mean Scores and Ranking Lines

(Figure 4.17) shows the pattern of ranking line-developed and ranking line-developing divided into three distinctive parts: the similar ranking section composes health, human capital, technology-ICT, smart living, and lifestyle, which implies that *the two groups of respondents expect the urban development policy to address health first and foremost, then*

human capital, and the relatively least important technological-driven criteria, and lifestyle.

The five Sustainability-Uqol indicators relate to the human-physical-contextual environment in different levels of reality, which are the universal demand the policymakers must stress. There is a greater division of evaluation gap in the ranking of mobility, social, economy, environment, governance, and culture between the two groups. The developing countries ranked environment, governance, and culture relatively lower than the developed countries with the relatively higher prioritization of mobility, social (job opportunities, and welfare), and economy to the developed countries. Developing countries currently lack mobility/transportation systems (mobility in the developing countries is ranked at the 2nd place), job opportunities, welfare, health care, education and skill training, sports centers, infrastructure development, a well-performed corruption-free government, technology-ICT capability. Improvement of these lacking areas is expected in developing countries. The Sustainability-Uqol ranking results seem to agree with the MHN theory, which states that the developing country's pre-requisite most likely acquires the basic physiological need level for an upgrade of the higher psychological need level. In general, the respondents from developing countries normally desire the socio-economic offerings over environmental sustainability than those living in the developed countries (Mukherjee, 1989; Ali and Nsairat, 2009). To the developed countries, since the basic human needs have been fulfilled, ranking environment the 2nd place is understood, and much value governance and culture because those respondents tend to be more educated and expect to fulfill the psychological need level. However, *a revised MHN idea will be suggested in Chapter 5 when ICT plays a significant role in urban-rural development for challenging the conventional MHN theory*

One-point worth stressing is that the economy was ranked 6th (developing countries) and 8th (developed countries) out of eleven places. *To the economic-driven urban policymakers, income levels are the primary determinant of well-being (Gokdemir & Dumludag, 2011), but it is not the case according to the subjective demand-side evaluation. It seems that a communication gap or evaluation gap between the economy-driven urban development policy and the long-term needs of the residents exists.* Although the low ranking of the economy would be a result of the skewed distribution of sample size, according to the (Economist Intelligence Unit, 2005; European Commission, 2009; Stiglitz, 2009; Pinter et al., 2012), material well-being, as measured by GDP per person, no longer explains the broader quality of life in a country. *The surprising result suggests that governments from the developed countries should re-examine their traditional capital-led urban development policy by taking the residents' needs into account potently instead of following the usual practice.* In the meantime, policymakers from the developing countries should explore and take a different path on urbanization strategic planning.

Mainstream opinions in more advanced societies tend to differentiate 'quality of life' from 'standard of living.' The standard of living refers to the level of achieved satisfaction in basic materialistic needs. In addition to life satisfaction in basic physiological needs, QOL also covers satisfaction in emotional needs, such as being satisfied with freedom, justice, and opportunities to complete individual capabilities. QOL research is concerned with an extensive range of topics, amongst which are: individual physical and mental health, well-being, satisfaction, family, work, housing, social relations, political and cultural lives, social ethics, and others. The study recommends that a more human-centric SUD policy prioritizing health, environment, mobility, human capital, governance, social, economy, culture, technology-ICT, smart living, and lifestyle should be promoted as an alternative for future urban development.

Although technology-ICT and smart living were ranked at the bottom of the eleven indicators, technological advancement, especially in transportation and ICT, catalyzes inter-connectivity and inter-exchangeability of people, commodities, information, culture, and moral and political ideology. It formulates the new mix of social and cultural patterns, imposing a new challenge for governance because unique demographic and geographical backgrounds divide people into groups regarding urban livelihoods. Often, cultural gaps and conflicts can disturb any establishment and deteriorate the living environment and quality of life in developed countries. In such a case, urban policymakers need to envision the significant impact triggered by the technology-ICT and its means-end relationship of smart living to the holistic urban ecosystem. Urban policymakers need to consider transportation and ICT network as critical as the social and cultural indicators in drafting sustainable urban development policies in the digital age.

Regarding the ranking of technology-ICT, smart living, and lifestyle between the developing countries, and developed countries, developing countries noticeably have higher MS, which is also reflected in (Figure 4.17): age - indicators of significant differences. Age above 56 has a critical set of lower MS (social, economy, technology-ICT, culture, smart living, and lifestyle) than the 16-55 age groups. The six indicators appear to be less relevant to older people because they tend to live for less material-driven lifestyle than the younger generation, while some of the elderly live with the retirement plan (i.e. all the retired respondents are from the developed countries), which explains why mean scores of the developing countries are higher than the developed countries. Does this phenomenon mimic the aging post-industrial towns of developed countries and the youthful developing countries? Also, the elderly lack the skill to engage in the internet of things (IoT) and other digital appliances (Fengying et al., 2011). In contrast, young urbanites appeal for an urban technology-driven lifestyle.

According to the 2030 Agenda of the (United Nations Development Programme, 1997), which is “to embark a development journey leaving no one behind” (UNDP, 2030), policymakers must not only subscribe to the mainstream disregarding the marginalized groups that an inclusive policy is serving both the younger generation and the elderly who possess different skills, and requests in life should be promoted. Indeed, the digital divide is a pressing social-economic-technological issue in digital ruralism due to different professions, ages, and education levels (Townsend et al., 2013; Eastin & La Rose, 2000; Fengying et al., 2011). Nevertheless, giving the implication, the WoSu will come in handy for the developing countries' urban policymakers where lacks data and information to understand the complex factors shaping the future cities. Further discussion will be performed in Chapter 5: Application.

4.2.5 Validating the Hypothetical SHE-City: Quantitative Approach

This section analyzes and validates the hypothetical SHE-City, which forms the first layer of the two-pronged WoSu. A triangulation research technique adopted literature review in section 4.1.2, a case study of Amsterdam’s SUD policy in section 4.2.2, and a CFA-SEM goodness-of-fit test to perform the tasks. The model assumed that the SUD driven TOD and ICT were the means for enhancing MHN based on the theme-goal of “SUD enhances Uqol”. First, confirmatory factor analysis (CFA) was used to identify and categorize the factor structure of TOD, and ICT. Second, the causal relationship of TOD and ICT to the theme-goal of SUD-MHN (Sustainability-Uqol), was tested for its goodness-of-fit by SEM. According to the defined composition of SHE-City and the validation result of WoSu, a hypothetical SHE-City model was conceptualized for testing (Figure 4.18).

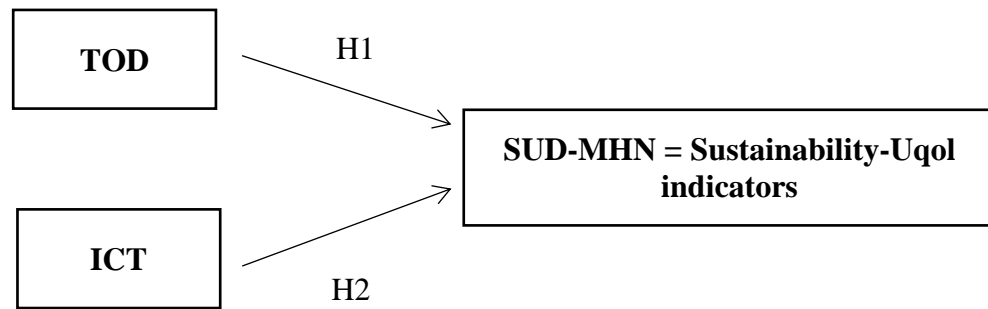


Figure 4.18 Hypothetical Model for Validating the SHE-City

Hypotheses 1: TOD has a positive impact on SUD-MHN

Hypothesis 2: ICT has a positive impact on SUD-MHN

Hypothesis 3: TOD and ICT are correlated positively.

4.2.5.1 Checking Data Suitability for Running Confirmatory Factor Analysis

SPSS was used to perform a data suitability test. The Bartlett and Kaiser-Meyer-Olkin (KMO) tested the eleven observed variables of the MHN measurement scale listed on (Table 4.8)

Table 4.8 KMO and Bartlett Tests of the Eleven Sustainability-Uqol Indicators

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.855
Bartlett's Test of Sphericity	Approx. Chi-Square	1100.041
	df	55
	Sig.	.000

The Kaiser-Meyer-Olkin (KMO) value is $0.855 > 0.5$ (Hair, 2019) and a significant probability of $0 < 0.05$ for the Bartlett test of Sphericity (Shan et al., 2017), it means the matrix is correlated and factorable, not identity matrix. The sample size $(N=357)^{22}$ is above the safe threshold of 200 suggested by (Matsunaga, 2010). With the data proved to be suitable for conducting CFA, the next step is to identify and validate the latent constructs of MHN.

²²357 out of 358 samples are valid for the model test.

4.2.5.2 Conducting Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) was applied to perform initial factor extraction because it is suitable for the hypothetical model developed with a strong theoretical base. Two significant factors with Eigenvalue >1 were confirmed (Seo et al., 2004), shown in Factor Loading of the Two Latent Constructs (Table 4.9), and a scree plot (Figure 4.19). The two-factor constructions explained a total variance of 52.615% >50%. Communalities should be >0.4 or close. Factor 1 was identified as TOD made up of six observed variables consisting of health, governance, mobility, social, human capital, and environment. Factor 2 was identified as ICT made up of five observed variables consisting of technology, lifestyle, economy, culture, and smart living. The result validated the two factors to form a cause-effect path diagram for undergoing the SEM goodness-of-fit test with a purpose to validate the hypothetical SHE-City model.

Table 4.9 Factor Loading of the Two Latent Constructs

Observed variables	Factor Loading		Communalities
	(1) TOD	(2) ICT	
Health(personal/society)	0.835		0.609
Governance(stability/freedom)	0.636		0.446
Smart Living (internet of things)		0.749	0.534
Culture(tradition/museums/events)		0.418	0.347
Technology-ICT (Wifi/innovation)		0.861	0.722
Mobility(transportation)	0.521		0.421
Environment (nature/green energy)	0.769		0.553
Social(employment/housing/equality)	0.685		0.541
Economy(income/trade)		0.618	0.515
Human Capital (education/people)	0.762		0.584
Lifestyle(shops/restaurants)		0.750	0.517

Note: accumulative variance of the two factors: 52.615%

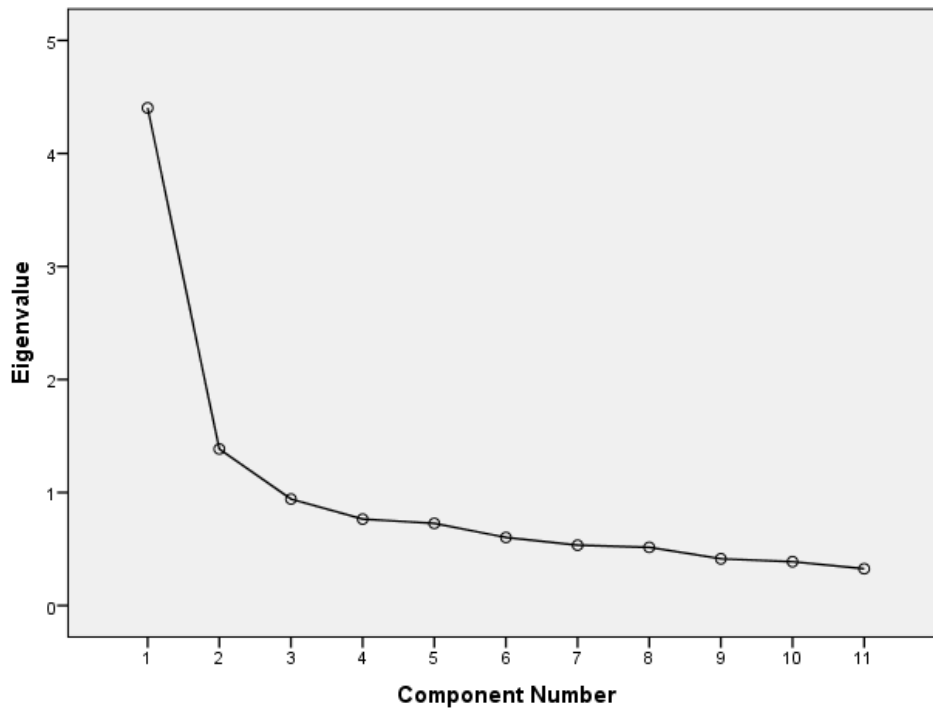


Figure 4.19 Scree Plot of Confirmatory Factor Analysis (CFA)

4.2.5.3 Running Structural Equation Modelling (SEM)

This section runs and discusses the Structural Equation Modelling (SEM) result intending to validate the hypothetical SHE-City model. SEM is an efficient and robust statistical technique to analyze a series of inter-relationships and causal relationships among multiple observed variables and detect latent constructs simultaneously in a model. Analysis of Moment Structures (AMOS vers. 20.0, IBM) was adopted to perform SEM goodness-of-fit test because it can handle the non-normal data with the maximum likelihood method of estimation, which is a robust estimation method for measuring the structural paths coefficients (Awang, 2012). By running and checking the SEM goodness-of-fit, the justified causality, association, and hierarchy of key components making up the future SHE-City, and WoSu as the integral parts of U2-CAS could be finalized.

Valid data were collected from 357 >100 respondents for five or fewer latent constructs (Awang, 2012). The empirical model was tested for the goodness-of-fit against the hypothesized She-City model. There were two stages involving the reliability test of the measurement model involving CFA (Chapter 4.2.5.2) and model fit test of SEM. The hypothetical SHE-City measurement scale was composed of eleven observed variables, and two latent constructs (TOD and ICT). (Figure 4.20) shows the test result, which will be carefully evaluated in (Table 4.10 and 4.11).

