RIGA TECHNICAL UNIVERSITY

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EVALUATION OF URBAN SUSTAINABILITY OF UZBEKISTAN IN THE CONTEXT OF REGIONAL DEVELOPMENT

Doctoral Thesis

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RTU Press
Riga 2024

Abstract

The purpose of this doctoral thesis is to develop a methodological approach to assessing urban sustainability in Uzbekistan. One of the objectives of this research is to explore the role of sustainability awareness among the country's citizens in addressing global warming, climate change, waste management, promotion of gender equality, and other sustainability-related issues and to evaluate the level of sustainability knowledge among the Uzbek population. The author conducts a comprehensive literature review via PRISMA method as well as bibliometric analysis using VoSViewer and RStudio. The literature analysis revealed that there was no commonly accepted definitions of terms "urban", "sustainability" and "urban sustainability", therefore the author proposed comprehensive definitions to these terms.

Further in this research the author conducted survey to assess the level of sustainability awareness among Uzbek population. Structural equation modelling (SEM) was then applied to analyse the survey results and to test the hypotheses developed from the theoretical analysis. The conducted theoretical analysis of the existing techniques of evaluation of urban sustainable development identified the main research gap, which was the absence of sustainability evaluation methodology that could be applied to Uzbekistan. Using data obtained from secondary sources, as well as interviews with experts in the field the author developed a formula for evaluation of urban sustainability in the country. The developed formula allows accessing the actual level of urban sustainability in Uzbekistan, while providing insights into what aspects seek immediate attention for improving sustainability progress in the country.

Keywords: gender equality, sustainability awareness, sustainability evaluation, sustainable development, urban sustainability, Uzbekistan

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INTRODUCTION

Natural resources and natural conditions are the basis of material production and the life of the population. The state of the environment and the quality level of resource use, protection, and reproduction largely determine the rates of economic growth and production efficiency. Economic growth, associated with obtaining only the maximum final benefit from production in the current period with ineffective use of natural resources and the environment, has practically exhausted itself. At the present stage of the development of society, consideration of the ecological factor when making decisions on the sustainable development of territories is becoming especially relevant.

As more and more people live in cities around the world, sustainable development is a notion that is becoming increasingly important for metropolitan regions. Urban sustainability that takes into account economic, environmental, and social challenges is becoming more and more necessary as a result of this transformation.

The demand for more sustainable methods of economic development and the growing awareness of environmental degradation led to the birth of the idea of sustainable development in the 1980s (WCED, 1987). Since then, the idea has expanded to include social and cultural factors as well, demonstrating a more comprehensive grasp of sustainability (UNESCO, 2014). Strategy development for urban sustainability has become a crucial component of implementing sustainable development in cities and urban regions.

Economic growth, social advancement, and environmental preservation must all be balanced in order for sustainable development to take place (WCED, 1987). In the 1980s, the idea of sustainable development became widely known, and it has since been a crucial consideration in the formulation of world policy (UN, 2015). But, putting sustainable development into practice is still difficult, particularly in urban areas where resource consumption, population increase, and environmental deterioration are all on the rise (Glaeser, 2014).

Currently, at the state level, some methods imply taking into account the environmental and social factors in national statistics. Still, they have not yet received widespread use in developing countries in the Central Asian region, firstly, due to significant differences in development between individual regions, and, secondly, since they are only a tool for reflecting the current situation and are not built into the mechanism for managing specific territories. At

the same time, the increasing technogenic load on the environment around the world and, in particular, in the aforementioned region makes it necessary to consider the environmental and social factors when developing regional development programs and justifying investment projects. In this regard, studies that are aimed at assessing the state of specific ecological, social and economic systems (regions and municipalities), monitoring their development, identifying development trends, and, most importantly, developing a methodology on the basis of which recommendations can be expanded on the correction of the development trajectory of the considered ecological and economic systems towards sustainable development are becoming increasingly important. At the same time, it becomes possible to identify tools of influence for use by the relevant governing institutions, assess the expected effects from the implementation of measures to manage the sustainability of development, and develop an effective policy that sets coordinated directions for the development of ecological and economic systems of different levels.

A significant contribution to the formation of the economic theory of nature management was made by J. Hartwick (1977), H. Hotelling (1929), T. Tietenberg (2009), and others. The theory of sustainable development was among others developed by D. Pierce and G. Atkinson (1989), K. Hamilton (1995), J. Pezzey (1989), R. Costanza (1997), H. Daley (2015), J. Forrester (1973), Dennis, and Donella Meadows (1982), M. Mesarovic and E. Pestel (1976), Ernst von Weizsaecker, E.B. A. Lovins, L.H. Lovins (2006), J. Randers (2004).

Nowadays, the issues related to the management of the sustainability of the development of ecological, social and economic systems of different levels remain insufficiently studied. At the same time, the formation of an integral indicator of sustainable development would make it possible to develop coordinated solutions that contribute to improving the efficiency of management of the objects under consideration in the direction of sustainable development. This thesis aims to fill the research gap in urban sustainability field by examining a central Asian region, specifically Uzbekistan, which has received very little attention to date.

Considering the immense gender gap in the central Asian region, namely in Uzbekistan, we would like to emphasize the topic of gender equality and female empowerment in this research, since women's empowerment leads to the fulfilment of SDG5, while also positively impacts many other sustainable development dimensions.

The current doctoral thesis develops a methodology for assessing urban sustainability in Uzbekistan's urban areas. The research also offers a classification of region-specific urban

sustainability indicators. Lastly, in order to incorporate it into the evaluation system, the author evaluates the nation's sustainability awareness level via surveys.

Research questions:

1. What is urban sustainability?

2. What metrics may be used to assess urban sustainability in Uzbekistan to ensure that the results are reliable and take into account regional peculiarities?

3. How aware are Uzbek citizens about the importance of urban sustainability?

The aim of the study is to fill the gap in scientific understanding of urban sustainability in the Central Asian region, specifically in Uzbekistan. The **aim** of the work is to develop a new methodological approach to the assessment of urban sustainability in this context, taking into account regional characteristics, the level of awareness of the population and the importance of gender equality. To achieve this, the following tasks are set:

1. to analyze the concepts of urban sustainability and sustainable development;

2. to investigate the approaches to regional development and discuss methodological aspects of such approaches in the context of urban sustainability;

3. to explore the importance of gender equality and female empowerment for the achievement of sustainable development in regional development context;

4. to discuss the role of sustainability awareness among the country's citizens in addressing global warming, climate change, waste management, promotion of gender equality, and other sustainability-related issues and to evaluate the level of sustainability awareness among the Uzbek population;

5. to develop a formula for assessing the level of urban sustainability in Uzbekistan;

6. to formulate recommendations to Uzbekistan authorities based on the findings on how to improve currently existing situation to achieve a higher level of sustainable urban development.

The **object of the research** is urban sustainability.

The **subject of the research** is evaluation of urban sustainability in Uzbekistan.

This thesis examines the dynamics of regional development primarily within the context of Uzbekistan, a pivotal nation in Central Asia with unique developmental challenges and opportunities.

The research design:

By combining qualitative and quantitative research techniques, the research design was created to address the research questions. The research questions, purpose of the research, and research objectives specify the logics of the research design.

Stage 1. Elaboration of research methodology and conceptualization of urban sustainability

Research question 1 "What is urban sustainability?" was addressed through the evaluation of the scientific literature, which produced the conceptualization of understanding for the subsequent principles:

- defining urban;

- defining sustainability;

- defining urban sustainability;

- models and approaches to sustainability.

Stage 2. Exploration of metrics that may be used to assess urban sustainability.

The main focus of stage 2 of the research was to investigate various methods of urban sustainability evaluation and detect whether there was a methodology applicable to Uzbekistan. The exploration of research question 2 "What metrics may be used to assess urban sustainability in Uzbekistan to ensure that the results are reliable and take into account regional peculiarities?" put forward the following principles:

- in spite of abundance of various sustainability evaluation methodologies, there is not a single one that took into account specifics of the region. Most of them were proposed and applied in developed countries and were not tested on developing countries in the researched region;

- regional development could have a great potential in improving sustainability level of the region, especially when taking into account local shortcomings (lack of female empowerment and sustainability awareness).

Stage 3. Investigation of sustainability awareness among Uzbek citizens via surveys

Phase 3's goal is to investigate the level of sustainability awareness among Uzbekistan population. This includes assessing their knowledge on existing problems related to urban sustainability as well as their consciousness when it comes to implementing steps for eradication of harmful impact of their daily activities. The stage is crucial to answering Research Question 3 How aware are Uzbek citizens about the value of regional urban sustainability?

Stage 4. Elaboration of methodology for urban sustainability assessment in Uzbekistan

The aim of this phase is to develop a formula for evaluation of urban sustainability in Uzbekistan. The first part of this phase depends heavily on phase 2 of the research. After the analysis of numerous indicators of urban sustainability, the author selected the most applicable ones. Then these indicators were approved and ranked by the experts. These ranking was later used to adjust weights to each indicator. The second part of the phase focuses on elaborating the possible maximum and minimum values resulting from the formula to be used as a reference for the result of Uzbekistan.

Research methods

The author used general methodological approaches: systemic and complex, as well as methods of scientific research: statistical methods, classifications, comparative analysis, and programming tools. The theoretical basis of the research was the work of scientists in the field of environmental economics, the economics of sustainable development, and regional economics. The research methods include:

- Literature analysis;

- Bibliometric analysis;

- Content analysis;

- Secondary data analysis;

- Survey;

- Expert interviews.

Data analysis methods include:

- Graphical analysis;

- Correlation analysis;

- Factor loading analysis;

- Structural Equation Modelling;

- Interview transcripts.

Qualitative data analysis methods:

- Systematic literature reviews;

- Bibliometric analysis;

- Qualitative content analysis of scientific articles;

- Data triangulation.

Scientific novelty

1. Identification of indicators necessary to assess urban sustainability in Uzbekistan. To the knowledge of the author no recent research has been made in the field of urban sustainability in Uzbekistan. Currently all the methodologies that are applied to Uzbekistan were developed in Soviet times and were not specific to the studied region. Based on the analysis of the country the author offers a set of indicators of urban sustainability specific to that region.

2. Classification of urban sustainability indicators necessary to assess urban sustainability in Uzbekistan. While most of the research offers three pillars when it comes to sustainability: economic, ecological and social, this does not always fully correspond to the complex nature of urban sustainability. Thus, the author offers "awareness" as a separate pillar of urban sustainability in Uzbekistan. Increasing sustainability awareness is expected to positively impact ecologic, social and environmental situation in the country. Additionally, considering the high level of sexism and misogyny on the country, which has a negative influence on all the pillars, the author proposes to classify gender equality indicator into a separate group to bring more attention to this issue.

3. Development of the methodology for evaluation of urban sustainability in Uzbekistan. To the knowledge of the author, no such methodology currently exists in Uzbekistan, or neighbouring countries. Thus, the only way to assess the level of sustainability in urban areas is through methodologies developed in Europe and North America, that do not take into consideration social, economic and environmental peculiarities of the country.

4. Based on the literature analysis the author proposes a definition of the term "urban". The definition proposed in this thesis offers a more complex understanding of contemporary urban environments and their socio-economic, cultural, and ecological complexities.

5. The proposition of definition of "sustainability". Literature review shows that even though a lot of scholars are using this term, no specific commonly accepted definition is provided for it in the literature. In this thesis, the author synthesizes the existing definitions of "sustainability" and provides a new one that addresses the shortcomings of the existing definitions.

6. The proposition of definition of "urban sustainability". Although the term "urban sustainability" is becoming increasingly popular in the last few decades not many scholars define it, thus providing a comprehensive definition can be considered a scientific novelty that addresses the research gap in this field.

When it comes to the proposed definitions it is acknowledged that definitions are fundamentally context-dependent. While definitions across academic fields are never universally accepted, reflecting a diversity of perspectives that is both inevitable and valuable in this study, the concepts "urban," "sustainability," and "urban sustainability" function as critical points of analysis. Thus, the rationale behind proposing new definitions for these key terms stems from an identified need within the literature. For example, when discussing sustainability, there is an overall consensus, that it touches upon at least the following pillars: society, environment, economics and their maintenance over time, nevertheless, a term that encompasses all that was not proposed earlier. On the other hand, a term "urban" has a lot of different meanings depending on the context, however it mostly addresses the physical aspects of it, which makes the use of proposed terms not precisely accurate in interdisciplinary research, especially in social sciences.

Practical application of the research

To author's knowledge, no such research has been previously conducted, and no other formula for evaluation of Uzbek urban sustainability currently exists. No measuring of the level of sustainability awareness among Uzbek citizens was previously performed. Thus, these findings can be used to improve current sustainability level of urban areas in the country. Additionally, the author proposes a questionnaire to assess sustainability awareness among population.

Hypotheses

Hypothesis 1: Increased sustainability awareness among population has a positive impact on addressing sustainability issues in the region.

Hypothesis 2: Higher gender equality is positively associated with urban sustainability.

Hypothesis 3: Higher environmental awareness is positively associated with higher level of consumption consciousness.

Theses for defence

The following theses are presented for defence by synthesizing theoretical findings and the outcomes of the empirical research attained during the development of the doctoral thesis:

1. Female empowerment is essential to sustainable urban development because it has a profound impact on multiple aspects of society, including economic, social, and environmental aspects. When women have access to education, healthcare, economic opportunities, and political participation, they can contribute to the development of their families, communities, and countries.

2. Sustainability awareness is crucial for sustainable development because it enables people and organizations to comprehend how their actions affect the environment, society, and economy. It is challenging to establish and uphold sustainable practices and policies without awareness and comprehension of sustainability.

3. For effective regional development, it is crucial to integrate a robust methodology for evaluating urban sustainability. This helps in identifying areas of weakness that need to be prioritized. This methodology should be regularly utilized to track

progress, adjust strategies, and ensure continuous enhancement of urban sustainability within regional development.

Approbation and practical application of research results

The research results were presented and discussed at international scientific conferences in Latvia, Lithuania, Poland, Sweden and Ukraine and were further reflected in the corresponding scientific publications. The comments and suggestions received at the conferences, and during peer reviews of the articles were taken into account and the appropriate changes in the research were done

Limitations

This research is limited to Uzbekistan; however, the proposed methodology can be tested on the other countries in the Central Asian region. Additionally, one part of the developed methodology is evaluation of sustainability awareness via surveys. Since people tend to portray themselves better when answering survey questions – another limitation of this research can be not fully reliable answers.

Scientific publications

The results of the research were reflected in 14 articles, 10 of which are indexed in Scopus and Web of Science:

1. Veckalne, R., Tambovceva, T. The (2022). Role of Digital Transformation in Education in Promoting Sustainable Development. Virtual economics, 5(4), 65-86. https://doi.org/10.34021/ve.2022.05.04(4)

2. Veckalne, R., Us, Y., & Gerulaitiene, N. (2022). Evaluation of sustainability awareness in Uzbekistan. Marketing and management of innovations, (3), 88-102.

3. Veckalne, R., & Tambovceva, T. (2022). Sustainable regional development planning. Proceesings of the 12th International Scientific Conference Business and Management 2022, Vilnius, Lithuania, 315-324.

4. Shvindina, H. O., Veckalne, R., Balahurovska, I., & Khrin, N. (2022). Development Features and Directions of Modern Management: In the Case of Ukrainian Health Care Institutions.

5. Lyeonov, S., Pimonenko, T., Chygryn, O., Reznik, O., & Gaynulina, R. (2021). Green brand as a marketing instrument: Principle, features and parameters. International Journal of Global Energy Issues, 43(2-3), 147-165.

6. Hyrchenko, Y., Skibina, T., Us, Y., & Veckalne, R. (2021). World market of liquid biofuels: trends, policy and challenges. In E3S Web of Conferences (Vol. 280, p. 05005). EDP Sciences.

7. Veckalne, R, Tambovceva, T. (2021). Innovations in circular economy for sustainable urban development. Marketing and management of innovations

8. Veckalne, R., & Tambovceva, T. (2021). Waste management within context of urban sustainable development: bibliometric analysis. In Proceedings of the 20th International Scientific Conference Engineering for Rural Development, Jelgava, Latvia (pp. 26-28).

9. Veckalne, R., & Tambovceva, T. (2020). Influence of sustainability factors on economic development within the context of globalisation. Innovation, social and economic challenges, 25.

10. Gaynulina, R., Tambovceva, T. (2020) Sustainable Development of Urbanized Territories. In: Политика развития в условиях цифровизации общества: материалы Всероссийской научной конференции с международным участием = Development Policy in the Conditions of Society Digitalization: Materials of the All-Russian Scientific Conference with International Participation, Russia, Krasnodar, 22-23 October, 2020. Krasnodar: Kuban State University, 2020, pp.36-41.

11. Gaynulina, R. (2019). The revival of protectionism in the modern world: Case study of Uzbekistan. In Scientific Conference on Economics and Entrepreneurship Proceedings (pp. 17-23).

The results of the research were presented at the following 6 conferences:

1. Veckalne, R., Tambovceva, T. Evaluation of Urban Sustainability in Uzbekistan. In: Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regional and Territorial Development ICEREE'2022: Latvia, Riga, 29-30 September, 2022.

2. Veckalne R., Us Y. & Tambovceva T. Circular Economy on Construction and Demolition Waste; the Case of Latvia. BUP symposium, Sweden, 19-20 October, 2021.

3. Veckalne, R., Tambovceva, T. Recycling as an Ecologic-Economic Balancing Mechanism for Regional Development Mechanism. In: 8th International Scientific Conference "New Trends in Management and Production Engineering - Regional, Cross-Border and Global Perspectives": Poland, Brenna, 10-11 June, 2021. Poland: WSB University, 2021.

4. Veckalne, R., Tambovceva, T. Sustainable Development Through Circular Economy Practices. In: Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regional and Territorial Development ICEREE'2021: organized within 62nd International Scientific Conference of Riga Technical University: Book of Abstracts, Latvia, Riga, 30-30 September, 2021.

5. Gaynulina, R., Tambovceva, T. Review of Approaches to the Analysis of Sustainable Development of Urban Territories. In: Scientific Problems of Engineering Economics of Construction and Real Estate Management, Regions and Territories Development ICEREE'2020": Organized within 61th International Scientific Conference of Riga Technical University: Latvia, Riga, 1-3 October, 2020.

6. Veckalne, R. The Revival of Protectionism in the Modern World: Causes and Consequences. No: Scientific Conference on Economics and Entrepreneurship SCEE '2019: Organized within the 60th International Scientific Conference of Riga Technical University: Latvia, Riga, 11.-12. October, 2019.

Contents and volume of doctoral thesis

Chapter 1 "Conceptualizing Sustainable Development: Definitions, Models and Influencing Factors" provides a comprehensive review of sustainability and sustainable development related concepts, explores various models and approaches to sustainability as well as discusses factors related to sustainability and sustainable development. In this chapter the author conducts literature review via PRISMA method as well as bibliometric analysis using VOSViewer and RStudio. Additionally, focus group discussions to approve the proposed definitions of "sustainability", "urban" and "urban sustainability" are reported.

Chapter 2 "Assessment of Urban Sustainability" investigates various indicators and indices of sustainability as well as approaches to its evaluation. Additionally, the author discusses strategies and approaches to regional development. In this chapter the author uses bibliometric analysis to indicate which factors are believed to be related to urban sustainability using VOSViewer.

Chapter 3 "Evaluation of Urban Sustainability in Uzbekistan" presents results of surveys on sustainability awareness among Uzbek citizens that are analysed via SPSS and SmartPLS. In addition to that, the author proposes a methodology to evaluate urban sustainability in Uzbekistan. The author also conducts qualitative analysis with experts to select and weigh the indicators for the methodology. The statistical data related to the methodology components is analysed via MS Excel and SPSS.

1. CONCEPTUALIZING SUSTAINABLE DEVELOPMENT: DEFINITIONS, MODELS, INFLUENCING FACTORS

1.1. Definitions of "sustainability", "urban" and "urban sustainability"

1.1.1. Definition of "sustainability"

Although the idea of sustainability has been around for a while, it wasn't until the 1970s that it really began to catch on. An ecosystem must be able to create its own resources and take in waste without deteriorating into other ecosystems or losing its usability to people. It is argued that sustainability encompasses both economic growth and human health and well-being in addition to conserving natural resources.

By the end of the 20th century, diverse ideas from various movements, such as social justice, internationalism, and conservationism, have united in the call for "sustainable development." The motivation behind sustainable development is usually complex, personal, and diverse; thus, it is unrealistic to list down the reasons for single individuals, groups, and committees being occupied with reaching this goal. Yet, for many, sustainability comes down to what we, humans, are leaving to future generations. But what exactly does sustainability stand for?

In Cambridge Dictionary (2019), the term "sustainability" is defined as:

1. The quality of being able to continue over a period of time;

2. The quality of causing little or no damage to the environment and therefore able to continue over a period of time.

The Brundtland Commission, in its universally known report "Our Common Future," proposes that sustainability means meeting one's own needs without compromising the ability of the descendants to meet their needs (The Brundtland Report, 1987). Additionally, to natural resources, social and economic resources have to be taken into consideration; therefore, not only environmentalism but also economic development and social equity are essential constituents of sustainability.

Scholars at the University of Alberta define sustainability as a process of living within the limits of available resources (natural, social, and physical), creating living systems that enable humans to thrive in perpetuity (University of Alberta, 2011). The United States Environmental Protection Agency (2020) claims that sustainability is the study of the ways in

which natural systems function and remain diverse while producing everything the ecology needs to remain in balance meanwhile using the resources responsively to sustain the modern way of life. James et al. (2015) claim that modern consumerist and predominantly urban societies consume a significant number of natural resources, and this consumption is only anticipated to be on the rise (James et al., 2015).

Zhurova and Toporkov (2017) mention that sustainability includes two aspects: state (statics) and process (dynamics). In the case of dynamics, sustainability determines the range of parameters within the limits of which the structure is preserved, that makes up static stability, and going beyond the indicated parameters, which transitions the system into an unstable state. Thus, the nature of stability can be either static or dynamic. When considering sustainability in regard to the process of developing the system in the long-run, higher priority values of target indicators are provided in comparison with the indicators of its initial state. In this case the term "sustainable development" is used.

It is agreed that the terms "sustainability" have many different interpretations (Johnston et al., 2007). According to Kates et al. (2005), these various definitions differ either in determining what is to be sustained, or in what is to be developed, or in the length of time. It is clear that there is much debate around the term "sustainability". In recent years, when this term became somewhat a buzz-word defining sustainability becomes more and more complex, that leads to further complications in the related research.

To clarify the definition of this term the author conducted a bibliometric analysis using R-studio. First, the author searched "sustainability" AND "definition" in Web of Science and limited the search to documents in English, 5193 results appeared. Then, 500 of the most cited articles were selected and analysed.

As it is seen on Figure 1.1 the documents were from a 30 year period between 1992 and 2022 and came from 291 different sources. On average, the interest in this topic grew 10.31 percent a year and was contributed to by nearly 1300 authors. The average age of the documents was 8.13 years, meaning that despite this theme being very topical the scientific production does not keep up with it.