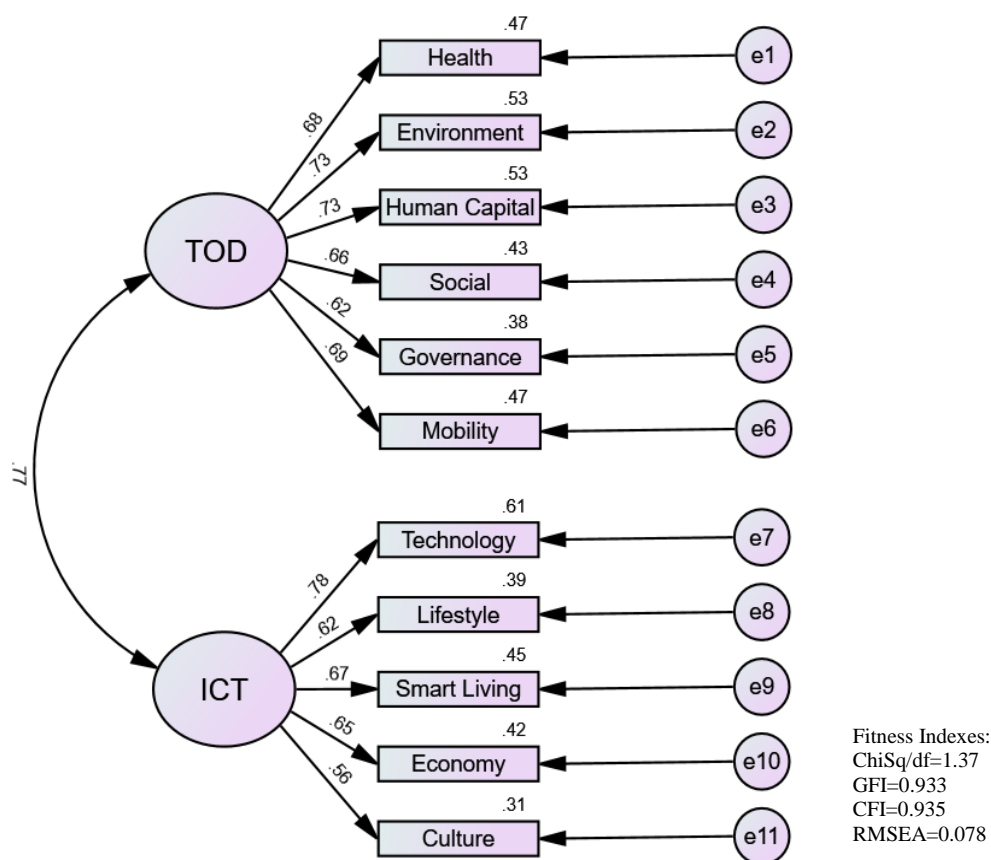


Figure 4.20 Hypothetical SHE-City Model for Structural Equation Modelling (SEM) Test

(Table 4.10) illustrates the desirable goodness-of-fit assessment (Bentler, 1990 ; Baumgartner & Homburg, 1996) derives from Chi-square/df = 1.37<5, probability level = 0.000<.05 (Marsh & Hocevar, 1985), RMSEA 0.078<0.08 (Browne & Cudeck, 1992), GFI 0.933>0.90 (Joreskog & Sorbom, 1984), and CFI 0.935> 0.9.

Table 4.10 Results of SEM Testing

Model-Fit category	Name of index	Level of acceptance	Index Value	Tested Result
Parsimonious fit	Chi-sq/df	Chi-sq/df <5	1.37<5	good
Absolute fit	RMSEA	RMSEA<0.08 Rang 0.05-0.1 is acceptable	0.078<0.08	good
Incremental fit	GFI	GFI>0.90	0.933>0.90	good
	CFI	CFI>0.90	0.935>0.90	good

*Goodness-of-fit indices of SEM suggested by (Awang, 2012)
 Note: The sample size is 357; bootstrapping: 2000 time

Table 4.11 Results of Hypothesis Testing for the Respected Path

	Hypothesis statement of path analysis	Estimate	P-value	Results on hypothesis
H1	TOD has a significant positive relationship with health, governance, mobility, environment, social, and human capital.	0.62-0.73	0.00	supported
H2	ICT has a significant positive relationship with technology, lifestyle, smart living, economy, and culture	0.56-0.78	0.00	supported
H3	TOD and ICT are correlated positively.	0.77	0.00	supported

All the factor loading tested was fit in the model with a score between 0.5. to 0.8. Hypotheses (H1 and H2) of ICT and TOD have a significant impact on the eleven Sustainability-Uqol criteria because all corresponding factor loads of the measurement are positive, and above 0.5, stating that the eleven observed variables are effective indicators for measuring TOD and ICT. In other words, TOD and ICT were the cause for affecting the eleven Sustainability-Uqol indicators statistically significant. TOD played a significant role in affecting health (0.68), environment (0.73), human capital (0.73), social (0.66), governance (0.62) mobility (0.69), and which, while ICT contributes significant to technology (0.78), lifestyle (0.62), smart living (0.67), economy (0.65), and culture (0.56). H3 was supported by a correlation of 0.77<0.85 (Awang, 2012). The acceptance of the hypothetical SHE-City Model was validated by the

significant positive relationships of the two factors to the observed indicators. From the SEM testing result, the model fits with the necessary figures that fall within the parameter, accordingly, both the WoSu and SHE-City models were validated with two-round of qualitative and quantitative justifications.

4.2.6 Validating and Confirming the U2-CAS

The U2-CAS is a multi-dimensional hierarchy, hence, validation of both the SHE-City and WoSu is the pretext for validating the innovative U2-CAS. A mixed-methods research strategy and two sequential triangular verifications were shown with a checklist of research methods for accomplishing the two planned objectives. First, a case study was conducted for reviewing Amsterdam's SUD policies, supplemented with field observation to strengthen the claim. Second, the WoSu was constructed with a comparative analysis and validated with mean score test, Mann-Whitney U-test and Kruskal-Wallis test for building the hypothetical SHE-City model. Third, CFA and SEM were employed to test the hypothetical SHE-City model. It illustrates the relationships of the four key components (TOD-ICT-SUD-MHN) of future SHE-City, and the causal relationship of TOD-ICT to the eleven observed Sustainability-Uqol criteria (SUD-MHN), which is in line with the findings from the literature review with other qualitative studies. With the significant qualitative and quantitative justifications, the U2-CAS was validated and confirmed with the acceptance of all the three hypotheses corresponding to the core statement.

Table 4.12 Check List of Research Methods for Validating and Confirming the U2-CAS

Research goal	Research methods
Developing U2-CAS	✓ Mixed-methods research (qualitative and quantitative justifications)
Achieved research objectives	✓ Triangulations
1. Conceptualizing and validating the future SHE-City	<ul style="list-style-type: none"> ✓ Literature review ✓ Case study of Amsterdam’s SUD policy ✓ Subjective well-being survey (SWBS) <ul style="list-style-type: none"> • Model validation: CFA and SEM
2. Developing and confirming the two-pronged WoSu	<ul style="list-style-type: none"> ✓ Literature review ✓ Comparative analysis of the relevant Sustainability-Uqol indices ✓ SWB Survey <ul style="list-style-type: none"> • Mean score test, Mann-Whitney U-test and Kruskal-Wallis test • Comparison of mean score
Result: Validation and Confirmation of U2-CAS	Mixed-methods research was accomplished by two sequential triangulations with significant validations

4.2.6.1 Acceptance of Hypotheses and Core Statement

Along the logical and empirical trajectory, a “duality in its dynamic state” is a suitable mechanism in tackling the current individual, domestic and global issues as materialized by the U2-CAS. The U2-CAS, firmly anchored to the human-physical-contextual environment (H-P-C), has been verified scientifically to agree with the three hypotheses stated in earlier.

1. QOL is subjective due to demographic and geographical differences.
2. Well-being evaluation gap exists in the ranking result of the Sustainability-Uqol indicators (WoSu) between developed and developing countries.
3. SUD, TOD, ICT, and MHN of SHE-City are the main components for defining people’s Uqol.

Convenient public transportation, technology, social-economic-environmental advancement, and smart living have been considered as the main aspects serving people's Uqol; moreover, this bundle of local constraints varies from time to time, village to village, town to town and city to city in accordance to each nation's political-economical-social-environmental agenda. Accordingly, a sound and effective urban evaluation system equipped with the ability for localization is essential to accommodate the local needs as well as governing principles. With the acceptance of the above hypotheses, the argument of this study is justified:

“There is a need for developing an Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS), an urban evaluation system integrating the external top-down policy-driven indicators and the internal bottom-up subjective well-being evaluation.”

The study states that QOL is subjective with the acceptance of hypotheses 1 and 2. The acceptance of hypothesis 3 validates the SHE-City subsequently justifying the two-pronged WoSu evaluation tool (Figure 4.21). In discussing social-economic sustainability, the city became/become/will become a place inhabited by people with different demographic and geographical backgrounds. *The findings of the MS ranking prove that demographic and geographical background have a cause-effect relationship impacting well-being evaluation, which is why the attribute of QOL is subjective by nature. Successively, the result also illustrates that significant Sustainability-Uqol disparities between the groups of developed countries and developing countries are marked through the different phases of the urban development lifecycle. The study reminds urban policymakers to rethink their economy-led urban development policies to tackle the new challenges brought by the emerging cultural-diversified global community where we all share the future in thick and thin.* Since the WoSu was derived from the SHE-City, the significance and prioritization of the four key components (TOD, SUD, ICT, and MHN) making up the SHE-City, therefore, the acceptance of hypothesis

3 by illustrating the causality of TOD-ICT-SUD-MHN with a desirable SEM goodness-of-fit result further certifying the two-pronged WoSu, and the multi-layer U2-CAS scientifically.

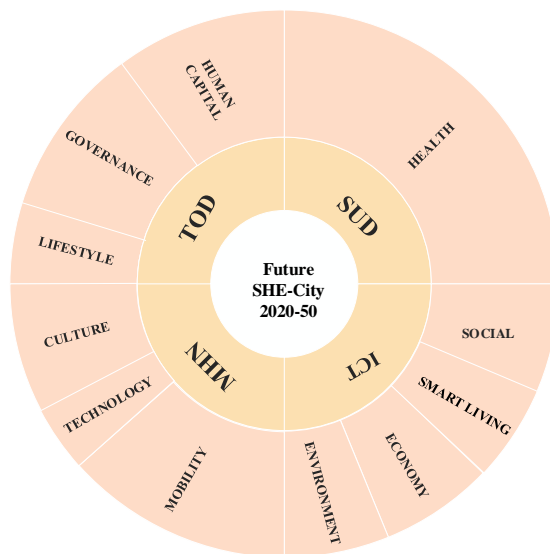


Figure 4.21 Wheel of Sustainability-Uqol (WoSu)

4.2.6.2 Limitations

Since “Reality” is nested inside the unknown “Truth,” the most this study can achieve is to reveal the “Reality” as close as to the “Truth,” not the whole “Truth.” On the one hand, once the SHE-City limits the parameter, the limit confines the reality. The four main components making up the SHE-City confine the definition of QOL, giving QOL a unique meaning in the urban context. On the bright side, the limitation would be a plus in achieving the goal effectively and efficiently because the scarcity of resources is the pivotal universal constraint.

Regarding data collection, uneven distribution of sampling size was found among each group in the same category. Whereas, such a case is unavoidable in the process of sampling. Noting that, the disproportional number of respondents between the groups would inflate the respondents’ rate of the bigger group causing a skewed result. Thus, certain groups were combined with the other groups, such as merging the “Employed - work from home” and “Employed - work in the office” into the “Employed” group. Besides, non-parametric Kruskal

Wallis H-Test and Mann-Whitney U-Test were applied to reduce the systematic error. This non-funded independent research limits an extensive sampling of the Uqol survey to reduce the standard deviation. Whereas it has been a good start for the research, and we have translated the online SWBS into different languages such as French, Spanish, Russian, Portuguese, and Chinese to collect more samples when there is funding available for future development.

The sensitive political factor has not been included in the discussion. There is no clear judgment on which political ideology is the best one for improving urban quality and well-being, but one thing for sure, mutual understanding and trust built on “dualism” and “pluralism” is for achieving the goal of SUD. Whereas, improving urban quality and wellbeing is a subjective and localizing matter subject to the complex-adaptive urban system, which is fundamentally dictated by demographic and geographical attributes. Consequently, empirical study at the local geographical level can yield the insightful and more precise implications for better urban policymaking. Although the research delivers the part of “understanding and evaluating the urban quality of life”, but not the part of “enhancing the urban quality of life”. Whether the U2-CAS can contribute to improving well-being or not will still take time and effort for other cause-effect variables to act in the time capsule, a story needs to be told with the proof in the future. The next chapter aims to realize (objective 3) by applying the WoSu evaluation tool to explore a new urbanization path for the developing countries.

4.4 INTERMEDIATE SUMMARY

As noted earlier, the two separate approaches of the policy-driven monitoring QOL through a set of indicators and the use of sample surveys for measuring people's subjective well-being should be combined for examining the sustainability of a place and people's livelihood. The U2-CAS and the two-pronged WoSu were developed to solicit and prioritize residents' perceptions of the policy-driven social, economic, environmental, cultural, and technological

offerings to facilitate sustainable urban policymaking, and to accommodate the local Sustainability-Uqol demand while compromising the global concept of sustainability. It was initiated with a "duality" idea, defined by the urban space and human needs, integrating the gap of the top-down policy-driven Sustainability-Uqol supply and the bottom-up subjective well-being demand, verified with mixed-methods research. The two-pronged WoSu evaluation tool is a composite of health, mobility, environment, human capital, governance, social, culture, economy, technology-ICT, smart living, and lifestyle. The study proves that a two-pronged evaluation tool is critical to urban policymaking because its comprehensive evaluation can reflect the supply (policy-driven goal) and demand (urbanites' expected MHN needs) of urban development with measurement capability for possibly reaching the equilibrium state of sustainability.

In the beginning, I asked how can humans regain or improve the balance of social-economic-environmental growth in the highly culturally diverse developed countries and what might be the future urban development policy should the developing countries expected? Now, they can apply the WoSu as the fundamental urban evaluation tool to assess the current urban conditions to design a sustainable development framework. For example, the developing countries can use the human-transportation-social-economic-environment-technology-driven composite of Sustainability-Uqol indicators to build their urban evaluation tools.