Figure 1.1 Overview of the bibliometric analysis of "sustainability" AND "definition" (created by the author)

Figure 1.2 demonstrates that there were fluctuations in publications in this sphere, however starting from 2002 there has been a rapid growth and in the past 20 years the number of documents related to definition of sustainability grew over 5 times. When it comes to citations (Fig.1.3), again, severe fluctuation with peak years being 2004 and 2008 can be observed. This means that over time this topic was gaining and losing attention. And from 2018 the number of citations was declining rapidly. This is an indirect sign of scholars losing interest in researching this subject.
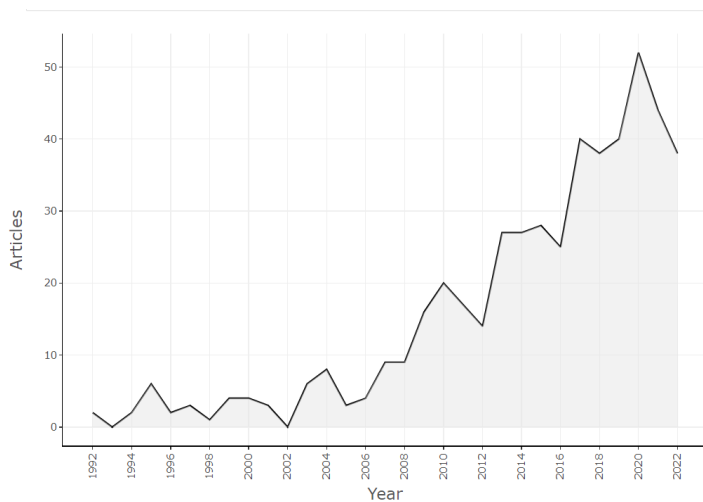
Figure 1.2. The number of articles on "sustainability" AND "definition" published over time (created by the author)
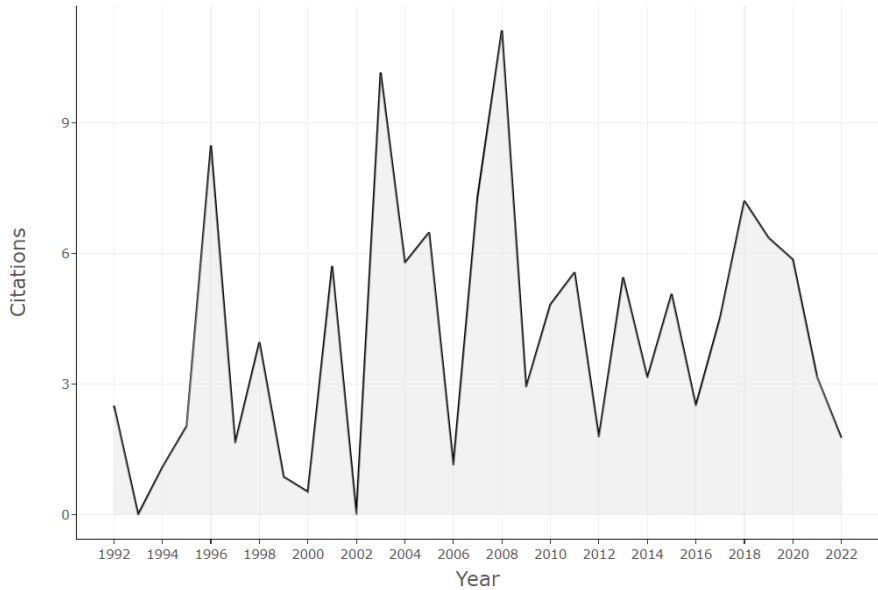
Figure 1.3. The frequency of citations of articles on "sustainability" AND "definition" over time (created by the author)

The next step in the analysis would be investigating the most common words that occur in the selected articles. For this analysis the selected articles were run through R-studio with algorithms selecting the highest occurring keywords from the articles. The top 10 are presented in the table below (Table 1.1).

Table 1.1.

Occurrence of main keywords (created by the author)

Word	Framework	Management	Indicators	Performance	Impact	System	Definition	Science	Governance	Consumption
Occurrence	53	51	43	36	22	21	17	17	16	15

As it is seen, although "definition" being the searched keywords, meaning that all of the selected articles should contain it, this term does not even make it into top 5. This clearly shows that there is a gap in research when it comes to defining "sustainability".

Figure 1.4 shows the change in the frequency of occurrence of the discussed words over the years. "Framework" is the keyword that grew exponentially, reaching the highest frequency at the end of a period. It is followed by "indicators", "impact", "performance". This means that more and more scholars are interested in defining the indicators that can measure the performance and/or impact of various sustainability practices, rather than defining the term itself.
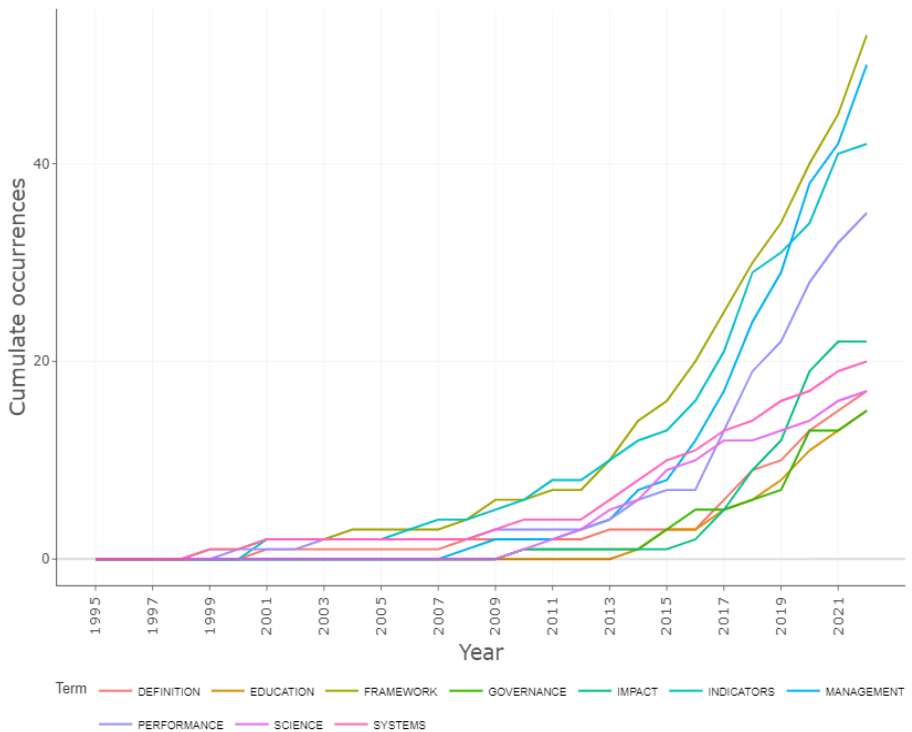
Figure 1.4. Top 10 words occurred overtime (created by the author)

Figure 1.5 shows the analysis of some of the author-created keywords that were used on the selected papers. In this case, again, there can be seen a lot of words that are closely related to sustainability and sustainable development, they however cannot provide a definition for the studies term.
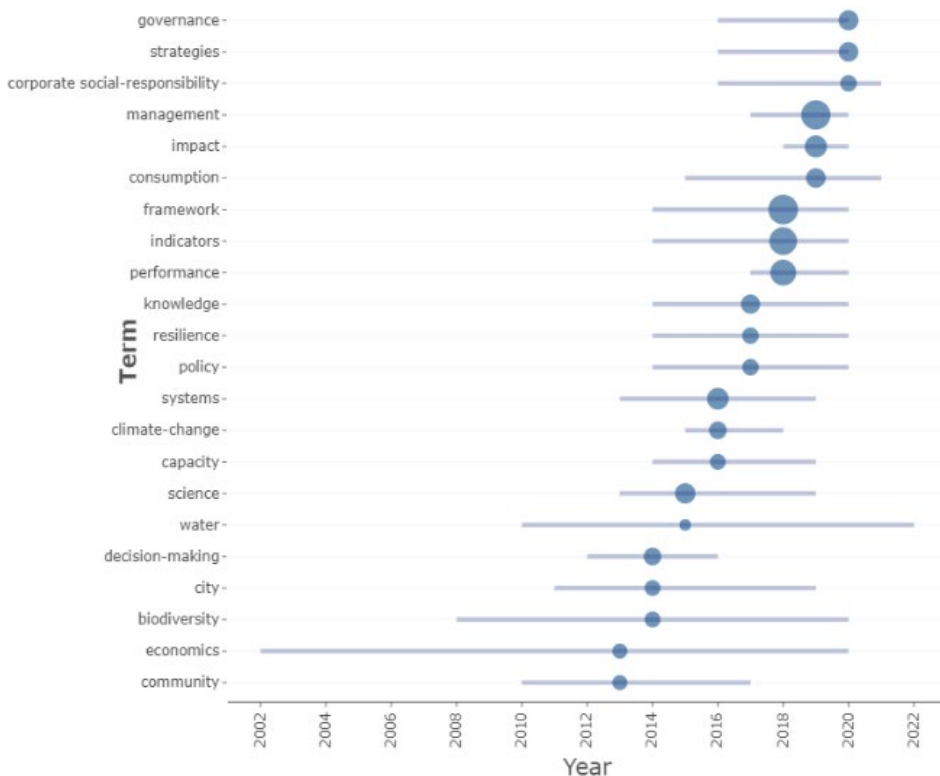
Figure 1.5. Top author-offered keywords in the selected papers

(created by the author)

In the further analysis the author looked at the co-occurrence of mechanically selected tags in 500 papers chosen for investigation. The documents were divided into two groups according to their time of origin. The first group contained articles published between 1992-2017, while the second one – between 2018 and 2022. The links between the two groups show the connection of keywords between them, while the size of the rectangle of the keyword shows the frequency of its occurrence. It is shown, that between 1992 and 2017 the most frequently appearing keywords was framework. This could indicate that during that period most of the authors attempted to develop a framework for reaching, maintaining or perhaps evaluate sustainability. Some of the other frequently used keywords were biodiversity, growth and water, showing the main problems associated with sustainability. In the latest years, however, the keyword appearing the most was management. This shows that nowadays more and more scientists are preoccupied with findings the ways to manage sustainability or improve the

existing practices. This analysis demonstrates a switch from framework development paradigm to management paradigm.
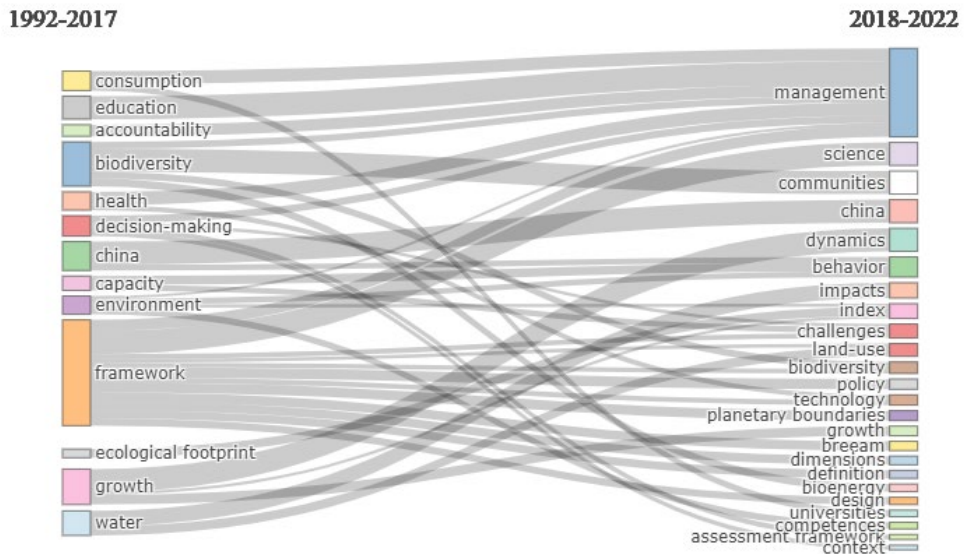
Figure 1.6. Field plot analysis of the keywords in "sustainability" AND "definition" papers occurred over time (created by the author)

The terms in the dataset were subjected to the study's Multiple Correspondence Analysis (MCA). Figure 1.7 shows the conceptual organization of the keywords connected to the "sustainability" AND "definition" articles analyzed in this research. In order to create a simple two-dimensional (or three-dimensional) graph that reflects the similarity between the keywords, it condenses large amounts of data with many variables into a low-dimensional space. The keywords that are closest to the center point have attracted a lot of attention in recent years (Xie et al., 2020).

Based on the relative placements of the dots and their distribution along the dimensions, the findings are interpreted; the closer the words are depicted in the map, the more similar their distribution is (Aria & Cuccurullo, 2017). Papers on economic sustainability, environment, sustainability management, corporate social responsibility, justice, and stakeholders are included in Cluster 1 (red color). The most significant cluster, Cluster 2 (blue), has only 3 keywords that are concentrated on publications about uncertainty, metrics, and policy.
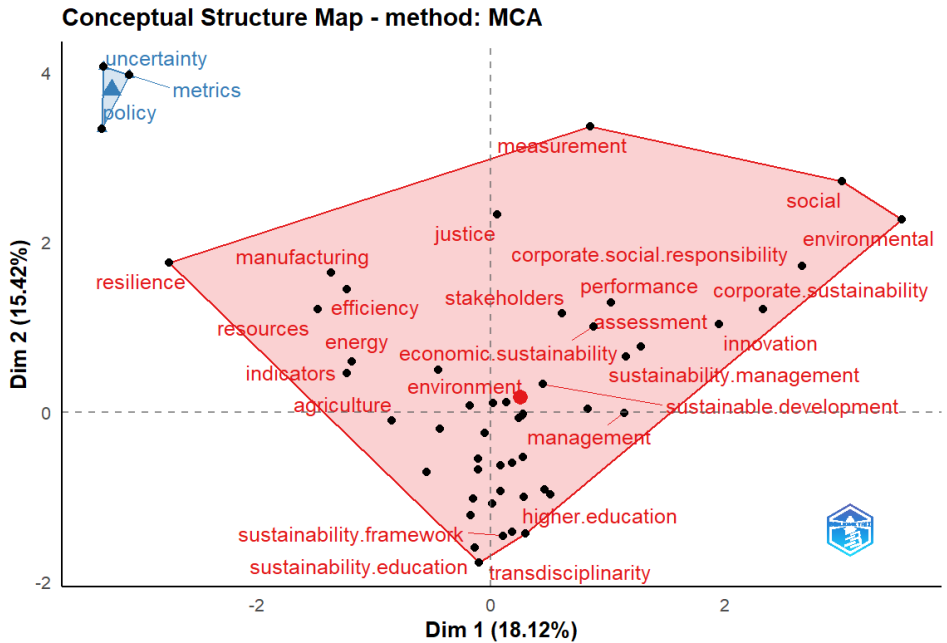
Figure 1.7 Factorial analysis of conceptual structure map-method: MCA of high-frequency keywords (created by the author)

From the aforementioned analysis it is clear that there are various ways in which scholars describe sustainability. For instance, Schaltegger and Sturm (2018) suggest that the ability of a system, process, or resource to be maintained or sustained over time. Or as a broad notion that covers a variety of environmental, social, and economic factors, which as the globe faces a number of global concerns, such as climate change, resource depletion, and social inequality, has gained more significance.

Sustainability in the context of the environment refers to the capacity of natural systems to operate and regenerate in a way that permits them to continue benefiting people and other species well into the future (Sachs et al., 2019). This entails safeguarding the planet's natural resources, such as the air, water, and biodiversity, as well as managing land, forests, and oceans in a way that reduces drawbacks and optimizes advantages.

The ability of communities and societies to meet the requirements of their current members without compromising the capacity of future generations to meet their own needs is

referred to as sustainability in the social context (Kates et al., 2005). This covers concerns with social justice, equity, and the rights of underrepresented groups.

The ability of economic systems to work in a way that fosters long-term prosperity and well-being rather than merely short-term benefits is referred to as sustainability in the context of economics (Rockström et al., 2018). This frequently entails finding strategies to ensure that economic development is inclusive and beneficial to all societal members while balancing economic growth with environmental and social factors.

The "triple bottom line," which refers to the three pillars of sustainability—economic, social, and environmental—is a common way to convey the idea of sustainability (Elkington, 1998). This paradigm acknowledges that achieving sustainability necessitates striking a balance between each of the three pillars' requirements and interests and figuring out how to meet present-day needs without jeopardizing the ability of future generations to meet their own needs.

Overall, sustainability is a complicated and diverse idea that entails finding ways to make sure that human activities do not go beyond what the earth's natural systems can sustain while also balancing the requirements and interests of the present with those of the future. It is an important idea that will continue to influence how we behave in daily life, at work, and in our interactions with others.

Based on the comprehensive analysis conducted above, the author suggests the following definition of this term. Sustainability is the ability to maintain economic growth over time, while promoting social development and preserving environment. The breakdown of the proposed term with the explanation of each word is presented in Appendix 1.

For further analysis, the author compared 13 of the most prominent and most commonly used definitions of sustainability against the keywords from the proposed definition (Table 1.2). In addition to the 4 keywords (economic growth, social development, environmental preservation, maintenance over time) "derivatives for "sustainable" column has been added. As some definitions of sustainability use word "sustainable" it makes it harder to comprehend, thus the author believes, that derivatives of the explained concept should not be used.

Table 1.2.

Comparison of "sustainability" definitions (created by the author)

Organization	Economic Growth	Social Development	Environmental Preservation	Maintenance over time	Derivatives from "sustainable"
Organisation for Economic Co-operation and Development (2018)	X	X	X		X
United Nations Environment Programme (2017)			X	X	
United Nations Millennium Development Goals (2013)				X	
United Nations Educational, Scientific and Cultural Organization (2005)			X		
World Wildlife Fund (2004)		X		X	
International Institute for Sustainable Development (2003)			X		
United Nations Framework Convention on Climate Change (1992)				X	
World Commission on Environment and Development (1987)		X		X	
Brundtland Commission (1987)			X	X	
World Business Council for Sustainable Development (1987)				X	
United Nations Educational, Scientific and Cultural Organization (1985)				X	
International Union for Conservation of Nature (1980)				X	
American Association for the Advancement of Science (1972)			X		

As it is seen in the table, the majority of definitions see sustainability as something being maintained over time, however when it comes to explaining what is to be sustained only one definition (OECD, 2018) offers a complex of economic growth, social development and

environmental preservation. However, it ignores the time span (maintenance over time) and uses word "sustain" in the definition, which is as already stated should not be used.

It is clear that sustainability is a complex concept that entails finding ways to make sure that human activities do not go beyond what the earth's natural systems can sustain while also balancing the requirements and interests of the present with those of the future. To clarify the definition of sustainability the author conducted a literature analysis and a bibliometric analysis using R-studio. Based on this analysis the author proposed a new definition of "sustainability" that addresses the shortcomings of the existing definitions. In the next chapter the author attempts to analyse term "urban" and provide a clear definition of it.

1.1.2. Definition of "urban"

Throughout time and in numerous fields, the term "urban" has been defined and understood in a variety of ways. However, "urban" generally refers to something that is associated with a city or town, usually a heavily populated place with a mixture of commercial, residential, and other buildings (Oxford Languages, 2022). The phrase can be used to refer to a location, a person, or a product that is connected to an urban setting.

Based on population size and density, one typical definition of "urban" states that a region is "urban" if there are 2,500 or more people living there per square mile (1,000 people per square kilometre) (United Nations Statistics Division, 2018). Governments and international organizations frequently utilize this concept for statistical purposes.

A different meaning of "urban" is based on a location's social, economic, and cultural traits (Florida, 2005). This definition identifies a place as "urban" if it has a diverse and complex social structure, a diverse economy, and a high concentration of facilities and cultural activities (Glaeser, 2011). Sociologists and urban planners frequently utilize this term when researching the social and economic dynamics of cities.

The built environment and geographic features of a location serve as the basis for a third definition of "urban." This definition states that a region is "urban" if it has a high construction density and a small amount of open space (National Geographic, n.d.). Geographers and urban planners frequently utilize this term while researching the physical makeup and development of cities.

Overall, the definition of "urban" depends on the context in which it is used and the specific focus of the research. Although there are various definitions of the term "urban," they

all acknowledge the significance of cities and urban regions in human society as well as the need to comprehend and manage them in a sustainable and liveable manner.

To analyse the meaning of this term in more detail 71 of the highly cited articles with "urban" AND "definition" as the keywords were selected. Then the articles were screened with 13 that were published in a language other than English, 45 that were not applicable to the current research and 13 that did not provide definition of the investigated term excluded.

As it is seen in the table 1.3 most authors refer to "urban" space as to a city. Many scholars claim that "urban" also includes social construct that is absent in "city".

Table 1.3

Definitions of "urban" in the selected papers (Created by the author)

Authors, Year	Definition of "urban" and/or main ideas
Machek J., 2020	"urban" is a synonym of "city".
Pu X., 2019	Cities and urban settings are synonymous terms that refer to the focal point of a certain region's politics, economy, culture, religion, and people. It is a sophisticated settlement that has seen the emergence and advancement of human civilization.
Tandel V., Hiranandani K., Kapoor M., 2019	If a settlement has a population of above 2500 (2500+), it is considered urban; otherwise, it should be considered rural.
Božilovć J., 2019	Lower territorial scale with great autonomy.
A. Eichler	The meaning of "urban" is "city."
Iossifova D., Doll C., Gasparatos A., 2017	The urban is frequently compared to its "counter-concept," the rural, and is ascribed to "varied assemblages of certain measurable features" and is thought to be "inherently spatial."
Pierce J., Lawhon M., 2016	The functional qualities of population density, economic activity intensity and variety, and/or formal local government borders, such as in a city, are what are meant by the term "urban."
Irby J.D., 2015	"urban" is a characteristic of a city
McComas W.F., 2014	Urban areas are typically distinguished from non-urban areas based on high population density, diverse economic activity that is largely non-agricultural, and increased home to work commuting patterns.
Osorio A., Ozkazanc-Pan B., 2014	A census tract, or group of census tracts, is considered an urban area if its population density is much higher than that of its bordering areas.
Schneider C., Achilles B., Merbitz H., 2014	The term has its roots in ancient Greece and comes from the Latin word "urbs" (the city). It also, predictably, refers to a lifestyle that is only found in cities.

Buendía E., 2011	The definition of "urban" has been condensed to racial, economic, cultural, and geographic characteristics that are thought to encompass all of their goals, encounters, and intellectual tendencies.
Ultramari C., Firmino R., 2010	Cities are boundary defined phenomena, while "urban" has unclear delimitations.
Sénécal G., 2007	Urban implies a society existing inside a region with a dense pattern of growth and a high level of social contact.
Monte-Mór R., 2005	The terms "urban" and "rural," which originally referred to the city and the countryside respectively, have recently acquired the autonomy to also refer to a variety of cultural, socioeconomic, and spatial interactions between those forms and processes.
Hesselberg J., 2005	Urban is characterized in a variety of ways worldwide. The fundamental characteristics of a location of a given size with a predominance of non-primary economic activity, such as services, trade, and industry, are, nevertheless, shared by all definitions.
Wirth L., 2005	The urban is the effect that the size, density, and heterogeneity of the city have on the social character of collective life.
Mcintyre N.E., Knowles-Yánez K., Hope D., 2004	A consistent, quantitative description of urban takes into account the dynamic and heterogeneous physical and social characteristics of a territorial system.
Kim S., 2002	An urban area is defined as a densely populated place with a sizeable number of inhabitants.
Baumont C., Huriot J., 1998	"Urban space" is synonymous to "city".
Magnusson, W. 1985	The use of "the urban" as an analytic category is widely regarded as a sign of intellectual or political underdevelopment.
Sayer A., 1984	"Urban" is a synonym to a "city", however it adds social construct to it.
Feldman, M. 1978	The term "urban" refers to the ideological perception of the social reproduction of labor power in capitalist society.
McElrath D., 1965	"Urban" is "local area".
Anderson N., 1962	Urban is opposite of rural.
Anderson N., 1959	Urbanism theory is developed mainly in the more advanced countries.

Then the author used the selected papers as well as some more articles from Scopus and Web of Science with a keyword "urban" for qualitative content analysis. Qualitative content analysis is a research method used to analyze textual or visual data in a systematic and interpretive manner. It involves systematically coding/tagging and categorizing qualitative data to identify themes, patterns, and relationships within the data. This approach helps researchers gain deeper insights into the content and meaning of the data, providing a foundation for theory development and understanding complex phenomena.