Urbanization is a process of population concentration, not a form (Brenner & Schmid, 2015; Tisdale, 1942). Time and the socio-spatial impact cannot be generally interpreted; otherwise, it will create an urban supply and demand gap by the faulted urban development policy, most importantly, it will intensify the issue of climate change, and degrading our QOL. The different urban realities revealed from the developed countries and the developing countries appeal to a transitional SUD pathway, guiding the developed countries to regenerate their overexploited urban areas to the "after a developed period". To the developing countries,

designing and constructing their natural landscape for poverty relief while compromising to the future sustainability goals become the pressing challenges in designing the SUD policies. For sure, the trajectory of a future SUD must focus not only on economic or materialistic requests but also on non-materialistic fulfillment in culture, social and environmental protection, and improvement. The study concludes and disseminates information on influential factors and their relationships confined in the human-centric urban environment (SHE-City), which can help inform effective SUD policies of the developing countries for upgrading residents' ways of life.

The sample respondents' profile shows that a diversity of people coming from different nationalities residing in either the developing countries or developed countries perceived Sustainability-Uqol differently. However, health is significantly prioritized in the pursuit of happiness. In retrospect of the COVID-19 global health crisis, health has been identified as the main component for building the Health Silk Road endorsed by the World Health Organization (WHO) Memorandum signed in 2017. So, metropolitan cities with impressive GDP like London, Paris, Hong Kong, New York City, and Tokyo symbolize prosperity in terms of overall life satisfaction would be a paradox. Urbanization might contribute to economic growth, but not necessarily translating into the wholesome Uqol improvement, instead, it would be an indicator of an unhealthy living environment boxed within limited creativity and living spaces to the average people.

Regarding the developed countries, the current economic-driven urban development model in favor of the capitalist market is no longer a suitable model for solving global and local issues while serving the needs of average citizens (Enfu & Xiaoqin, 2017). For example, the happiest country in the world ranked by the UN's 2018 World Happiness Report, Finland's Prime Minister Sanna Marin adopted SUD reforms to develop a balanced society for embracing financially responsible, socially equitable, and environmentally sustainable. The status quo of

the developed West as the benchmark for urban development over the past decades demands a paradigm shift to fit its future scenarios. A new way of thought and urban development models should be initiated.

As for the developing countries, proving by both qualitative and quantitative illustrations, the reality should be understood, analyzed, and viewed in each case regarding the demographical and geographical backgrounds besides economic advancement. In the age of globalization and digitalization, where operation matters now more than ever, cultural diversity is the by-product of immigration, becomes the norm of urban development. Still taking a generalization approach to conclude the reality is just a trend that hinders the performance of any SUD projects; therefore, the traditional urban development paradigm and QOL evaluation system used to work for the developed countries will not work for the developing countries. It is time for urban policymakers and scholars to conduct an urban evaluation with a comprehensive yet realistic approach for future urbanism, specifically for developing countries. *As mentioned in the beginning, rapid urbanization happens in developing countries, and how those countries design, operate, and manage their urban development policies is extremely crucial to the sustainable development of our future world. Therefore, more effort and research on the study of Uqol about sustainable growth in the developing counties should be promoted substantially.*

Lastly, the newfound knowledge informs that the demographic attributes shape the Sustainability-Uqol evaluation gap exhibited geographically, implying location would become less significant in the process of urbanization. It means that the diffuse city would somehow proliferate into the countryside. The future study can explore a new development path supported by TOD-ICT for serving the home-based employment, e-commerce, e-entertainment, e-doctor, e-education, and internet of things to develop the new urban-rural complex ecological system.

CHAPTER 5: APPLICATION

This section initiates a pilot test for the study based on the findings derived from (objectives 1 and 2). It aims to achieve the last objective of the ORF for conceptualizing a future development path for developing countries. From the theoretical and analytical stages, learning and developing the Sustainability- Uqol evaluation system/tool are the key concepts aimed at understanding and responding to the global challenges posed by urbanization, and the need for merging some of the well-being gaps between the developed and developing countries. To Romero-Lankao et al., (2016), the critical importance of clarifying the uncertain urban terms should be elongated from a theory to include the operational context.

Thus, the application stage, the critical importance of applying the theory into practice is realized through answering the question of “What kind of urban-rural development path can accommodate the local well-being demand and the governmental supply for realizing balanced urbanization in the developing countries?”. This part of study has been used to write a publication titled: A Demand-Side Approach for Linking the Past to Future Urban-Rural Development” for the special issue of “Planning for Rapid Change in Cities” in the Urban Planning Journal (I.E. Copyrights belong to the Author). Please read this chapter as an independent paper for easy understanding.

5.1 ABSTRACT

Is economy-led urbanization the only answer to urban planning? By 2050, about 70% of the world population will live in urban areas, intensified by rapid urbanization in developing countries. A new urban development framework is critically relevant to investigating urban living’s emerging complexity for advancing human-social-economic-environmental sustainability. The multi-disciplinary study explores a roadmap for solving industrialization’s adverse effects to inform future resilient development in developing countries. The classical

Maslow's Hierarchy of Needs (MHN) and some scholars have stated that human physiological needs would be prioritized and fulfilled by developing countries, and psychological needs would be satisfied and desired by developed countries after fulfilling physiological needs level. Our study argued that transit-oriented-development (TOD) and ICT could simultaneously fulfill some essential physio-psychological needs with digital-ruralism. Structural equation modeling (SEM) was adopted to test the indicator-based MHN theory developed by literature, urban quality of life (Uqol) evaluation between the developing and developed countries and backed by digital-ruralism success in developing China. The Uqol evaluation identifies the developing countries' subjective well-being demand as the health, mobility, governance, environment, social, economy, human capital, technology-ICT, smart living, and lifestyle, which are used to transform the classical MHN model to the indicator-based MHN model. The SEM subsequently illustrates that the observed well-being indicators are positively correlated to the TOD and ICT, defined by the proposed urban-ruralism development framework. The study contributes to an innovative approach to reconnect the classical MHN theory to contemporary sustainable urban planning while narrowing the socioeconomic-environmental gap between the developed (urban) and developing (rural) domains, which encourages a paradigm shift for future resilient urban development in the developing countries.

5.2 INTRODUCTION

In the past and now, the city is the heart of global power where economic, cultural, social, and political centers locate. It has since remained a major attraction and trigger for human migration and dislocation, mainly for job opportunities. City development dictates the ways of human living and the fabrication of our natural landscape. Although urbanization provides employment, social living, and urban lifestyle to urbanites, the rosy picture of urbanization driven by economy-led urbanism is responsible for 80% of the world's resource consumption. Many urban problems such as crime, mental health, homelessness, an influx of immigrants,

unemployment, poverty, pollutions, and planetary problems, including climate change, ecological degradation, biodiversity loss, result in lower quality of life (QOL). These current challenges for cities' sustainability goals have been highlighted and discussed on the global agenda for work (CIMI, 2018).

United Nations predicted that three out of four people will habitat, live, work, or commute to work in the urban area in the future. Although globalization's trend fosters economic growth and urban development, it undermines social and environmental sustainability because of overexploitation on our labor and natural resources and the misuse of capital, which disrupts the balance of sustainability and degrades people's QOL. For example, the manufacturing towns and cities, such as Pittsburgh (USA), Detroit (USA), Wakefield (UK), Burnley (UK), and Mirafiori (Italy), have been hurt by high social deprivation and job loss, and Dongguan city and many other industrial towns in developing China have gone through the same historical setbacks. They need effective revitalization plans to tackle the pressing social-economic-environmental-cultural issues, and to ease the development gaps between the densely populated city center and the marginalized countryside, especially the pleas for solutions at the local level. Therefore, we should rethink the conventional economy-led urban development strategy and search for a better path to build our future habitat.

Indeed, economic growth is essential for improving liveability. However, limited natural resources fix the scheme of social, economic, and environmental sustainability. Premised by the rule of demand and supply, a notion of growth and development based on equilibrium becomes the new standard for optimization and sustainability. Speedy urbanization in the developing world signifies that matching urban resources (supply) and QOL needs (demand) is crucial for future regional and global sustainable growth (Park, 2017). How well governments can allocate their resources to build a sustainable habitat and improve their citizens' living environment becomes overly critical in urban policymaking and planning; in

return, the citizens should think and behave to support the introduced urban development policy. Their mutual understanding, trust, and cooperation are needed for realizing the sustainability scheme. Thus, investigating the residents' well-being demand is the first step for paving the feasible way for policymaking and planning.

5.2.1 Digital-Ruralism Support in Developing China

In the case of developing China, she adopted a transit-ICT development approach on solving its three rural issues (San Nong) relating to the agricultural industry, rural conditions, and farmers' ways of living, while combating its urban challenges. The Chinese rural development strategy relatively simulates the same DNA as the urban-rural development network of city-town-village for developing countries introduced by Rondinelli (1983). Further to follow the 2030 Agenda of the UNDP advocating to embark on a development journey leaving no one behind (UNDP, 2030), the central government implemented digital-ruralism to narrow the well-being and digital gaps between urban and rural areas. Transit-oriented-development (TOD) and ICT development policy become the primary pursuit of the central and local governments (Qiang et al., 2009).

Often prioritized by the developing countries in the beginning stage of urban development, TOD is for economic development first and foremost. In 1978, infrastructure started to develop China when 90% of Chinese worked in the countryside. During the industrialization period, many youngsters moved to the city for better job opportunities and living standards. The rural residents were mainly aged farmers with low income and education because they were physically isolated from the marketplace and urban areas. Since then, the high-speed railway network has been rapidly built to cover the whole country, from the well-developed capital city Beijing to the less developed landlocked region Ningxia to different China's major cities for logistic support and improving liveability. So far, 35,000 kilometers of high-speed rail network has been built, exceeding the rest of the world's total length

combined (CGTN, 2020). It speeds up the urbanization process substantially while facing similar setbacks as the developed countries, such as the unsustainable living environment in the densely populated city centers, marginalized post-industrial cities and towns, and run-down rural areas. Thus, the central government introduced the ICT-driven digital-ruralism development policy two decades ago. It has since attracted a handful of urbanites moving back to the countryside to operate e-business and work in tourism industries besides farming.

China modified the action-based ICT eEurope 2005 and i2010 development frameworks addressing its county and local village conditions in terms of demographic, economic, cultural, and political backgrounds to tackle the economic and digital divide between the urban and rural areas. It launched the National ICT Development strategy (2006–2010) to boost the economy and social improvement in the agricultural-based rural areas, installing ICT enabled hardware and establishing ICT help centers in the designated villages or counties to narrow the socioeconomic and digital gaps. The physical infrastructure, such as roads, high-speed railways, other public transportation modes, and post offices facilitated by ICT, has been built to serve consistent economic growth in remote communities. E-government, e-learning, e-health services, e-entertainment, and e-shopping make up the e-business environment in the ICT-enabled rural areas. The infrastructure enhancement, human capacity, and service enrichment provide a holistic environment to advance the economy, society, culture, and governance to merge the well-being gaps between urban and rural areas (Statistical Report, 2017).

By March 2020, China had 904 million netizens, and 99.3% are mobile phone users, with a remarkable surge trend over the past years (Figure 5.1). Rural internet users had 255 million occupying 28.2% of China's total netizen population, up 1.5% from 2018. Urban internet users had dropped from 73.3% to 71.8% (649 million) of China's total netizen population (Figure 5.2). The total internet user sizes' distribution was 78.6% (710 million) for

e-shopping, 85.0% for e-payment, 94.1% for e-entertainment, and 76.8% for e-government services in China (Statistical Report, 2020).

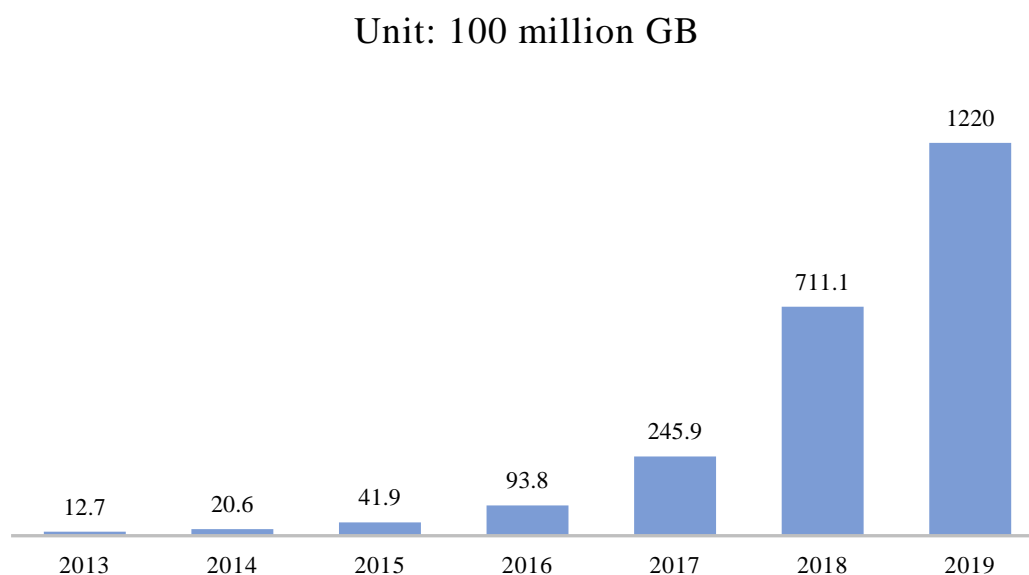


Figure 5.1 Mobile Internet Access Traffic in China
Source: Ministry of Industry and Information Technology

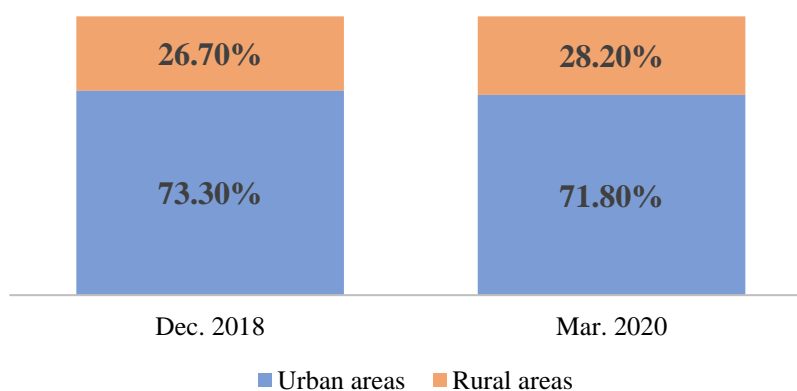


Figure 5.2 Urban and Rural Structure of Internet Users
Source: Statistical Survey on Internet Development in China.