The author read the articles and looked for the words closely related to the term "urban" or used to describe it. Some papers did not provide the necessary data and therefore have not been tagged. Overall, 87 papers were retrieved, 34 were excluded because they were written in language other than English, after what 36 papers went through process of tagging. Those papers that were untagged provided no relevant to this discussion information. Overall, 4 main tags and 4 sub-tags were created. They are: Population, Economic vibrancy, Social and City. With lifestyle and culture being the sub-tags of social; and space and neighbourhood the sub-tags of city. The results are shown in Figure 1.8.
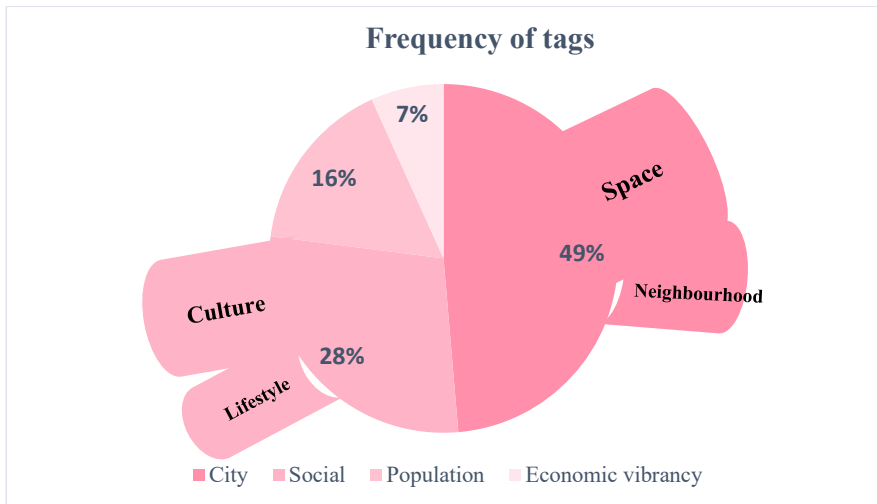
Figure 1.8. Tagging of "urban" related concepts in the selected literature
(created by the author)

It is clear that in spite of more terms used, "city" is the most common across the selected articles. It means, that the majority of authors either use "urban" as a synonym to "city", or use "city" as the foundation of "urban", while adding more meaning to through social, economic and other constructs.

Interestingly enough, when running a bibliometric analysis on "urban" AND "definition", we can notice that most of the articles are related to each other (Fig. 1.9), meaning that various authors that attempt to define this term refer to one another, thus, the gist of the term changes little-to-none from paper to paper.

Figure 1.9. Bibliometric analysis of "urban" and "definition" (created by the author)

In the analysis presented above (Fig. 1.9) the author took a paper "What is urban in the contemporary world?" by Monte-Mor (2005) as it provides perhaps the most in-depth investigation into this term. All the papers in the investigated scientific databases (WOS, Scopus and DOAJ) that were published after 2005 were either related to it or to another paper that referenced it.

It can be inferred from the aforementioned research that the term "urban" refers to a city or town, particularly in terms of its atmosphere, culture, and way of life, entailing traits such as a diverse population, a high density of buildings and people, and a focus on commerce, entertainment, and other forms of cultural expression. Urban areas frequently have a reputation for invention, inventiveness, and a fast-paced way of life, but they also struggle with issues like pollution, crime, and social injustice. The breakdown of the proposed definition with each words explained can be found in Appendix 2.

The **purpose** of this research was to analyse the meaning of this term "urban" in more detail. The analysis showed that although many scholars use this term regularly, no clear definition currently exists. By analysing the existing definitions and synthesizing them, while addressing their limitations the author proposes a new definition. In the following chapter another term – "urban sustainability" will be explored.

1.1.3. Definition of "urban sustainability"

First, let us look at the existing "urban sustainability" literature. To begin with, "urban sustainability" was searched in Scopus and Web of Science (WOS) databases. The results of this search will be presented below. Additionally, a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method will be conducted later in this chapter.

In WOS there were 39,863 publications highlighting key phrase "urban sustainability". The majority of articles were published in the fields of Environmental Sciences, Green Sustainable Science Technology, Environmental Studies and Urban Studies (Appendix 3).

Meanwhile, in Scopus the search for "urban sustainability" resulted in 30,020 documents. As it is shown in appendix 4 the first time, the appearance of this key word in a paper was as early as 1981, when only one paper was published, followed by a 4 year quiet period with no publications related to this topic. Over time, however, there was a steady increase in the interest in this field and a rapid growth to nearly 4000 articles written in 2021.

Finally, the author looked at the most active authors in the indicated field of research (appendix 5). The highest number of publications was written by Bibri S; He C; Rogers C; Brown R; and Haase D. There are numerous research papers available related to the topic of "urban sustainability", but what does this term mean exactly? When trying to identify the definition of this concept the number available of papers decreases dramatically.

When searching for "urban sustainability" AND "definition" only 90 results appear on WOS and 133 on Scopus. Despite the fact that "urban sustainability" related documents first appeared in 1981 the definition of this concept according to Scopus was first introduced almost 15 years later (Appendix 6). Going through some serious fluctuations the number of documents that are supposed to provide the definition of this term peaks in 2022 with 18 documents.

The author analysed all the indicated articles to find the definition of urban sustainability, however it turned out that in spite of "definition" being one of the searched keywords, most of the authors do not provide such definition in the selected papers. Nevertheless, the author went through all of these articles and other scientific sources using PRISMA method to define "urban sustainability" (Fig. 1.10).

Identification

Records identified from:
Databases (n =2)
Registers (n =223)

Records removed *before screening*:
Duplicate records removed (n =52)
Records marked as ineligible by
automation tools (n =0)
Records removed for other reasons
(n =13)

Screening

Records screened
(n =158)

Records excluded
(n =147)

Reports sought for retrieval
(n = 23)

Reports not retrieved
(n =12)

Reports assessed for
eligibility
(n =11)

Reports excluded:
 Reason 1 (n =0)

Included

Studies included in review
(n = 11)
Reports of included studies
(n = 11)

Figure 1.10. PRISMA for systematic literature review of definition of urban sustainability
(created by the author based on Page et al., 2021)

First, "urban sustainability" AND "definition" were searched for in Scopus and WOS.
Overall, 223 documents appeared in response to this search. 52 out of 223 documents were
duplicated and therefore one of the copy of each of the 52 duplicates were removed. 13
documents were written in languages other than English and thus also removed from the
selection. After all these steps we had 158 documents left. Out of 158 documents full texts to
12 papers could not be found, leading to their exclusion from the final set of documents for
analysis. Each document was then screened for the definition of "urban sustainability",

however, although all of this documents had "urban sustainability" among the key-words and used this phrase numerous times within papers, only 11 papers actually contained the definition.

Now let us look at what authors of the selected articles offer as the definition of urban sustainability. In the table below (Table 1.4) you will find the references of the papers and proposed by the authors definitions.

Table 1.4

Definitions of "urban sustainability" from the selected via PRISMA method papers (Created by the author)

Reference	Definition and key ideas
Ahvenniemi H. and Huovila, A., 2020	Here, the authors do not provide their own definition, instead they refer to other author (Macke et al., 2019) who stated that the definition of urban sustainability is still vague.
Montoya, J., Cartes, I.Á. and Zumelzu, A., 2019	Urban sustainability is the desirable state of urban conditions that endures throughout time. Additionally, the authors refer to Barton (2006) who claimed that urban sustainability is seen as a method that makes it possible to plan according to ideals that serve as a long-term "goal-objective" for developing cities; and Hiremath et al. (2013), according to whom the goal of urban sustainability is to strike a balance between environmental conservation and urban development that is also socially equitable in terms of things like income, employment, housing, and access to essential services. The authors conclude that urban sustainability is a balanced process involving the four dimensions: economic, social, environmental, and the built environment.
Ojeda-Revah, L., González, Y.O. and Vera, L., 2020	Here, again, the authors do not provide their own definition, but refer to another paper in which urban sustainability is understood as "an adaptive process of facilitating and maintaining a virtuous cycle between ecosystem services and human well-being through concerted ecological, economic, and social actions in response to changes within and beyond the urban landscape" (Wu, 2014).
Camagni, R., Capello, R. and Nijkamp, P., 1998	Urban sustainability logically refers to the three environments in two ways: (a) in a static sense, as maximization of the net cross-externality effects of each of the three environments on the other two, both in the short and long terms; this entails avoiding negative interactions and trade-offs to the greatest extent possible and utilizing all potentials for positive feedback effects; and (b) in a dynamic sense, as co-evolution of the three environments.

Camagni, R., 2017	In this paper the author does not provide a definition to urban sustainability, instead it defines sustainable urban development, which according to him is a process of co-evolution and synergistic integration of the major systems that comprise a city (economic, social, physical, and environmental), which ensures long-term wellbeing for the local population without interfering with nearby areas' potential for development and, as a result, lessens the negative effects of development on the biosphere.
Toli, A.M. and Murtagh, N., 2020	There isn't a single, widely accepted definition of sustainability at the urban level. Nevertheless, there is a collection of urban sustainability traits that are frequently used. Intergenerational equity, intragenerational equity (social, geographic, and governance equity), environmental preservation, significantly reduced use of non-renewable resources, economic vitality and diversity, local autonomy, citizen well-being, and satisfaction of basic human needs are a few of these.
Hassan, A.M., Lee, H. and Lee, Á.H., 2014	Urban sustainability reflects the optimal conditions that continue to exist within the urban area, whereas sustainable urban development refers to the creation of sustainable urban areas. The two concepts are closely related and are frequently used interchangeably. Sustainable urban development, on the other hand, refers to the policies and procedures that advance sustainability.
Lorr, M. J., 2012	Urban sustainability means making dense urban life appealing and livable while staying within set development or growth boundaries
Shen, L., Peng, Y., Zhang, X. and Wu, Y., 2011	Urban sustainability can be considered a measure to determine how far a city has progressed toward a desired level of sustainability. This condition is defined as a practice that makes efficient use of resources, enhances life quality in a wonderful environment while remaining constrained by the physical limits of our planet.
Shen, L, Kyllo, J.M. and Guo, X., 2013	The essential value of urban sustainability always resides in the balance of environmental, economic, and social growth, despite the fact that there are many distinct definitions of urban sustainability given by various communities in various locations about their own unique problems.
Wu, J., 2014	Urban sustainability may refer to a set of dynamic conditions that meet the demands of the present and future generations in a city, but its true essence lies in the constant adaptive process of creating and upholding those conditions.

As it is seen from the Table 1.4, even in these 11 articles many authors do not provide their own definition, and rather refer to other authors, while some simply claim that no such definition exists. Additionally, some authors, provide the definition of sustainable urban development instead of urban sustainability, in spite of the latter being the keyword. This leads to a lot of confusion when conducting research in this field. Thus, it can be concluded, that there is an urgent need for term "urban sustainability" to be clearly defined. Before attempting it, let

us look at the term "sustainable urban development" and discuss why it can or cannot be used as a substitute to "urban sustainability".

According to the literature, the concepts of sustainability and sustainable development are frequently related, and both phrases are consequently used interchangeably in academic and scientific contexts (Ruggerio, 2021). However, various schools of thought assert that sustainable development is a paradoxical idea since it is impossible to sustain limitless economic expansion on a finite world and because of the inconsistencies in its goals (Redclift, 2007; Sachs, 1999). Not only does this stance raise problem epistemologically, but also in social, political, economic, cultural, and environmental spheres, caused by basing local and international environmental policies and activities on a tangled or vague idea. In light of this, some authors like have warned about the need to rethink sustainability as a different term (Hedlund-de Witt, 2014). This situation demonstrates that both ideas are still up for debate and highlights the necessity for a more in-depth scholarly examination of their definitions (Whyte and Lamberton, 2020).

Despite some debates around this topic, various scholars tend to agree about the definition of sustainable development concept. Since its first appearance in the early 1970s, when various publications warned that the Western development model needed to be constrained (Mebratu, 1998; Mitlin, 1992); the cumulative evidence of the harmful effects on the environment of the agricultural green revolution (Carson, 1962); industrial pollution, including cases like the Seveso disaster and the Minamata disease (Bertazzi, 1991; and the Western way of life and urbanization (Meadows et al., 1972), the concept went through a number of transformations. Finally, sustainable development was defined as one which satisfies existing demands without jeopardizing the capacity of future generations to satisfy their own needs. Of course, different authors share different perspectives on such definition, however the gist of the concept remains homogeneous.

So, is there a difference between sustainability and sustainable development? Despite the fact that these terms are commonly used interchangeably and share some similarities in their meanings, as semantics of the second concept applies – it is a process. Thus, sustainability is viewed as a long-term objective, whereas sustainable development refers to the various methods and routes taken to get there. In other words, sustainable development is a procedure or a set of actions; while sustainability is the goal. Thus, using them as synonyms is not particularly correct.

Based on the discussion above the author proposes the following definition of sustainable urban development - "**the method of progress that implies ideas and tools that are implemented by urban planning to improve and/or construct cities without permanently depleting their natural resources, while enhancing the standard of living in a city across several dimensions (environmental, cultural, political, institutional, social, and economic) for current and future generations.**"

This definition is derived from a combination of the keywords urban, sustainability and development. Urban, then, refers to the land immediately next to and including a city. Dense human constructions, including homes, businesses, roads, bridges, and trains, characterize highly developed urban regions. Sustainability is a balance between economic growth, environmental protection, and social well-being so that the demands of both present and future generations are met (Scoones, 2016). In terms of social, environmental, and economic impact, a sustainable urban environment is one that has been planned and managed to minimize negative effects (Sodiq et al., 2019). The development of environmentally friendly replacements is a key component of many sustainability programs. Therefore, it can be seen that the meaning of sustainable urban development revolves around the balancing of the resources in cities without compromising the needs of future generations.

Meanwhile, the term **"urban sustainability"** can be defined as "**a state in which the major subsystems of a city (economic, social, physical, and environmental) work in harmony to ensure the long-term well-being of its inhabitants and the preservation of the natural resources on which the city's growth and prosperity rely.**" The breakdown of this definition is presented in Appendix 7.

Thus, it can be concluded, that urban sustainability refers to a city's state of being planned, constructed, and maintained in a way that supports the long-term health and wellbeing of both its citizens and the environment, while also fostering economic and social fairness. Natural resource conservation, a decrease in greenhouse gas emissions, an improvement in the quality of the air and water, and the development of livable, walkable, and accessible areas for all residents of the community are characteristics of this state. Urban sustainability refers to a city's capacity to respond to 21st-century concerns including population increase, resource depletion, and climate change while yet maintaining a good standard of living for its citizens.

In this chapter the author analyses the term "urban sustainability" and proposes the new definitions of "urban sustainability". Additionally, the author compares terms "urban

sustainability" and "sustainable urban development" and explains why these are not fully interchange, through clarification of both concepts. In the next chapter the author will report the results of a focus group interview aimed at discussing the proposed definitions.

1.1.4. Focus group discussion on the proposed definitions

To evaluate and refine the proposed definitions of "sustainability," "urban," and "urban sustainability" a focus group discussion was organised, the purpose of which was to ensure that the definitions are academically sound, while being easily comprehensible to a diverse audience, including students and professionals in the field. By engaging academics and students in the discussion, the aim was to integrate expert knowledge with practical understanding to achieve a common understanding of the key concepts.

There were 18 people in the focus group, including 10 students, 5 academics and 3 professionals in the field of sustainable development. The academics were chosen for their competence in sustainable development research; they all hold or pursue PhDs and have an substantial publications record in the area. The students were pursuing undergraduate or graduate degrees and were selected to represent diverse backgrounds, experiences, and perspectives.

Three definitions were **proposed for discussion**:

Sustainability - the ability to maintain economic growth over time while promoting social development and preserving the environment.

Urban - a city or town, particularly in terms of its atmosphere, culture, and way of life, entailing traits such as a diverse population, a high density of buildings and people, and a focus on commerce, entertainment, and other forms of cultural expression.

Urban Sustainability - a state in which the major subsystems of a city (economic, social, physical, and environmental) work in harmony to ensure the long-term well-being of its inhabitants and the preservation of the natural resources on which the city's growth and prosperity rely.

The focus group discussion took place over the course of a single online session that lasted approximately 2 hours. A brief introduction of the attendees took place at the start of the session. The moderator then gave an outline of the discussion's goals and expectations before presenting the suggested definitions. On each proposed definition, the participants were

encouraged to share their thoughts, feedback, and suggestions related to the correctness, comprehensiveness, and understandability of the respective definitions.

The participants were urged to interact with one another and respond to one other's to foster an open and cooperative discussion. The moderator guided the conversation to ensure that all perspectives were heard and to maintain a balance between the input from academics, students, and professionals.

Due to their backgrounds and areas of expertise, the participants were assigned to particular roles in the discussion:

Academics: They had the primary duty of assessing the accuracy and comprehensiveness of the proposed definitions using their theoretical and research-based knowledge of sustainable development.

Students: Their main responsibility was to evaluate the definitions' clarity and readability in order to offer insight into how the ideas could be effectively conveyed to a wider audience.

Professionals: They were responsible for ensuring that the definitions were applicable and useful in real-world contexts by sharing their experiences and thoughts on the concepts' applicability. They were specialists in the practical applications of sustainable development.

The definition, which encompasses the economic, social, and environmental pillars of sustainability, was generally accepted by academics. The interconnection and interdependence of these pillars, they argued, may be more explicitly emphasized in the definition, which would be advantageous. Additionally, mentioning the importance of balancing short- and long-term concerns is crucial for establishing sustainability, according to some participants.

The students found the definition to be clear and understandable, although they recommended that giving examples of sustainable activities could assist to further convey the concept. They added that highlighting the importance of striking a balance between the three pillars will make the concept's holistic aspect clearer.

The experts concurred that the concept was pertinent to their line of work, but they pointed out that it might be made more action-oriented by highlighting the demand for realistic plans and tactics to attain sustainability. They also advised adding the idea of resilience to the term in order to emphasize the significance of adjusting to shifting circumstances and unforeseen difficulties.

When it came to the definition of "urban" it was generally accepted by the academics, although they indicated that it might do a better job of addressing the spatial and functional characteristics of urban regions, such as infrastructure, transit systems, and land use patterns. They suggested adding the concepts of governance and urban planning to the term as well.

The definition, which caught the vibe and cultural facets of urban living, was seen by the students as being understandable and relatable. However, they indicated a desire to learn more about the distinctive qualities that set urban places apart from rural or suburban ones. They added that adding aspects like infrastructure and urban development will give the concept a more thorough grasp.

Professionals emphasized the necessity for a more direct mention of the potential and challenges that cities face. The professionals enjoyed the emphasis on the atmosphere, culture, and way of life in metropolitan areas. They recommended emphasizing the significance of addressing issues including housing, transportation, public services, and environmental quality in the context of urban development.

Finally, when discussing "urban sustainability" the academics concurred that the definition's emphasis on the seamless operation of a city's main subsystems effectively merged the ideas of urban and sustainability. In order to achieve urban sustainability, they suggested clarifying the roles of governance, urban planning, and stakeholder involvement. In order to adequately capture the complexity of the problem, they also recommended adding the ideas of equity, inclusiveness, and resilience.

Although the definition was thorough and educational, some students said they had trouble comprehending the term "subsystems." To improve comprehension, they proposed using plainer terminology or giving instances of the subsystems. To better convey the notion, they also suggested providing concrete instances of urban sustainability programs.

The experts stressed the significance of a context-specific approach to urban sustainability, acknowledging that different cities have different possibilities, problems, and resources. They recommended that the definition take these differences into account and encourage adaptability in the solutions and techniques used. Additionally, they emphasized the necessity for a clearer mention of how innovation and technology are boosting urban sustainability.

The participants generally agreed on the significance of highlighting the connection and interconnectedness of the many components inside each idea across all three definitions. For

instance, they agreed that the notion of sustainability should emphasize the harmony between economic, social, and environmental considerations. In a similar way, they emphasized the complexity and context-specific character of urban sustainability while recognizing the significance of including elements of governance, urban planning, and infrastructure in the definition of urban.

The participants' opinions on the amount of specificity and detail needed in the definitions varied, although there were no significant conflicts. More examples and real-world applications, according to some participants, would improve understanding and relatability, while others, mostly academics, felt that the definitions should be brief and concentrate on the key ideas of each topic. The professionals also stressed the significance of include new ideas, real-world possibilities, and problems in the definitions to ensure their application and relevance in practice.

Based on the focus group discussion the following recommendations could be drawn:

For the definition of "sustainability":

- Stress the interdependence and interconnection of the three pillars of the economy, society, and environment;

- emphasize the significance of striking a balance between short- and long-term issues;

- think about including the idea of resilience and useful tactics for achieving sustainability.

For the definition of "urban":

- include spatial and functional aspects of urban areas, such as land use patterns, transportation systems, and infrastructure;

- Describe how government and urban planning affect the development of cities;

- think about the difficulties and chances that cities confront when tackling problems like housing, transportation, public services, and environmental quality.

For the definition of "urban sustainability":

- clarify the functions of stakeholder involvement, urban planning, and governance in achieving urban sustainability;

- to more accurately capture the complexity of urban sustainability, incorporate the principles of equity, inclusiveness, and resilience;

- acknowledge the context-specific nature of urban sustainability and promote flexibility in strategies and solutions;

- Emphasize the role of innovation and technology in advancing urban sustainability.

While these recommendations are extremely valuable, following them, for instance, emphasizing the role of innovation and technology, or providing information on challenges urban areas come across would lead to an explanation of a concept, instead of creating a definition, which is not the primary goal of this research. Thus, the author believes it would be fair to leave the proposed definitions as it is, as they met no considerable criticism, and simply add some information recommended by the focus group participants to provide more complete explanations of the studied concepts in the further research.

In this chapter the author discussed the results of a focus group interview aiming at confirming the proposed earlier terms. The interview results show, that although a further clarification of the terms through a more expanded explanation of each term will be beneficial, the terms address the challenges academics, students and professionals in the field of sustainability face. The proposed definitions have proven to be clear and comprehensive. In the following chapter various models and approaches to sustainable development are discussed.

1.1.5. Models of sustainable development

According to Franck (2002), there are ten key characteristics of scientific models:

1. Models provide a simplified representation of reality;

2. They represent what is essential to this reality;

3. They can be tested;

4. They are conceptual;

5. They enable measuring and calculation;

6. They allow the explanation of the reality;

7. They can become the object of study;

8. They are a fictive representation of reality;

9. They represent systems;

10. They are isomorphic (later proven also homomorphic) to the systems they represent.

Some of these characteristics are more general, whereas others are more representative than others. The analysis of models used to describe sustainable development relates to the newly introduced area of research – sustainometrics (Todorov and Marinova, 2009).