(Figure 5.3) shows the narrowing of the increase in Internet penetration rate between urban and rural areas. The popularity and accessibility of ICT in China’s urban and rural areas set an extremely favorable digital-ruralism development environment. According to the National Bureau of Statistics, the number of 5G terminal connections has exceeded 200 million, ranking first globally. However, a shortage of Internet skills, limited literacy level, and an aging

population are significant factors preventing non-netizens from accessing the Internet in rural areas, waiting for improvement (Statistical Report, 2020).

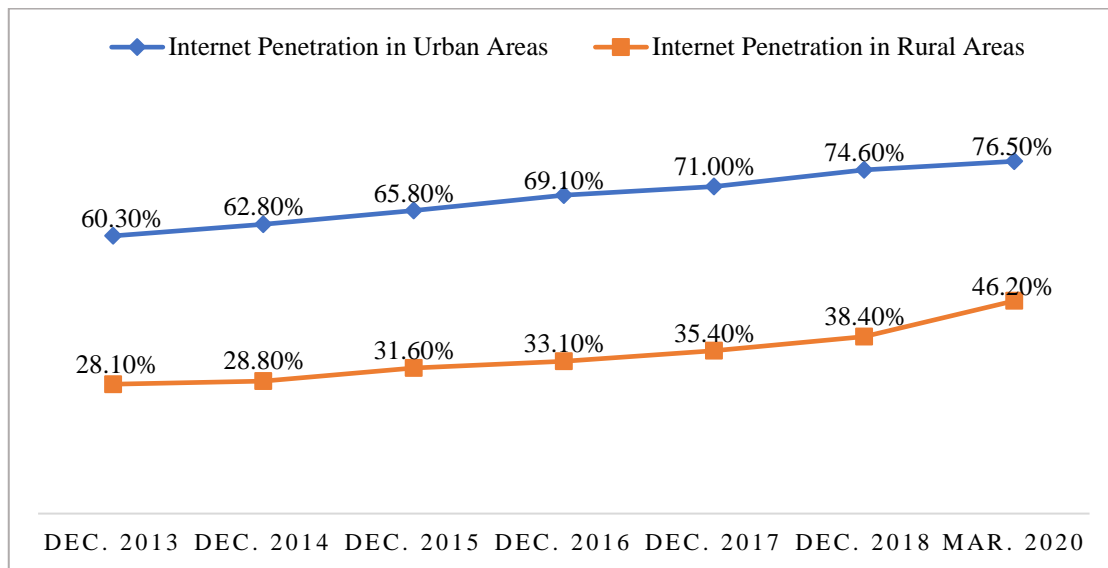


Figure 5.3 Internet Penetration in Urban and Rural Areas. Source: Statistical Survey on Internet Development in China.

Nevertheless, the snowball effect triggered by ICT is unimaginable and unmeasurable. ICT favors e-business; besides, it accommodates residents' safety needs. For example, security would be an important issue in rural areas due to its low population density and remoteness; a smart living space can be furnished with artificial intelligent surveillance systems. Thus, ICT becomes one of the critical components in future urban-rural digital development, with TOD to fulfill the Maslow's Hierarchy of Needs (MHN) and impact society (Freeman, 1996). With such progressive digital-ruralism support in developing China, urban location will not be a critical factor for urban migration when the fundamental physio-psychological needs can be satisfied in rural areas through digital-ruralism. Remarkably, through infrastructure development (physically and virtually), China moves most of its 1,4 billion population out of absolute poverty in 2020, accounting for 80% of world poverty reduction and creating the world's largest middle-class per country according to United Nations. China's digital-ruralism strengthens socioeconomic activities in remote areas and sheds light on the TOD-ICT-led urban-ruralism for developing countries.

5.2.2 SUD, TOD and ICT Impacting MHN

Most of us agree that QOL is a broad and vague concept, and its multitude of concepts makes it very difficult to be understood precisely and inclusively even though various definitions of QOL have been found from almost every academic discipline. QOL is a kaleidoscope with all these ever-evolving segments inside. Subjective well-being surveys consistently show that more equal societies contribute to the highest life satisfaction and happiness (Helliwell et al., 2019). Well-being depends upon good health, positive social relationships, and accessibility to necessary resources such as mobility and employment (Ballas & Tranmer, 2011), more than economic satisfaction in the domain of overall life satisfaction, which has been highlighted in the urban quality of life (Uqol) evaluation (Table 5.1). Relevantly to the sustainable urban development (SUD) equilibrium, MHN is the different levels of motivations and human needs evolving and correlating along the city development lifecycle, which is the impetus for distributing the resources and labor equitably and sustainably, disregarding the external factors. MHN is the alpha principle, vaulted by the human-physical-contextual environment, the powerful synthesizer upholding all the relevant disciplines contributing to the overall QOL. Often, the MHN basic physiological need level is most likely acquired by the developing countries' pre-requisite for an upgrade of the higher psychological need level to catch up with the developed countries (Maslow, 1943). What if TOD and ICT can serve the two MHN levels altogether? The well-being gaps between the developing and developed countries or the urban and rural areas would subsequently be made closer.

In the urban production system, all built environments serve human needs, whereas infrastructure is the backbone of any economy (Zanabria Ruiz, 2015). TOD and ICT are the means for achieving SUD and the main actors for building the logistics and virtual communication network in the pursuit of digital-ruralism. As a potent sustainable urban planning tool, TOD is famous for its effectiveness in shaping the urban form and imposes a

significant impact on enhancing the Uqol (BOT, 2020). ICT acts as the catalyst by networking virtual connectivity for smart growth. TOD and ICT foster sustainable urbanization because they provide efficient communication and effective mobilization of labor forces and goods. For example, AI technology, driverless vehicles, online shopping platforms, solar plants, and wind farms can be facilitated and monitored by the 5G network to increase aggregate value (productivity accumulated from different divisions of labor).

ICT is the key to value creation and competitive advantages, especially after labor, land capital, and overall productivity factors in a developed country. The faster the internet access and the more comprehensive the coverage leads to the higher the human productivity. People worldwide can exchange intangible ideas and knowledge, financial activities, entertainment, and social activities in the digital world without time-space constraints. ICT facilitates the output generated from human capital, monetary capital, cultural context, and natural resources distributed through TOD networks more precisely and sustainably. The narrative of TOD and ICT's power on affecting MHN, defined by the conceptual UxR development framework, has been unprecedentedly documented in the post-industrial society. The following sections will discuss and test the new development framework with a demand-side approach.

5.3 RESEARCH DESIGN AND METHODOLOGY

This section analyses and justifies the proposed UxR development framework by proving ICT and TOD's roles in enhancing the critical Sustainability-Uqol (well-being) indicators defined by the developing countries. Three objectives for accomplishing the task include: (1) to illustrate well-being gaps between developing countries and developed countries through an Uqol survey; (2) to revise the classical MHN model into the indicator-based MHN model (Figure 5.6) based on the findings from (Table 5.1); and (3) to illustrate TOD and ICT are

related to the defined Sustainability-Uqol indicators positively through a structural equation modelling goodness-of-fit test (SEM: Figure 5.7).

The classical MHN theory is essential for developing the indicator-based MHN model (Figure 5.6) to construct the theoretical SEM for testing. The SEM is a relationship path of TOD and ICT measured by the well-being indicators (indicator-based MHN). First, we established the theoretical model (Figure 5.4–B) from the literature review and a Sustainability-Uqol evaluation (Figure 5.4–A1 and 5.4–C1). Second, we conducted a confirmatory factor analysis (CFA) and SEM to test the strength of prediction recommended by (Anderson & Gerbing, 1988; Williams & Hazer, 1986), attempting to prove the association of the eleven observed well-being indicators under the two latent constructs (TOD and ICT). The research design prompts for initiating the proposed UxR framework: A + B (Figure 5.6) + C (Methodology: Table 5.1, & Figure 5.7) = Output (Figure 5.8).

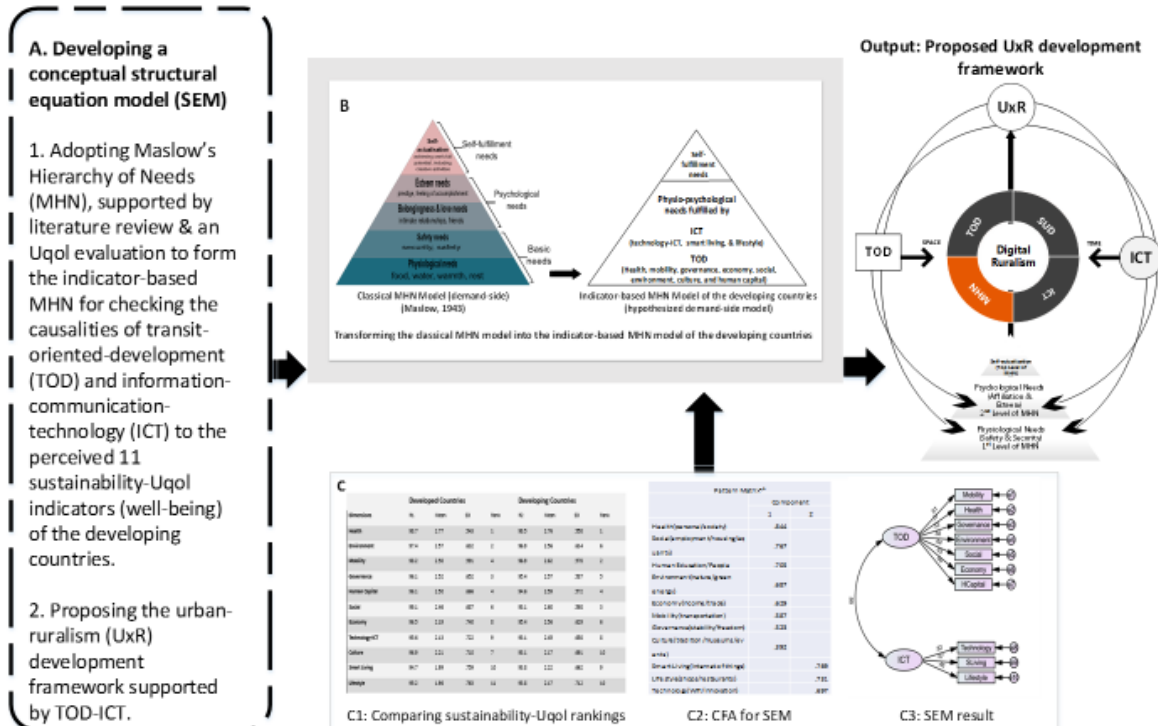


Figure 5.4 Research Design

Wheeler (1996) argued that SUD is possible if mutual understanding and cooperation among the stakeholders, especially the city government and the residents. To understand the urban condition, evaluating subjective perceptions on the objective living environment is fundamental (Campbell, 1976; Low et al., 2017; Marans, 2014; Marans & Stimson, 2011; Mukherjee, 1989; Sedaghatnia et al., 2013; Veenhoven, 2000) and necessary for drafting the effective local development plans. More specifically, the Uqol evaluation is affected by the demographic attributes, and that these attributes are influenced by the objective living environment (Campbell, 1976; D'Acci, 2014; Marans & Stimson, 2011). Therefore, we conducted a Sustainability-Uqol survey to document the well-being disparities between developed and developing countries to state a need for livelihood improvement in the developing countries.

5.3.1 Sustainability-Uqol Survey Design

After defining the Uqol with SUD, TOD, ICT, MHN, and the digital-ruralism support in developing China, we asked: What is good Uqol and bad Uqol according to residents' needs? To drive for resilient development while improving livelihood, we conducted a Sustainability-Uqol evaluation to learn about the well-being demand between the developing and developed countries for the digital age. The Uqol questionnaire (Uqol Survey, 2019) was designed by referring to the subjective well-being questionnaire (GNH, 2015) with modification. A professional panel composed of Professors/scholars and PhD students discussed and tested the questionnaire who are the experts in sustainable urban planning, sociology, environmental, architecture, and design engineering from the Interuniversity Department of Regional and Urban Studies and Planning in the Politecnico di Torino, Italy twice. Convenient sampling was conducted via online and offline channels for six months in 2018–2019. Distribution channels include Facebook, WhatsApp, WeChat, emailing, and collaboration with a non-profit-organization.

5.3.1.1 Demographic and Geographical Profile

The sample total is 358 (64% developed countries and 36% developing countries) from 47 countries. In Figure 5, female respondents (56%) are more than male respondents (44%). Age 26–35 occupies the highest portion (38%) of the sample, followed by age 16–25 (20%), 36–45 (17%), 46–55 (14%), and 56+ (11%). 43% are postgraduate, 29% are undergraduate, and 28% below undergraduate. In the professional group, 36% are students, 49% are employed, and 15% are either retired or unemployed. The sample profile reflects a young diversified, and well-educated group of representation, which would serve as the applicable sample to advise the future SUD requests. The wide coverage of countries presents a comprehensive study, but for the in-depth investigation still needs to collect more regional data. In the future, we would like to invite the concerned researchers and institutions to collaborate in conducting more regional surveys so that the stakeholders can review the different pieces of a picture without puzzling.