Below the author lists some of the sustainable development models.
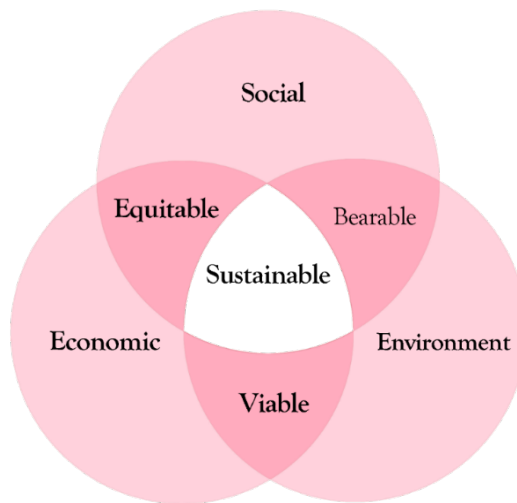
Figure 1.11 Venn Diagram of Sustainable Development (Agyeman and Evans, 2003)

It is universally accepted that sustainability lies on the three pillars – economy, society, and environment, which are, according to the World Conservation Unit (2006), illustrated as embedded circles, pillars, or in the Venn diagram with overlapping cycles. The Venn diagram (Figure 1.11) stresses the importance of the intersection of those three areas while also emphasizing the need for the inter-and trans-disciplinary approach to understanding sustainability. This model is criticized because:

1. The assumption "pillars" are independent constructs. It is argued that humans are biological entities and, thereafter, should also be considered environmental resources, thus making them interdependent. Moreover, the vast majority of the resources used by humans can be regarded as an ecosystem service, which makes them impossible to be separated from human development (e.g., by destroying

ecosystems for agriculture, we potentially destroy access to wood and medicines) (Costanza et al., 1997);

2. This model does not incorporate the time dimension, which is a core component of the World Comission on Environment and Development definition of sustainable development. Additionally, to that, there is also a lack of consensus on what each pillar contains (Kates et al., 2005).

Since the first introduction of three pillars model a number of modifications have been proposed by various scholars. For instance, some scholars (Brundiers et al., 2021; Muff, Kapalka & Dyllick, 2017) suggested a fourth pillar – political pillar. It reflects a rising understanding of the importance of governments and highlights the contributions that governmental decision-making and related community involvement can make to the creation of sustainable societies. Some others (Hawkes, 2001; Sabatini, 2019) claim that the fourth pillar is cultural, which highlights the need to respect diversity, heritage, and the development of cultures, ensuring their ability to adapt and contribute to sustainable futures. Also, there are some less popular opinions on ethics (Mori, 2014) being the fourth pillar. Last, but not least, there are five-pillar model (Greenland, et al., 2022) that also includes corporate pillar. Despite the fact that all the proposed pillars are important, it can be argued that they can be included in the well-established three-pillar model, for instance: humans and culture are part of social pillar, while corporate is a part of economic pillar, thus further in this research the author will adhere to three-pillar model.

In 1996 International Union for the Conservation of Nature introduced "The Egg Sustainability Model" (see Figure 1.12). This model illustrates the relationship between people and the ecosystem as one cycle inside another one, like the yolk of an egg. It implies that people are located within the ecosystem and thus are dependent on it – the well-being of the egg is only considered complete when the well-being of each individual subsystem is achieved (Thatcher, 2014).
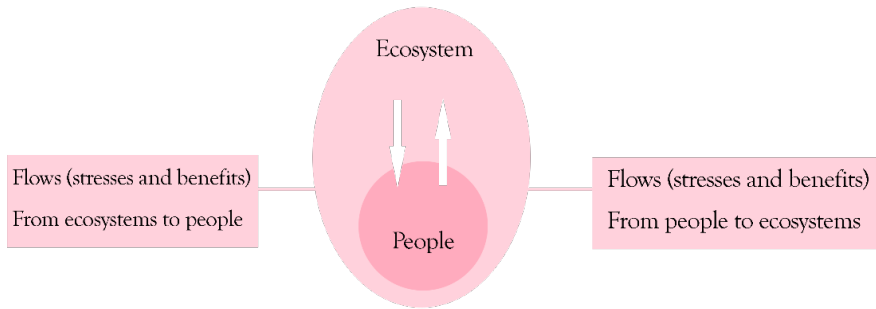
Figure 1.12 The Egg Sustainability Model (IDRC, 1997)

Another model, which is quite similar to the egg model – the concentric circles model (Fig. 1.12), which is a modification of the three pillars model, emphasizes that each cycle is constrained. Thus, two of these models address the concerns about the interdependence between subsystems; however, neither of them takes into consideration the time dimension.

In 2008 Lozano argued that the concentric circles model is extremely anthropocentric and places the economic subsystem in the center (Lozano, 2008). Instead, it is argued that in real, sustainable development, the circles should fully overlap, leading to the "first-tier sustainability equilibrium," which is then followed by the introduction of the time dimension, making it a perfect cylinder. To achieve sustainability across time means recognizing what is done today to achieve the same goal. The last step is the acknowledgment of sustainability as a dynamic process that requires a time dimension to bend back on itself to form a doughnut shape.
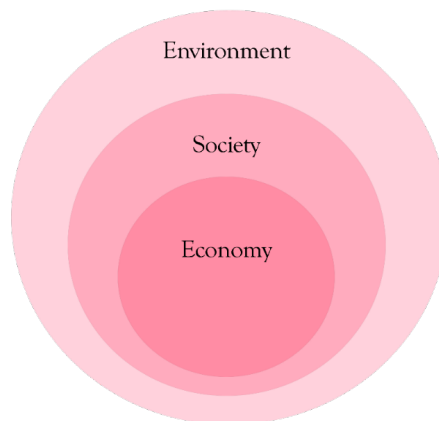
Figure 1.13 The Concentric Circles Model of Sustainability (Doppelt, 2008)

The Atkisson Pyramid of Sustainability (Fig. 1.14) supports and accelerates progress through identifying the vision of sustainability through brainstorming and analysis that lead to agreement on a credible plan of action. Its structure guides through the process of first building a company's base of understanding, searching and collecting relevant information, and then focusing on what is most important, effective, and doable. This model is aimed to help groups of 20-40 people move quickly up the sustainability learning curve.
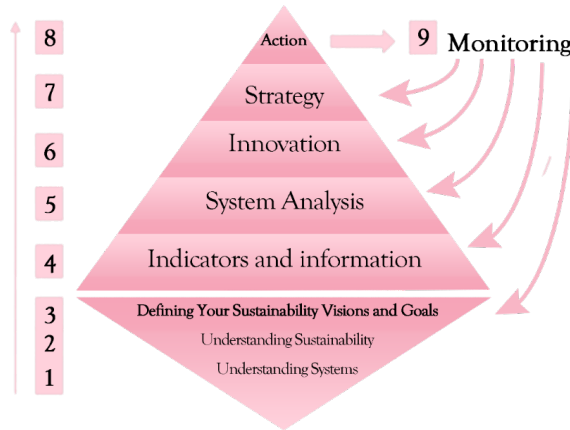
Figure 1.14 Atkisson Pyramid of Sustainability (Atkisson et al., 2004)

Another model of sustainability, Prism of Sustainability (Fig. 1.15), was developed by the German Wuppertal Institute (Stenberg, 2001). It defines sustainable development through four key components – society, economy, environment, and institution. The inter-linkages, namely care, access, democracy, and eco-efficiency, demonstrate the relation between the dimensions which could translate and influence policy. Each dimension offers norms of actions or so-called imperatives. In order to measure how far one has actually come, particular indicators are provided. This model suffers from much the same criticism as the Venn diagram; namely, it implies independence of each criterion, as well as in consideration of the timeframe.
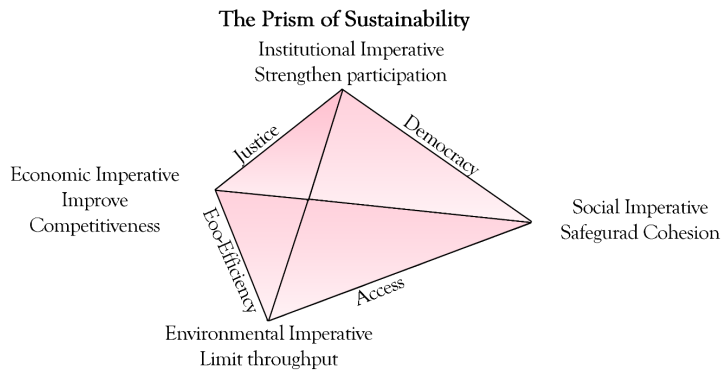
Figure 1.15 Prism of Sustainability (Stenberg, 2001)

The discussion presented above shows that there same as with the definition of sustainability there is no common ground when it comes to sustainability models. However, since the three-pillar model performs as a basis for many other sustainability models, further in this research the author will be referring mostly to this model, as it tends to act as a foundation to other models. In the next chapter the author will discuss gender equality, female empowerment and sustainability awareness as factors that clearly have influence on promotion of sustainable development, however, are often not taken into account when assessing sustainability.

1.2. Factors influencing sustainability and approaches to the sustainable development

In this chapter the author discusses the existing approaches to evaluation of sustainable development and indicators involved in it. However, in addition to many indicators already in use the author believes it is important to include indicators related to gender equality, female empowerment and sustainability awareness, since these factors have a strong influence on sustainable development, but are often overlooked when developing sustainability assessing methodologies. Therefore, in this chapter the author analyses these factors and their relation to urban sustainability.

1.2.1. Gender equality as a factor of sustainability

Being a part of SDGs, gender equality is also a driver of sustainable development in many dimensions, including fighting hunger and reducing poverty, building an inclusive society and

promoting prosperity, as well as protecting the environment and preserving natural resources, thus mainstreaming gender perspective systematically across all the SDGs is crucial for their achievement.

Women and girls, which are usually the ones that suffer the most from gender inequality, comprise half of the world's population. When their rights, such as political or economical, etc., are taken away from them, the consequences reverberate across societies (Ben-Amar et al., 2017). On the other hand, access to regular work and decent income leads to poverty reduction whilst supporting health and nutrition outcomes as well as the level of education (Bonewit and Shreeves, 2015). Nevertheless, the progress on gender equality has not been evenly successful in various dimensions of the 2030 Agenda. It is believed that unless the progress on gender equality is accelerated, it is doubtful sustainability will be achieved in the forthcoming future (UN Women, 2018). In order to attain gender equality, we must go beyond social and economic disparities and examine the disproportionate impacts of systemic problems, such as inequality linked to the environment. This calls for an integrated framework of policy that addresses the environmental, social, and economic aspects of inequality.
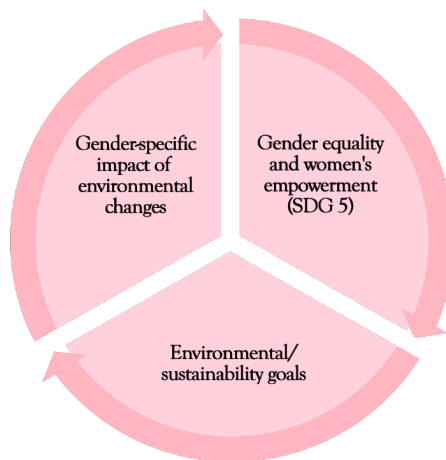
Figure 1.16 Gender-environment nexus (UNWomen, 2020)

The gender-environment nexus can be presented by the extent to which slow progress on environmental aims impacts the condition of women and men differently and hampers equality as well as how gender equality can positively impact the environment and other aspects of the 2030 Agenda. While the direct influence of gender equality on social and economic elements is apparent, the benefits to the environment tend to remain in the shadow. The 2030 Agenda

places a strong emphasis on environmental sustainability and gender equality, although the SDG framework only acknowledges some of these connections while excluding many others (OECD, 2020). Out of all the Sustainable Development Goals, gender and environment are combined in just 20 indicators. Therefore, it can be said that the SDG framework places a significant emphasis on concerns related to gender equality and environmental sustainability, although it only briefly mentions how they interact.

Identifying the interactions between SDGs and targets is crucial to help policymakers maximize synergies and avoid potential conflicts while managing trade-offs (Figure 1.17).