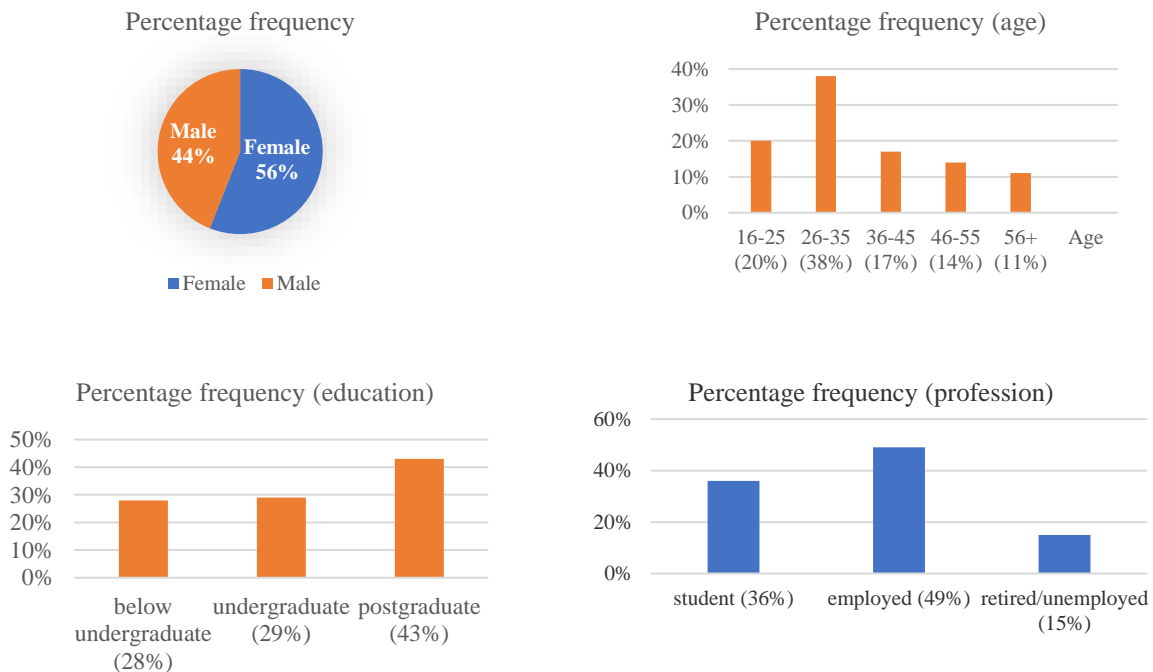


Figure 5.5 Demographic Profile

5.3.1.2 Comparison of Mean Score Rankings (Demand-Side Evaluation)

The eleven Sustainability-Uqol criteria embed the four components of TOD, ICT, MHN, and SUD identified by the extant literature and supported by China's digital ruralism accomplishment. The theme of "SUD enhances urban livelihoods" was adopted to select the eleven indicators out of seventy-two indicators from the relevant Sustainability-Uqol indices: (CIMI 2018; GPCI 2018; SCI 2018; SCMI 2017; MQCR 2018; SPI 2018; WHR 2015-19), which had been verified in a panel discussion. IBM SPSS Statistics 20 English version software was hired to run the raw data collected. The main question presented to the international respondents was: "Which factors/indicators are important in your IDEAL living environment?" in a 3-point Likert scale set (1=least important to 3=most important). We conducted Descriptive Statistics, Cronbach's Alpha reliability test, normality test, non-parametric Mean Score tests (independent t-test). The techniques for running the data have been practiced and illustrated by (Kingsford & Chan, 2019). The Cronbach's alpha reliability test (Likert scale bigger than 0.7) justified that the chosen scale was suitable, the data collection instrument was strongly reliable, and the responses were consistent with the survey (Shen et al., 2011; SPSS, 2006). We set the mean score (MS) threshold at 1.5 ($\mu=1.5$), which benchmarked any Sustainability-Uqol criteria with a mean score $\mu_a > 1.5$ as an indication of the significance of the identified indicators listed. The test result shows that the null hypothesis ($\mu=1.5$) was rejected with a p-value: $0.000 < 0.05$ and a frequency rate of over 90%. The eleven Sustainability-Uqol (well-being) indicators were validated. It allowed the confirmatory factor analysis (CFA) and structural equation modeling (SEM) for a goodness-of-fit test (Gokdemir & Dumludag, 2011; Sullivan & Artino, 2013).

Table 5.1 Comparison of Mean Score Rankings of Sustainability-Uqol Indicators

Indicators	Developed Countries				Developing Countries			
	R1	Mean	SD	Rank	R2	Mean	SD	Rank
Health	98.7	2.77	.543	1	98.5	2.76	.558	1
Environment	97.4	2.57	.632	2	96.9	2.56	.614	6
Mobility	98.2	2.50	.591	4	96.9	2.62	.578	2
Governance	96.1	2.52	.652	3	95.4	2.57	.587	5
Human Capital	96.1	2.50	.666	4	94.6	2.59	.572	4
Social	99.1	2.46	.687	6	93.1	2.60	.598	3
Economy	96.5	2.19	.740	8	95.4	2.56	.629	6
Technology-ICT	95.6	2.13	.722	9	93.1	2.45	.658	8
Culture	96.9	2.21	.710	7	93.1	2.17	.691	10
Smart Living	94.7	1.99	.759	10	93.8	2.22	.662	9
Lifestyle	95.2	1.96	.763	11	93.8	2.17	.712	10

Notes: Total sample size: 358 (developed countries: 228; developing countries: 130) Respondent rate: R1 & R2. Reliability test for the 11 indicators: Cronbach's Alpha (all countries = .845; developed countries = .848; developing countries = .825). P-value: $0 < 0.05$. Developed countries: Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czechia, Finland, France, Germany, Greece, Ireland, Italy, Japan, Latvia, Netherlands, Poland, Republic of Korea, Romania, Spain, Sweden, UK, and USA. Developing countries: Argentina, Azerbaijan, Bangladesh, Benin, Brazil, China, Colombia, Egypt, Ethiopia, Ghana, India, Indonesia, Iran, Kazakhstan, Lebanon, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Philippines, Russia, South Africa, and Sri Lanka.

Source : https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf

(Table 5.1) displays three sets of ranking characteristics. First, the top-ranking of health unanimously signifies that urban development should be human-oriented. Second, a similar ranking section composes human capital, technology-ICT, smart living, and lifestyle, showing that those critical Sustainability-Uqol indicators are the respondents' universal well-being demand from both the developing and developed regions. Third, a more significant ranking division showing the well-being gaps in the environment, mobility, governance, social, economy, and culture exist between the developing and developed countries. The lower the ranking number shows, the stronger the well-being demand perceiving by the respondents. The developing countries perceived the environment, governance, and culture (sixth, fifth, and tenth) as less critical than developed countries (second, third, and seventh). The developing countries ranked mobility, social and economic demand (second, third, and sixth) relatively stronger than the developed countries (fourth, sixth, and eighth), indicating a well-being gap of

mobility, and socioeconomic development disadvantage to the developing countries due to the different urban development stages. To Ali and Nsairat (2009), the developing countries often valued economic and social development over environmental sustainability to the developed countries. Worth noting, they both ranked the economy relatively low at sixth and eighth out of eleven indicators, implying that the economy-led development policy might need a modification. In this case, developed countries are recognized as urban, and developing countries are rural (China is an industrialized country facing the same urban issues as the developed countries, and its rural area is like the developing countries in terms of development). The well-being gaps between them (developed-urban vs. developing-rural) can be narrowed by adopting digital-ruralism as China's case, rationalizing the UxR concept. Thus, the validated eleven Sustainability-Uqol indicators provide the information for constructing the indicator-based MHN model.

5.3.2 Constructing the Indicator-Based MHN Theoretical Model

This section transforms the classical MHN into the more time-sensitive and indicator-based model for undergoing SEM examination. According to the classical MHN theory, human needs categorizing by MHN are satisfied through activities fulfilled in different life domains, including health, residential/food/safety, work, and home, leisure, education, social, friendship/family/love, and spiritual (Shek & Lee, 2007; Sirgy & Lee, 2016). MHN provides a core principle for categorizing and analyzing residents' needs to identify life satisfaction (Harifah *et al.*, 2014; Maslow & Boeree, 2006; Renne *et al.*, 2009). On the one hand, developing countries appeal to fulfill physiological needs of socioeconomic-driven offerings such as health care, convenient transportation, employment, welfare, infrastructure development, and a well-performed corruption-free government (Mukherjee, 1989). On the other hand, Kahneman, Diener, and Schwarz (1999) suggested that environmental-cultural context and self-identity sit at MHN's psychological level, which is often desired by the

developed countries. In the digital period, the identified well-being demand (Table 5.1) expected by the developing countries are health, mobility, social, human capital, governance, environment, economy, technology-ICT, smart living, culture, and lifestyle attaining to both MHN levels. As such, we revised the classical MHN into the indicator-based MHN model disregarding the hierarchical division with the modern well-being indicators. We claimed that TOD-ICT could fulfill the MHN's physio-psychological level and bridging the human-social-economic-environmental-digital gap between the urban and remote rural areas, advocated by the ICT implementation policies in Europe and digital-ruralism in developing China. (Figure 5.6) displays the contextual MHN's transformation to the indicator-based MHN model, which will be used for studying the cause-effect relationship of the sustainable-TOD-ICT to the observed MHN (well-being indicators).

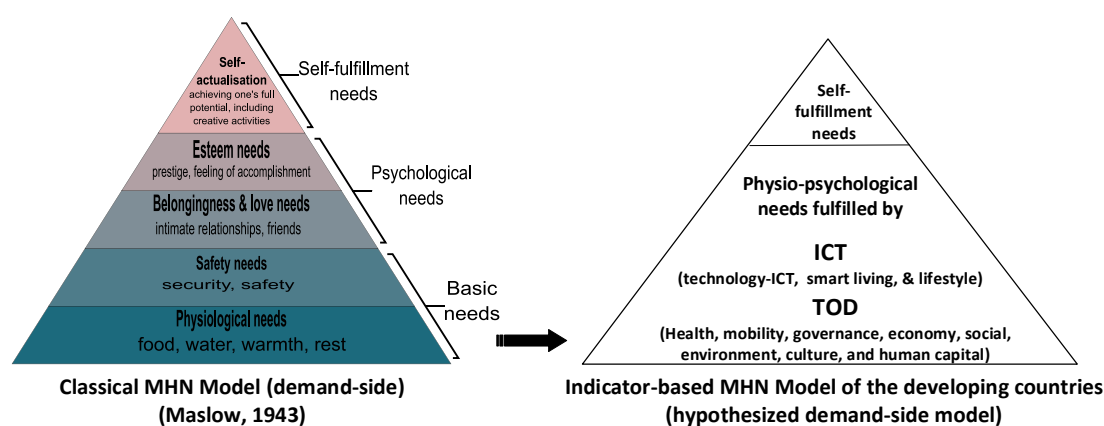


Figure 5.6 Transforming the Classical MHN Model into the Indicator-Based MHN Model of Developing Countries

5.3.3 Structural Equation Modelling (SEM)

SEM technique was adopted for validating the indicator-based MHN model because it is an efficient and robust statistical technique to analyze a series of inter-relationships and causal relationships among multiple observed variables and detect latent constructs simultaneously in a model. The hypothetical latent constructs TOD and ICT were identified from the literature and measured by the Sustainability-Uqol criteria to form the SEM for testing its causality

significance. There were two stages involving the reliability test of measurement model CFA and model fit test of SEM. In Figure 7, the Kaiser-Meyer-Olkin value is $0.818 > 0.5$ (Hair, 2019) and a significant probability of $0 < 0.05$ for the Barlett test of Sphericity (Shan et al., 2017), it means the matrix is correlated and factorable, not identity matrix. As the study was designed to inform developing countries' future urban development policy, the developing countries' data were used to undergo an SEM fit-test. The developing countries' data were collected from $106 > 100$ respondents for five or fewer latent constructs is acceptable (Awang, 2012). The CFA result displays two significant factors: Eigenvalue > 1 (Seo et al., 2004). It indicates that factor one consists of health, social, human capital, environment, economy, mobility, and governance, and factor two has technology, lifestyle, and smart living. The culture of factor one was dropped because $0.392 < 0.50$. The CFA result transformed the indicator-based MHN model into the hypothetical SEM.

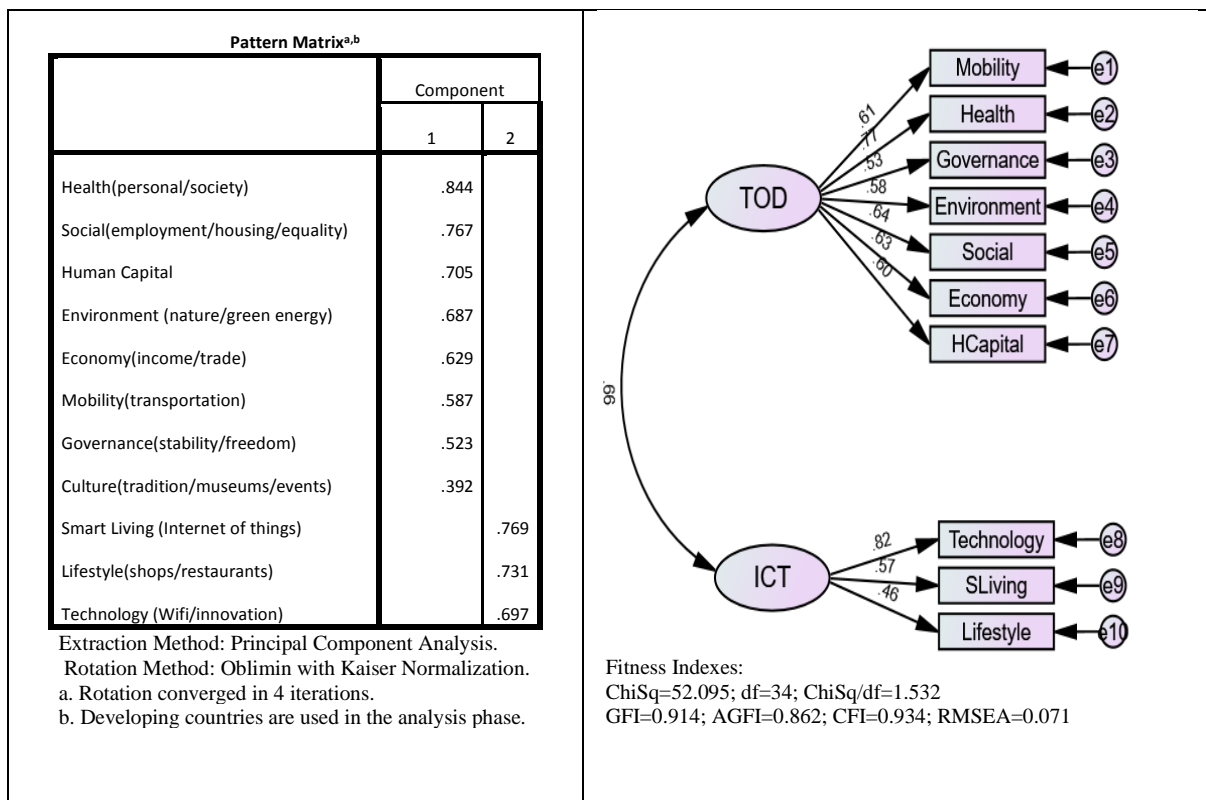


Figure 5.7 Results of CFA and SEM

We used Analysis of Moment Structures (AMOS vers. 20.0, IBM) to perform SEM goodness-of-fit test because it can handle the non-normal data with the maximum likelihood method of estimation, which is a robust estimation method for measuring the structural paths coefficients (Awang, 2012). Three hypotheses were designed to draw a causal path diagram. Figure 8 illustrates the testing result of the hypothetical SEM.

- H1 TOD has a significant positive relationship with health, governance, mobility, environment, social, economy, and human capital.
- H2 ICT has a significant positive relationship with technology, lifestyle, and smart living.
- H3 TOD and ICT are correlated positively.

The goodness-of-fit assessment derives from Chi-square/df = 1.532<5, probability level = 0.000<.05 (Marsh & Hocevar, 1985), RMSEA 0.071<0.08 (Browne & Cudeck, 1992), GFI 0.91>0.90 (Joreskog & Sorbom, 1984), and CFI: 0.93 > 0.9 considered a good fit (Baumgartner & Homburg, 1996; Bentler, 1990).

Table 5.2 Results of SEM Testing

Model-Fit category	Name of index	Level of acceptance	Index Value	Tested Result
Parsimonious fit	Chi-sq/df	Chi-sq/df <5	1.532<5	good
Absolute fit	RMSEA	RMSEA<0.08 Rang 0.05-0.1 is acceptable	0.071<0.08	good
Incremental fit	GFI	GFI>0.90	0.91>0.90	good
	CFI	CFI>0.90	0.93>0.90	good

*Goodness-of-fit indices of SEM suggested by (Awang, 2012)
 Note: Critical Number (C.N.) is 98, sample size is 106>98; bootstrapping: 2000 times

Table 5.3 Results of Hypothesis Testing for the Respected Path

	Hypothesis statement of path analysis	Estimate	P-value	Results on hypothesis
H1	TOD has a significant positive relationship with health, governance, mobility, environment, social, economy, and human capital.	0.53-0.77	0.00	supported
H2	ICT has a significant positive relationship with technology, lifestyle, and smart living.	0.46-0.82	0.00	supported
H3	TOD and ICT are correlated positively.	0.66	0.00	supported

All the tested factors loading was fit in the model with a score close to or between 0.5 to 0.8. Hypotheses (H1 and H2) of ICT and TOD significantly impact the MHN model's defined physio-psychological level. All corresponding factor loads of the measurement are positive, stating that the ten observed variables are effective indicators for measuring TOD and ICT. In other words, TOD and ICT are the cause for affecting the ten indicators statistically significant with $p\text{-value} = 0 < 0.05$. TOD plays a significant role in affecting health (0.77), social (0.64), economy (0.63), mobility (0.61), human capital (0.60), environment (0.58), and governance (0.53), while ICT contributes significant to technology (0.82), smart living (0.57), and lifestyle (0.46). H3 is supported by a correlation $0.66 < 0.85$ (Awang, 2012). The acceptance of the indicator-based MHN model was justified by the significant positive relationships between the two latent factors to the observed well-being indicators.

Although SEM is called causal modeling, the conclusion should come from the research design (Figure 5.4) rather than a statistical model. The above path diagram of the fitted SEM and the indicator-based MHN model proves that $MHN = TOD + ICT$, which means TOD and ICT, can theoretically contribute to physio-psychological needs listed in the revised MHN model. Together with the literature, the findings of mean score ranking comparison (developed-urban vs. developing-rural), the indicator-based MHN model, and the SEM testing result significantly validated the conceptual UxR development framework (Figure 5.8). Whereas the human habitat is a complex-adaptive system evolved in hierarchical order exhibited by villages, towns, cities, countries, and the world, we need to evaluate the micro-entity to learn and predict the next inline macro reality for understanding urban development. Thus, more empirical studies from the supply side are needed to strengthen the practicality of the new UxR development framework.

5.4 DISCUSSION AND THE UxR DEVELOPMENT FRAMEWORK

The quantitative justification shows that TOD-ICT could theoretically contribute to psychophysiological well-being enhancement, regenerating the classical MHN on the ordering of human needs. (Figure 5.7) shows TOD and ICT's causal flow to the ten observed well-being indicators and their correlational relationship from the demand-side perspective. SEM validated the indicator-based MHN model presenting the rationale of the UxR development framework.

From the European perspective, mirrored by the illustration of 'eclectic atlas' and the 'diffuse city' introduced by Stefano Boeri and Francesco Indovina, respectively, the observed urban phenomena in the European landscape not only a visual presentation, but also reveals the historical context shaped by human behavior and demand. A recognition of human habitation can be networked by an array of satellite towns disregarding geographical constraints and implying the UxR development path's possibility. The planetary urbanization experiences of developed Europe play like an urban development lesson for developing countries. Indeed, the EU has designed the workable blueprint for future urban-rural sustainable development. China's success in learning from the EU proves that the EU's digital development approach is worth implementation. It made the belief that whoever can access broadband Internet connectivity within rural areas can achieve economic and cultural progress, and the mix of endogenous and exogenous forces interacting at the local level encourages urbanites to move into the rural area (Roberts et al., 2017). As such, a new concept of urban-rural development should be introduced to harness the relationship between the urban establishment and the vast rural potential of growth to realize sustainable goals for enhancing human well-being. It reassures the new sustainable development path for developing and preserving the future urban-rural landscape in developing countries.

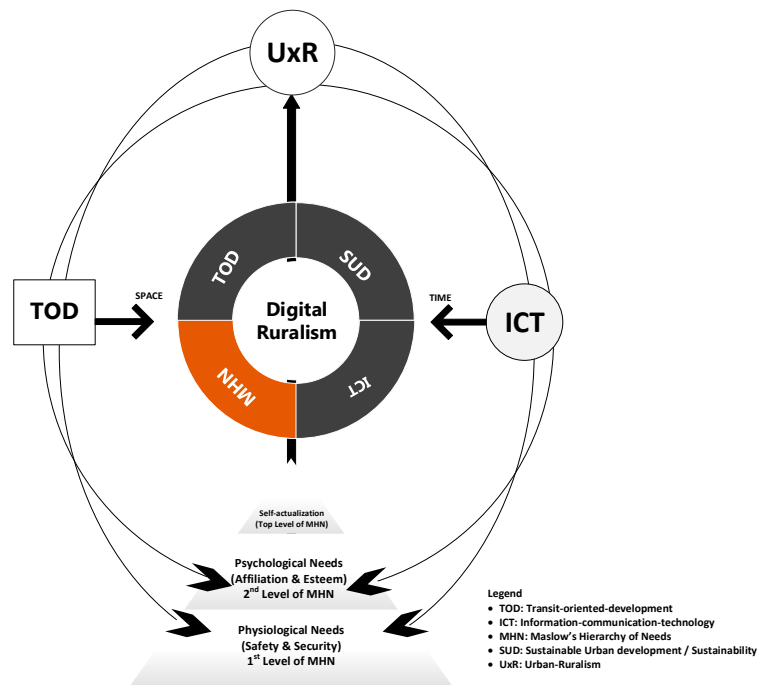


Figure 5.8 Proposed Urban-Rural (UxR) Development Framework

5.5 SUMMARY

In the post-industrial society, where TOD-ICT advancement (physical and virtual connectivity) allows many activities to be done almost anywhere, location choices are increasingly free of geographical limits empowered by digitalization. By referring to the action-based ICT eEurope 2005 and i2010 development frameworks and China's digital-ruralism, the social, economic, environmental, cultural, and digital divide between the urban and rural areas (developed-urban and developing-rural) can be narrowed by ICT. With the maturity of digital technology, urbanization will shift back to the countryside, where the smart living mode is defined by e-employment for self-reliance, the Internet of things, e-health, e-education, e-commerce, e-entertainment, and e-chat.

The demand-side research illustrates that TOD-ICT contributes to health, mobility, governance, environment, social, economy, human capital, technology-ICT, smart living, and lifestyle without location constraints in developing countries. It provides new knowledge for modernizing the classical MHN into the indicator-based MHN. In such a new theory, the UxR development framework can fulfill some of the contemporary MHN's physio-psychological

needs almost instantaneously. Likewise, it envisages that the past and present of the developed countries might not be necessary to be the future of developing countries.

Our study concludes that the economy-led urbanization path is critical for initiating smart growth in developing countries; however, the development process should be guided by understanding and providing for the human needs while optimizing the sustainability goals. By adopting sustainable development strategies such as TOD-ICT, the application can develop local capacity to access external market and internal resources (nature and human resources) to confront accessibility-socioeconomic inequalities within places. It highlights the harmony between urban and rural development, energizing interaction between cities, towns, and rural areas to the local, national and global marketplaces, merging the development gaps divided by multi-scalar geography. In future development, more empirical studies applying big data cloud well-being ratings and mapping should be conducted so that the new framework can stand the challenges of time and space. The enhanced economy-led urbanization development path would be one of many choices considered by the developing countries' policymakers and urban planners because it will help prevent them from running into the same historical setbacks as the developed countries while securing resilient development.

CHAPTER 6: CONCLUSIONS

Cities have long been the centre of economic and social development, but environmental development. The U2-CAS is the result of this dilemma adopting the Yin-yang universal law to bridge the gaps between theory, concept, and practice as the innovative way for defining an ambiguous definition, while enhancing SUD. It describes what has already occurred, assesses current conditions, predicts what will probably happen in the future, and prescribes the possible right course in a proactive fashion corresponding to the core argument, hypotheses, and objectives. The U2-CAS presents the underlying principles for building the SHE-City, discusses the relevant QOL indices, and identifies the eleven Sustainability-Uqol criteria for developing the WoSu evaluation tool and the conceptual UxR development framework.

As the definition of QOL is often contested due to demographic differences, and disparities of expected well-being needs, the aim for developing the U2-CAS is accomplished by redefining the QOL into Uqol through the three logical stages: theoretical base (HES), analytical illustration (WoSu), and application (UxR), joined by a theme-goal of “SUD enhances Uqol”. The development of the U2-CAS was logically staged by the mixed-methods research attaining to construct and validate the three outputs of SHE-City, WoSu, and UxR for verifying the novel U2-CAS.

It first identified the eleven significant Sustainability-Uqol criteria of health, mobility, human capital, governance, environment, culture, social, economy, technology-ICT, smart living, and lifestyle. Then, the CFA and SEM goodness-of-fit test proved that TOD-ICT could improve Sustainability-Uqol criteria. Afterward, the acceptance of hypotheses corresponding to the research argument validated and confirmed the proposed U2-CAS. In the application stage, the TOD-ICT-based UxR development framework was conceptualized and updated the

economy-led urbanization path by harnessing technological advancement to seize the great opportunity in post-industrial transformation.

The U2-CAS promotes harmony between man and nature. Its pretext involving any communication and evaluation gaps such as expected well-being requests must be merged as much as possible to enhance global sustainability because only mutual understanding and seamless cooperation among the different layers of realities in decision making and executing can accomplish the SDGs. To ease conflict and misunderstanding for encouraging cooperation among the stakeholders in urban policymaking, the open-platform U2-CAS can integrate the top-down policy-driven urban supply and the bottom-up subjective well-being demand to promote better urban-rural SUD policies. The WoSu evaluation tool reveals the insignificance of the economy in the Sustainability-Uqol ranking result. It challenges the conventional economy-led urbanization paradigm which GDP growth has been the de facto indicator and development agenda for the developed and developing countries for a long period. The innovative model breaks down the complex urban ecosystem into the most basic components: human and nature, to uncover the structures that underlie the key micro-urban systems' inter-relationship network. The study tells why, what, and how to strike a good balance for building a sustainable and resilient living environment and who are the players and when is the targeted future. The complex-adaptive organism is defined by its constant interacting and renewing to reach the equilibrium state (dynamic equilibrium), a miniature of the human society and a testimony of the Yin-yang universal law. In ideology, the U2-CAS can transform the abstract meaning of QOL into a WoSu evaluation tool for the application. The new system argues for a change in economy-led urbanism and provides an enhanced version of it by creating the conceptual UxR development framework for developing countries.

The research is not only about the solution but also a testimony for conducting a robust research framework, proven by a solid theoretical base, a comprehensive scientific research methodology, and its feasibility in the application. It attempts to return to the original theories of the human-environmental relationship and to give them a new coat with updated meaning. It documents the evolution of a complex urban ecosystem and its possible future formation. The Urban Quality of Life Dual-Complex-Adaptive System (U2-CAS) is a decoder of Yin-yangism, and the embodiment of the Cosmomic theory of Uqol: $1=2+3+4+11+N$. (Figure 6.1) features the different dimensions of Uqol including the HES (Habitus, E-B theory, MHN, Cosmomic theory), the human-contextual-physical environment, the SHE-City (TOD-ICT-SUD-MHN), the WoSu (eleven Sustainability-Uqol indicators), and the conceptual UxR development framework.

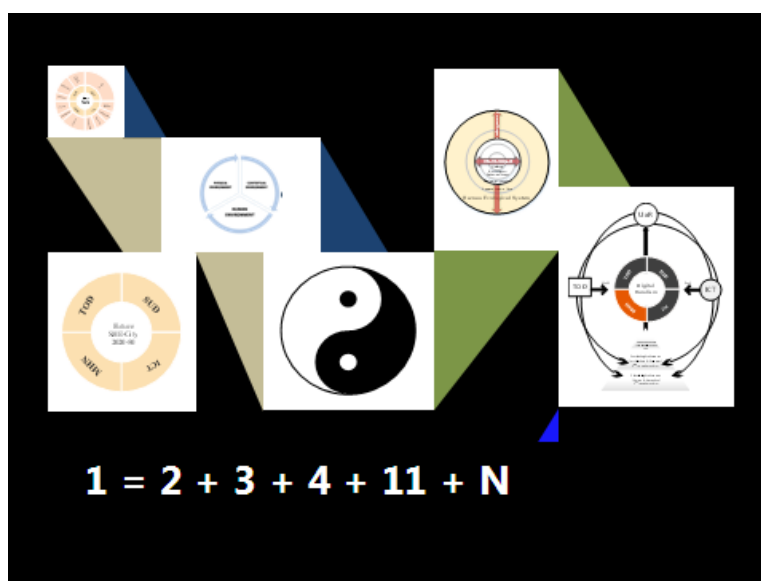


Figure 6.1 Definition of Urban Quality of Life (Uqol) in respect to Different Layers of Reality

6.1 CONTRIBUTIONS

The multi-functional U2-CAS is more than just a philosophical exploration, a practical roadmap for “acquiring knowledge” and a function for integrating scattering “subjective realities” into the neutralized “objective reality”. It is a transformer for translating and interpreting abstract philosophical thought into reality close to our senses, life satisfaction, and the spring of happiness fed by the external living environment to secure the harmony of man and nature. In other words, it is an ontology of the contemporary world referring to the past for envisioning the sustainable future.

This part states the original contributions of the research in the aspects of the beneficiary, new knowledge, and functions. In society, the subject, humans interpret the human-made world; the object, the human-made world is created by humans. Reality is not about facts and events. *“Truth” is an unknown as per Immanuel Kant and George Hegel. It is about the assessment of the object and the recognition of the subject (stakeholders). The significance of reality is according to “the magnitude of the people who can understand the object”, which is pretty much scaled by people’s contextual background.* The U2-CAS is developed to dissolve gaps in thought, value, culture, and opinions by upholding the common goal of the key stakeholders. The system can contribute to the significance of defining reality; the by-product of WoSu can reflect the expected urban reality perceived by the residents corresponding to the policy-driven goals specifically. It solidifies the vague rhetoric to let the concerned parties realize the object with consensus. It addresses the context and internal components that affect and reflect the Human Ecological System (HES). It facilitates mutual understanding and cooperation among the stakeholders for enhancing teamwork and serving the urban policymakers, scholars, and social indicator researchers. In this case, the research is a breakthrough in that it links structuralism to the discipline of SUD for informing better sustainable development policies,

which traditionally applies to sociology, psychology, economics, architecture, anthropology, archaeology, history, and linguistics.

To the urban policymakers, the reflection of urban sustainability, liveability, and mobility in the eyes of residents, can aid decision-makers in developing and revising their development policies more meritoriously because a robust assessment process is required to ensure the quality of data and support decisions makers (Pandis Iveroth et al., 2013).

To the urban study scholars and social indicator researchers, the research further perfects the social indicator development by providing an innovative way for urban evaluation and management in refining the current Uqol reality, which provides an effective communication platform and teamwork for tackling global unsustainable issues. The applied research can also inspire scholars in the pursuit of advancing knowledge of Sustainability-Uqol by linking the classical theories to the application with an interdisciplinary approach.

The U2-CAS is a comprehensive mechanism premised on a dual approach for solving the unsustainable issues due to mismatching supply and demand, by identifying the policy-driven urban development agenda and evaluating people's needs through a self-report survey to work out a strategic plan. It accommodates market needs with the predictable demand-supply, a compromise of smart governance, and public participation. The U2-CAS is a synthesis of appearance, idea, ontology, concept, structure, and implementation possible for applying to different disciplines such as epistemology, international relations, social science, political science, urban studies, and management. The U2-CAS would be implemented to identify the common elements and mutual benefit for merging the cultural and ideological gaps, through a bilateral dialogue to promote mutual understanding and cooperation.

6.1.1 New Knowledge

Although the core aim of the research is about the development a multi-dimensional U2-CAS, there are new “thoughts” being discovered in the process of establishing and verifying the U2-CAS. The new knowledge would be recognized in many ways. It contributes to *epistemology* by creating a new path to redefine or update an abstract term for easy communication and enhance cooperation among people in the contemporary society, linking the ancient Yin-yang universal law and global concept of sustainability to solve climate change issues in the long term. With its multi-functional attribute, its contribution comes in many directions listed as below.

- Proving the subjective QOL/Uqol is shaped by the demographic attributes, but not necessary geographically even though there is a ranking disparity exists between the developing and developed countries. A minor difference from the original claim (Hypothesis 1).
- Indicating the well-being gaps between the developed and developing countries (Hypothesis 2) and the TOD-ICT can enhance SUD-MHN (Hypothesis 3).
- Employment would be the key factor for relocation. It means that economic advancement would be the impetus of urban life, but not necessary pull urbanization is the impetus for economic progress if rural living can offer job opportunities to people as well. Whereas economy is just one of the expected well-being requests of health, mobility, environment, governance, human capital, social, culture, technology-ICT, smart living, and lifestyle confirmed by the respondents from the developed countries and developing countries.

6.1.2 Functions

Table 6.1 Key Original Contributions Corresponding to the U2-CAS Hierarchy

Scale	Layer	Level	Key original contributions in terms of function
Macro	3	Ideology	U2-CAS: A new system for defining the abstract QOL into the specific Uqol.
Meso	2	Framework	UxR: A new TOD-ICT-based development framework for merging the developed urban and developing rural well-being gaps.
Micro	1	Tool	WoSu: A new tool for understanding and evaluating local well-being requests to enhance mutual communication and cooperation among the stakeholders.

A. U2-CAS (Ideology-System)

The research contributes to a new approach to enact a meaning²³ (what is meant by a word, text, concept, system, and action) or an interpretation²⁴ (the action of explaining the meaning of something). *It allows scholars to define a “subject” by three distinctive aspects: context, measurement, and application for preventing misunderstanding and mismatching of value and resources as much as possible.* The redefinition of QOL from its rhetoric into a composite of eleven Sustainability-Uqol criteria that can stimulate scientific output to serve urban policymaking or social progress. It links SUD and QOL disciplines to create a new tool for filling the gap between objective urban policy indication and subjective well-being evaluation. The U2-CAS can reflect and evaluate objective living conditions such as transportation,

²³ Importance, value, goal, plan, TRUTH, intention, suggestion, implication, representation, and expression (<https://dictionary.cambridge.org/dictionary/english/meaning> and google translate).

²⁴ Explanation, construction, understanding, explication, version, and solution (<https://dictionary.cambridge.org/dictionary/english/meaning> and google translate).

technology, and socioeconomic-environmental development. It guides the pursuit of a more sustainable trajectory of urbanization in the developing countries.

B. WoSu (Tool)

The new Wheel of Sustainability-Uqol (WoSu) evaluation tool can aid in informing, drafting, and evaluating urban development policies. It can help urban policymakers understand and determine baseline conditions and predict trends in monitoring, reviewing, and improving urban living conditions with an agreement of residents' expectations. In the past, many QOL indices were developed for comparing and ranking purposes. Nevertheless, the comparison is often irrelevant to reflect the disposable QOL (quality of life factoring demographical and geographical limits). With the WoSu evaluation tool, Uqol can be defined by a set of well-being criteria subject to the living environment. The performance of urban policies and plans can be analyzed and measured for assessing and projecting future development.

The WoSu evaluation tool can reflect urban sustainability, liveability, and mobility in terms of veracity, support decision-making in developing and revising urban sustainable development policies more meticulously such as performance review, budget setting, or process improvement. It acts as an effective communication platform for merging differences among stakeholders into one common goal. The tool can unleash the full potential of all stakeholders in working on the project. To scholars and social indicator researchers, the novel U2-CAS contributes to new knowledge creation in social indicator development and operation by providing a ground-breaking way for perfecting urban evaluation and management. It is a breakthrough action-based evaluation tool for linking QOL to the global sustainability agenda with local practice. Its versatile nature allows urban development evaluators to perform a preliminary Uqol assessment on the targeted domain before and after implementing SUD policies. To the urban planners, a robust assessment process is required to ensure the quality of data to support decision-making and perform fine-tuning as time comes (Dublin Transportation

Office, 2007). Urban decision-makers can adopt the WoSu to evaluate an urban project and connect with the concerned stakeholders such as the urban planners, the private developers, and the public at large (urban users) for facilitating cooperation. It harmonizes communication and operational gaps between urban policymakers and grass-root stakeholders. In marketing, often, a good idea or an innovative project can be considered significant when it can be conveyed to the relevant people effectively. The new format for delivering the Uqol definition with a composite of eleven critical indicators can be easily understood by ordinary people, not limited to the well-educated professionals.

C. UxR (Framework)

The conceptual UxR development framework reconnects the classical MHN theory to contemporary urban planning while narrowing the socioeconomic-environmental gap between the developed (urban) and developing (rural) areas. It drives the offset distribution of the urban population between the urban and rural areas and promotes balanced urbanization. It lays the foundation for a paradigm shift from the conventional economy-led urban development model to a more comprehensive, fair, and future-oriented urbanization path, aiming to serve people's sustainable wellness. It tends to build a resilient and sustainable habitat in the developing countries, which is critical to help the developing countries upholding the "Paris Agreement".

6.2 FURTHER DEVELOPMENTS

The open yet inclusive U2-CAS is fundamentally built on a "duality" principle and can be applied in different disciplines for improving human development. Even though the definition of Uqol, the U2-CAS, the SHE-City, and the WoSu evaluation tool has been objectified, a modification of the U2-CAS mechanism, a specific Uqol indicator-system, and index-system tailored to serve certain theme-goals would be explored. The U2-CAS evaluation toolkit can be easily replicated and modified by urban policymakers, especially in the emerging cities of

Asia, the Middle East, and Africa. The novel U2-CAS can facilitate coordination, resource allocation across different layers of needs, and workforces for reaching the most achievable scheme of sustainability.

The WoSu builds the foundation for developing a sustainable urban composite of indicators and index for a specific scope, class, or group such as the SHE-City, the developing regions vs. developed regions, and the construction workers, forming an ecological supply-demand chain of U2-CAS. The systems and tools envisaged would become the foundation for future sustainable development addressing the hierarchical layers of the complex world; the reality of the world can be defined, understood, evaluated, and illustrated by the multi-dimensional U2-CAS, and its by-products. The study can be further developed into the following urban development means.

At the national level, SUD is often handled as a macro policy, lacking the micro inspection and fine-tuning function. The action-based WoSu would be used as an effective presentation tool to evaluate, deliver, and promote the theme-goals of urban planning projects among the stakeholders at the local level.

6.2.1 WoSu for Belt and Road Initiative

A Wheel of Sustainability-Uqol Index (Uqol Index) can be developed for assessing the before and after Sustainability-Uqol for the Belt and Road Initiative (BRI) projects in Africa, Southeast Asia, and Eastern Europe. The customized evaluation index can facilitate those involved parties in planning and executing the TOD-led urban development projects more precisely and effectively. Simultaneously, the indicator-based index can help promote the BRI agenda in the international forum and community. Tracking on how TOD-ICT affects Sustainability-Uqol, WoSu contributes to developing a measuring tool to record the improvement of urban conditions and livelihoods in the area developed by the BRI. In such

practice, the “Reality” will be revealed with an objective evaluation and communication. Besides, the customizable BRI Index can be the objective indication to help set goals, identify and solve local issues, and facilitate cooperation among the BRI promoters, the locals, the governments, and the developers. The BRI Index provides comparable data for the urban policymakers to evaluate and predict advancement and the corrections needed for further improvement. By documenting the BRI Index periodically, a comparison study before and after BRI will become the legitimate indication for enhancing BRI's credibility and its reputation worldwide.

To global urbanization, the suggested BRI Index fosters the momentum and roadmap to upgrade the living conditions in the less developed areas, flattening social inequality and harmonizing social and environmental unrest between the developing and developed areas, all for the scheme of sustainability and improvement of human livability and well-being. For the urban decision-makers, they can also use the report to communicate with their citizens to avoid local conflict while enhancing governance. For the BRI institution, the BRI Index is the soft power that would be harnessed to promote the great idea of revitalizing the old Silk Road with a mission to restore world order of social, economic, environmental, cultural, and political sustainability. By measuring the needs of people in the local context, factoring in their culture, history, and living standard to reflect local ways of living, this system is especially useful to the developing countries and rural communities along the land and sea route of BRI. Likely, their urban development policies would be designed to accommodate the real needs of local reality, spending budget effectively for smart growth. A more integrated trade-oriented community can be built by BRI to bring together the developed and developing regions and various economic systems and ideologies for developing a harmonious, resilient and healthy society. In hope, through the BRI network, the U2-CAS can help policymakers to understand and analyze the ongoing investigation of an alternative urban-rural development

pathway to overcome the future urban challenges in the developing regions. To strive the BRI can bridge the culture, distance, and digital divide for levelling the well-being gaps between the two regions ultimately. The two steps suggested to reach the agenda are:

1. Testing the TOD-ICT-based UxR development framework in the member countries of the BRI.
2. Developing the BRI index for matching the native residents' well-being requests and the limited resources.

6.2.2 QOL Index for the Construction Industry

In Hong Kong (HK), the construction industry faces a problem of worker shortage due to aging, occupational illnesses, and injuries (Yi & Chan, 2016), mostly from the negative image portrayed in public. HK youngsters have no desire to join the construction workforce. An “HK construction worker QOL index” can be developed to assess the well-being of Hong Kong construction workers to identify difficulties they are facing and then design effective solutions to help them. The solutions can include uplifting their public image in society, with an effort to motivate youngsters to join the booming industry in line with BRI's local, regional, and global developments. The QOL Index can be easily modified to assess BRI construction workers' well-being across the new Silk Road, locally and globally. Suggestively, the Construction Industry Council (CIC), Hong Kong Construction Association, and BRI institution can provide support for developing the QOL Index.

6.2.3 A Development Framework for Enhancing the Conventional Economy-Led Urbanization

Finally, answering the previous question mentioned: What kind of future development paradigm can properly serve human needs and secure our natural resource? Well-balancing urbanization is a sustainable route for materializing human happiness according to the Yin-yang universal law.

In the outlook, ICT's role is critical in achieving digital-ruralism. The conceptual UxR development framework would be modified according to time and the implementation of digital-ruralism. As stated previously, ICT would substantially impact the economy, social, mobility, governance, education, smart living, lifestyle, culture, and health. To the rural residents, the dependence on TOD will be minimized for occasionally commuting to major transportation hubs for traveling overseas instead of a comprehensive influence on their living ways in the digital age. The conceptual UxR provides the foundation for further verification. Is UxR the efficient way to connect marketplaces and rural resources for narrowing the well-being gaps between the developing and developed countries? More theoretical and empirical studies are necessary to predict and reach a common development goal between the government (supply-side) and the residents (demand-side).

6.3 AFTERWORD

While the philosophical implications should be considered secondary to its practical contributions now, proving just as consequential for solving ideology conflict in the future. The research is a theory explained and illustrated as a precise science. In the multi-dimensional orderly constructed yet complex dynamic world, full of contradiction, misunderstanding, and conflict become the unavoidable norm internally (human) and externally (nation, city, and community). Human imposes the conflict onto nature or humans themselves, the conflict between the binary of the object and subject or the top and down, and the conflict created by the disparities of ideology, political system, market system, lifestyle, tradition and culture (classical and pop-culture), educational level, age, wealth, race, profession, and geography. The attributes of demographic profile divide people into the developing and developed regions geographically and mentally. However, it does not matter which world one belongs to; all humanity faces the same global climate change catastrophe ingrained by irresponsible human behaviour. Only focusing on economic growth or GDP advancement is no

longer the norm in future urban development and a paradigm shift should be prescribed for securing our sustainable future.

The U2-CAS defines the original point of reality and sets the goal, identifying the critical points within the urban parameter, networking to form lines and shapes to map out a projection. It explains and proves that reality represents an individual's perception projecting on the world, ending in a collective social effort. To Nietzsche, "Truth" is not a property; it is to do something, which must involve mobility and activity. The research concludes that "Truth" can equal "Reality" when a theme-goal system is developed for transforming "individual realities" into a "collective reality" and must be limited on the same parameter and constraint for the specific layer of reality. Anything beyond this boundary, there are possible conflicts and unsustainability.

Global warming is the gap between the ideal and realistic scheme of sustainability. To close the gap, popularizing the evaluation concept to help people understand their surrounding environment is extremely important while developing the proper evaluation tool to support SUD. The performance of environmental sustainability depends on the engagement of the people, particularly at the community level, to LEARN and ACT collectively to achieve the climate change goal set by the Paris Agreement. It means that the quality of human development (human environment) is essential for reaching the SDGs. As problems accumulate faster than the solution, the evolutionary transition to a new city development paradigm becomes necessary, particularly to developing regions. The redefinition of QOL from rhetoric to implementation (a function of "word" and "action") could be realized by the multi-functional U2-CAS. It integrates the dual elements of "human vs. nature", the "internal vs. external environment" or the "top-down policy-driven indication vs. SWBS" through the route of means-goal and causality, allowing freedom of movement exercising within the parameter, where idealism rides with realism, adjusting and modifying to actualize the future Sustainable

Human Eco-City (SHE-City) of 2030-50. Although the study attempts to further Kevin Lynch's normative theory, which deals with the relationship between human values and ecological settlement form explicitly (Lynch, 1981), there is still so much research and empirical studies to be done consistently. The U2-CAS only explains, depicts, and validates the SHE-City, and the WoSu critically, however, the rest of the microsystems of the complex human-ecological society including the HES, and the human-physical-contextual environment are still requiring sufficient propositions and assertions.

How would that ideal city be? This vision is particularly necessary for developing countries, where cities are in dynamic creation processes. Developing countries cannot continue being the second-rate imitations of developed countries, because their reality is different from that of the developed countries due to demographic, and time-space factors. Developing countries can learn from the successes and failures of advanced countries to create a new, more appropriate, and better city development models suiting for themselves (Sourcebook 2005). Which country is going to set the standard with the kind of vision and human resources to build a better world for the next generations without depriving their entitled resources? When the evaluation system is designed for developing countries, learning the mistakes made by most of the developed countries is essential. Once the new form of urban development is established with great success, then the leadership will be cherished and followed.

The newfound knowledge: *“thought shaping our world and our happiness,”* contextual environment was proved to be the vital factor affecting inhabitants' well-being, not less than the physical environment, especially in the developed countries. Indeed, the contextual effort is the impetus for achieving social-economic-environmental sustainability because thought leads to action. Therefore, the right balance of the WoSu derived from the contextual environment, human environment, and physical environment is upheld by the U2-

CAS. Both hardware and software should be included in sustainable development for the developing countries, especially the significant contextual dimensions such as education, cultural preservation beyond the TOD-ICT support.

Looking ahead, is ICT the good or bad factor impacting human's ways of living? Human is entering to live at the time of "Machine vs. Human". The problem and solution of the "thing" are the "people" who are the "subject," not the "system". Any system is designed and utilized by the "people" for improvement supposedly. Nevertheless, the image of a city is the implication of the quality of the people mentally and physically. By nurturing merit talent and constructing an effective system for governing the nation, the healthy Human Ecological System (HES) would be built, maintained, and modified by artificial intelligence for ongoing progression. Will the future SHE-City be enabled by techno-utopianism²⁵ or vice versa?

Noting that this study has no intention to reach any judgment on what is supposed to be the ideal future sustainable development norm. Time is acting as the ever-changing factor in the developing process, which requires the concerned planners and players to act, react, choose, and alter any set models or practices to suit the real situation periodically. No one formula works for ALL in this ever-evolving digital age! However, one thing that can be sure of is that "the people build the city for serving the Sustainability-Uqol".

This research project is to understand, discuss, justify, conclude and disseminate information on influential factors and their relationship confined in a future human-centric habitat for optimizing people's livelihoods with respect to nature. Maybe a different kind of city paradigm apart from the "metropolitan-led high-dense city paradigm" would be more suitable for challenging current global and urban issues! Likely, a new kind of lifestyle directed by "Yinyangism" for promoting living well with one's full potential would be the concept of

²⁵ An ideology about the advancement in science and technology for developing an ideal society.

“Sustainablism” in the making, which demands a new development framework such as the UxR. The advancement of technology will solve many issues that will drive people away from city living. Will the countryside become the hotbed for improving our well-being while fighting climate change? Presented by Rem Koolhaas (OMA), the “Countryside the Future” exhibition in the Guggenheim Museum of NYC predicting the future urban development is to embrace ruralism. Will a hybrid of Ruralism and Urbanism be the future mode of development, oriented around smart living made possible by the advancement of technology such as e-payment, e-governance, e-health, 5G, flying taxi, and driverless cars? What if the BRI endorses the hybrid UxR development framework, will BRI reshape our planet with a healthy and fruitful living environment along the “Health Silk Road” to further advance globalization? This research is just the beginning for studying, understanding, and evaluating the ever-changing human society, far from perfect, of course, more transdisciplinary research should be conducted in different development scales and locations relating to SUD, and QOL.

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**Source: Related Urban Quality of Life Ranking List for Amsterdam, Netherlands:
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Appendix I: Interviews of International Respondents in Zurich, Florence, and Hong Kong 2018/2019

(Perceived Uqol of the Developed Cities: Zurich, Paris and Hong Kong)

#	Age group Gender	Marital status	Citizenship Mercer's QOL 2019 City Ranking	Do you like Zurich? Why?	Do you like Paris/Hong Kong? What are the main factors for you to relocate to a new place?
1	34-45 (M)	Married with children	Indian (lived in the USA) Hyderabad 143rd	No, transportation & welfare are cool, but people are cold.	Yes, these cities are more human-oriented with good infrastructure, jobs, and friendly people.
2	34-45 (F)	Single	Brazilian (working in a bank) Rio de Janeiro 118th	No, although it is very well developed and convenient, I do not feel it.	Yes, culture and people, job. I am still searching.
3	16-25 (F)	Single	Austrian (student from Vienna, major in music) Vienna 1st	Yes, but I love Austria	No, Paris is dirty and chaotic. It does not look and feel like what I saw in the movie.
4	34-45 (M)	Married with children	British London 41st	Yes, I am here for a job interview, but I think my chance is meager because they tend to hire locals even though the policy seems to welcome foreigners.	No comment, I relocate only for a job opportunity . However, if I choose, I tend to stay where I am because I have children.
5	16-25 (M)	Single	French Paris 39th	Yes, but I just got in and need more time to know the city.	Yes, Paris is the best city. The culture, architecture, transportation, and people. Love it!
6	16-25 (F)	Single	Canadian (student) Toronto 16th	n/a	Yes, this is the 3rd time I am in Paris because I have friends living here. Once I come to Europe and I tend to stop by Paris to see them. I love the city because of the lifestyle, culture, museums, restaurants ...if I can get a job here, I will move down here.
7	16-25 (F)	Single	Brazilian (student) Rio de Janeiro 118th	Yes, I love the nature and transportation system here...a beautiful city.	n/a
8	26-35 (F)	Single	Spanish (fresh graduate studied international law) Barcelona 43rd	Yes, the transportation system , a well-developed city. I am doing an internship here and would like to get a permanent job here.	n/a
9	26-35 (F)	Single	Spanish	Yes, it is a beautiful city, but the living space is tiny.	Yes, very much, there are many activities and the city lifestyle... a very romantic city. I will move to Paris if I can get a job.

10	26-35 (F)	Married without children	Iranian (Ph.D. student) Tehran 199th	Yes, I would love to move to Zurich because it is a wonderful city with a high living standard.	n/a
11	30-35 (M)	Single	Pakistanis (Post-doc) Islamabad 194th		Yes, because I want to get citizenship, and I have two more years to go. There is freedom and good governance in Hong Kong. I believe governance is the critical driver for securing Uqol. Then it gets triggering to education and healthy...amenities. It also depends on the level of city development, in developing countries such as Pakistan, people expect excellent amenities before health, education, and governance. People from developing countries want instant satisfaction and benefit in the present. However, in developed countries such as Italy or Switzerland, people view health as a vital factor driving Uqol. Besides, there is a different educational system; for the developed countries, the government tends to educate analytical thinkers. In developing countries, the government tends to train followers. There are no right or wrong practices if the aggregated outcome is beneficial to society within the code of conduct in morality; otherwise, poisoning society's atmosphere is a long-term disease for the death row.
12	25-30 (F)	Single	British London 41st	n/a	As beautiful, nature is for me the first and most important thing that made me relocate to a new place is its people , without doubt, the place makes me feel comfortable and welcomed more than anything. To truly understand a city, you need to see and feel how people think, live, and treat their guests.
<p>Findings: Uqol is subjective due to demographic and geographical profiles divided into two distinctive groups: developing and developed countries. In general, people perceived the quality of people, transportation, and employment are essential for improving their wellbeing. Besides, lifestyle, nature, culture (architecture, art, and music scenes), and sense of belongings are crucial to people from the developed countries. On one hand, the findings provide the rhetorical definition of Uqol in people's minds. On the other hand, it shows that the world QOL indices might be too general to tell the different stories of the average person at the local level. Thus, there is a need for developing a universal U2-CAS to help in conducting a multi-scalar evaluation and report the different local needs subject to demographic and geographical variables for informing urban policymaking more effectively.</p>					

Country	City	Mercer's QOL City Ranking 2019/231 cities
Austria*	Vienna	1
Switzerland*	Zurich	2
Canada*	Toronto	16
France*	Paris	39
United Kingdom (Britain)*	London	41
Spain*	Barcelona	43
China ^a	Hong Kong	71
Brazil ^a	Rio de Janeiro	118
India ^a	Hyderabad	143
Pakistan ^a	Islamabad	194
Iran ^a	Tehran	199

Source : <https://mobilityexchange.mercer.com/Insights/quality-of-living-rankings>
i.e. *=developed countries, ^a=developing countries

Appendix II: Comparative Analysis of Relevant QOL Indices (Pool of QOL Indicators for the Wheel of Sustainability-Uqol)

Indicators	CIMI 2014-17	Global Power City Index 2017	Sustainable Cities Index 2016	Sustainable Cities Mobility Index 2017	Mercer's QOL City Ranking 2017	Social Progress Index 2018	Future Cities' Indicators (BFWC2016)	World Happiness Report 2012-17	The Smartest Cities in the World 2015	Total Count
Human Environment										
Human Capital (entrepreneurs / talent, & education)	x	x	x		x	x	x		x	7
Governance	x				x		x	x	x	5
Research Innovation		x			x					2
Health					x	x	x	x	x	6
Social (equality & social justice, stability / safety, freedom & trust, & social cohesion)	x	x		x	x	x	x	x	x	9
Service of Lifestyle							x			1
Physical Environment										
Economy/Productivity	x	x	x		x			x	x	6
Environment (natural assets, & green space)	x	x	x	x	x	x			x	7
Mobility & Transportation	x	x		x	x		x		x	7
Urban Planning	x	x							x	3
Livability		x			x					2
Smart Living									x	1
Contextual Environment										
Technology-ICT	x	x	x	x		x	x		x	7
Culture (international outreach, tourism, historical heritage, & diversity)	x	x		x	x		x		x	7

Total count sets at 5 as the benchmark for indicator selection, except for smart living and service of lifestyle because those two indicators are significant for future development.