Foster synergies across economic, social and environmental policy areas

Identify trade-offs and reconcile domestic policy objectives with internationally agreed objectives

Address the spillovers of domestic policies and consider intergenerational impacts
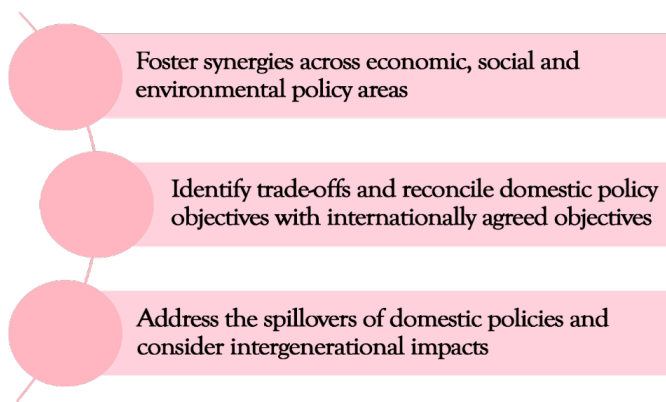
Figure 1.17 Interactions between SDGs and targets (Developed by the author based on UNWomen, 2020)

Environmental influences have a varying effect on various genders due to gender inequities, biases, and accepted norms in a culture that prescribes specific gender roles. For example, Street et al. (2018) found that, in comparison to men, some women's biological indicators may be more adversely affected by environmental harm, such as air pollution, hazardous chemicals, etc. Yet, environmental harm exposure can also dictate how men and women should respond to the unfavorable effects of a natural danger (Neumayer and Pluemper, 2007).

In government institutions, there is a discernible gender imbalance in terms of governance and decision-making, particularly in the areas that are crucial for accomplishing the SDGs. For instance, the largest gender employment gaps and the lowest percentage of women in senior positions across public and private organizations are found in the infrastructure sector (OECD, 2019, Kersley et al., 2019). However, given that women have a favorable attitude toward

environmental preservation and protection, closing this governance gap is essential to accelerating the 2030 Agenda's fulfillment. We must witness resolute action against prejudice and discrimination in addition to a greater demonstration of efforts to close gender inequalities in a number of other fields, such as science, technology, engineering, and mathematics.

Perhaps, one of the many problems that lead to institutional gender inequalities across the globe is the fact that most countries, both OECD and non-OECD members, have not agreed on the definition of "gender," and there are no specific categories that this term comprises. Additionally, it is worth mentioning that women and girls tend to be discriminated against and excluded more often than men based on age, race, disability, ethnicity, religion, socioeconomic status, and other characteristics.

The pursuit of sustainable development for each and every one requires upholding human rights principles, widening freedoms, and promoting peace while combining it all with respect for the environment. It is essential to address discrimination in households, as well as at local, regional, national, and global levels. To do this, we need to redirect the interconnected environmental, social, economic, and political processes and challenge current production pathways that proved to be unsustainable, just like consumption and distribution patterns. This requires accountability and clear actions from the civil society, the private sector, and, most importantly, the state. Additionally, communities and individuals are needed to build societies to transform institutions and power relations whilst democratizing knowledge. Thus, gender equality is integral to the definition and pursuit of sustainable development.

Gender equality requires the realization of fundamental human rights. Rights that are not real in practice are not enough. To make them applied in real life power and voice are demanded to challenge dominant institutions and forms of knowledge (Fraser, 2013). This is precisely where we need to see the vital role of collective actions to fight stereotypes and to make those accountable for the realization of rights finally work.

Sustainable development relies heavily on ending discrimination toward women and providing equal access to education and employment opportunities. Gender equality is believed to stimulate economic growth, as higher female inclusion in economic processes dramatically contributes to the rise of economic indicators. UN Women report (2018), for instance, demonstrates that 50 percent of economic growth in OECD countries over the past five decades is attributed to better access to education for girls and women. Meanwhile, there is also a connection to the decreased gap in the number of years boys and girls spend schooling.

Despite all the efforts, women are still facing a number of barriers to entering the labor market in many countries across the globe. The World Bank (2022) reports that women are still prevented from working specific jobs legally in many states, while in 18 countries, men can legally forbid their wives to work. When women happen to work, however, the gender gap still remains in most industries, meaning that they are not earning as much as men. Globally, women earn only 82 cents for every dollar earned by men, leading to over 172 trillion USD in lost income (CNBC, 2022). Thus, it can be concluded that many countries will not be able to develop as well as they could unless they ensure women's inclusion in the labor market. Meanwhile, women are known to invest as much as 90 percent of their income back into their households, which is 2.5 more than men (UN Women, 2018). This eventually leads to improved health and education for their spouses and children.

Most people that suffer from chronic hunger globally are women (UN Women, 2018). Additionally, women own less than 20 percent of land compared to men (World Economic Forum, 2017). In developing countries, i.e., in the Northern African region, women only comprise less than 5 percent of the number of landowners (UN Women, 2018). This makes women more vulnerable to food security, violence, and even extreme weather events caused by climate change. Since gender equality is not only a fundamental right but also a necessary foundation for a peaceful, prosperous and sustainable world, as all the aforementioned data demonstrates, then despite gender inequality affecting both men and women, the latter tend to suffer substantially more from it. The next chapter of this research will focus on female empowerment as a critical tool for reaching sustainable development on our planet.

Gender equality is a fundamental right and a necessary foundation for a peaceful, prosperous, and sustainable world. Analysis of secondary sources demonstrate that female empowerment is a critical tool for reaching sustainable development, thus more attentions needs to be paid to it when promoting sustainability. In the following chapter another factor crucial for succeeding in sustainable development – female empowerment is discussed.

1.2.2. Female empowerment as a factor of sustainability

Gender equality, as discussed above, is central to sustainable development, and female empowerment is a crucial ingredient when it comes to gender equality, as women tend to be discriminated against much more often than men. Nevertheless, women play a central role in community support and resilience building, consequently ensuring the well-being of not only current but also future generations. Moreover, since women are usually responsible for the

upbringing of children, they have the potential to instill the importance of sustainability as well as sustainability practices to the growing population.

Eco-feminist and "women and environment" approaches reflect this unique understanding of nature and women's role as stewards of the environment (Dankelman, 2010; UNDP, 2019). It has already been discussed that women, in some cases, suffer from environmental degradation more than men due to their unique physical traits; however, they also differ from men's responses to environmental occurrences (OECD, 2021). For instance, Taylor (2002) argues that the integration of gender equality matters in expressing grievance about environmental issues, as well as definition, framing, prioritization, and choosing the proper prescriptions to address them.

The green economy offers plenty of opportunity for female involvement in green innovation when it comes to the environment, one of the pillars of sustainability; nevertheless, supportive social and policy frameworks must be guaranteed. Therefore, granting women access to leadership roles could encourage the public and commercial sectors to prioritize environmental goals (Hossain et al., 2017; Ben-Amar et al., 2017).

As mentioned in General Recommendation №37 of the Committee on the Elimination of Discrimination against Women (CEDAW, 2018), gender inequality frequently restricts girls' and women's ability to make decisions that affect their lives, as well as their access to resources like food, housing, water, and employment as well as health care, education, and social protection. These disparities make them less able to adapt to the effects of climate change and far more likely to be exposed to dangers associated with natural disasters. When it comes to Central Asian countries, such as Uzbekistan, the state emphasized in this thesis, due to their underdevelopment, cultural norms, and suppression of female power, women in these countries are often partially or entirely dependent on men of the family: the father or husband, and lack ability to make their own decisions whether it is about their education choices or even age of marriage.

The female's involvement in encouraging sustainable production and consumption, safeguarding biodiversity, and assuring climate-compatible human activity is another facet of gender-environmental sustainability. Even though women are already heavily involved in community grassroots activities, there is still a knowledge and awareness gap regarding gendered consumption habits that are connected to some of the most polluting activities, including eating, heating, moving around, etc. This could result in fewer gender-inclusive and

less successful climate policy (UN WomenWatch, 2009). According to Homsy and Lambright (2021), the structural gender gap prevents many women from holding leadership roles, which limits their ability to contribute to the government and commercial sectors. When they do, however, reach leadership positions, they are more likely to integrate sustainability practices into their organization's visions and strategy.

The concept of sustainability awareness is pivotal in achieving sustainability and reaching SDGs, and it will be discussed it in more detail later in this research; meanwhile, here, the author would like to briefly overview the role of a woman in a household in developing central Asian countries.

Communities living in Central Asia, alongside Kazakhstan, Uzbekistan, Tajikistan, Kyrgyzstan, and other states, have concrete social structures. These structures formed based on various factors:

- Historical context – based on pasturing herds over large areas of grassland and desert, people had to distribute household activities so that women had to tend to the family while men were protecting the land.

- Religious - the widespread of Islam played a significant role in promoting gender stereotypes and justifying gender inequalities in these countries.

Women in these societies played a notable role by undertaking many tasks starting from riding, housework, and crafting to raising children and caring for the elderly. Additionally, they managed domestic issues, such as buying the family's livestock. Furthermore, women organized various cultural events, bringing the communities together. Despite managing all these tasks, women in central Asia had many restrictions placed upon their roles within societies for centuries.

Not much has changed ever since. Today women in these regions still carry most household and community tasks on their shoulders, getting little-to-none respect from their male counterparts. Yet again, women are responsible for most of the consumption behavior patterns and passing it to the following generations: women clean houses using toxic chemicals, wash cloths with powders containing microplastics, collect trash in non-bio-degradable plastic bags, manage food leftovers and other waste, etc. So, if we want to make societies in these regions eco-friendlier and more sustainable, we first need to educate women and ensure their equal rights.

Earlier, the author discussed the importance of gender equality in achieving sustainable development goals. Below the table with detailed explanations of how female empowerment can accelerate reaching some of the SDGs is presented.

Table 1.5

Relationship of female empowerment and SDGs (OECD, 2021)

Goal	Relation to SDG5 (gender equality and female empowerment)
SDG 2. Zero hunger	Eliminating gender discrimination, especially when it comes to land ownership and inheritance rights, while promoting women's engagement in sustainable agriculture will eventually lead to achievement of SDG2, particularly targets 2.3 (small-scale farming), 2.4 (resilient and sustainable agriculture), 2.5 (conservation of animals' and plants' genetic resources).
SDG 6. Clean water and sanitation	Clean water and sanitation operate under gender context in many developing nations, since women are responsible for resource gathering. Enabling easy and safe access to clean water will ensure that women have more time to exploit economic opportunities. Additionally, free time will give them access to better education. Moreover, access to sanitation is pivotal for women's health and well-being (SDG3) and has influence of girls' schooling.
SDG 7. Affordable and clean energy	Accessible clean energy can empower women throughout the cost-reduction of collecting biofuels and barriers to child education in developing states. Energy poverty has a strong influence on women even in developed nations. Female's empowerment and leadership in the energy sector may become cathartic in promotion of clean energy and more efficient energy consumption.
SDG 9. Industry, innovation and infrastructure	Industrialization and migration from rural to urban areas need to consider women's role in families, communities and environment. Infrastructure is crucial to reaching objectives related to environment. Additionally, it should include a gender dimension that secures access to all. Women's role in science and research is hampered through biases and stereotypes that create barriers in access to STEM education.

SDG 11. Sustainable cities and communities	Because of their different social roles, occupation patterns and preferences males and females relate to urban and settlement design and transport infrastructure differently. Urban planning and transport infrastructure that does not account for the needs of different users causes reduction in economic opportunities as well as well-being of users, while increasing air-pollution and contributing to inefficient use of resources. When women are given more authority in decision making is expected to tackle the problem of the overall environment footprint of infrastructure.
SDG 12. Responsible consumption and production	Women make more purchasing decisions in households, however they have less power in production chains. Unsustainable production, waste generation, and pollution have significant impact on women, especially socially disadvantaged ones. This happens through natural goods they depend on to poor labour conditions. When women are given more decision making power in production of goods and services they may alter the level of environmental footprint.
SDG 13. Climate action	Here are gender differences stemming from cumulative economics as well as social and health impacts of climate change. Due to their role in recovery and household managements, women are noticeably influenced by climate change and natural hazards related to it. Natural disasters disproportionally impact women and girls, thus women are more interested in participating in climate action campaigns.
SDG 14. Life below water	This goal is related to the health of the environment; and progress toward its indicators can be buttressed by empowering and engaging women as agents of change. Women-led initiatives, which target the clean-up and protection of coastal areas show that women might contribute to more sustainable management of maritime ecosystems. Sadly, none of the targets of SDG 14 address gender equality or the relation of marine resources to the livelihoods of women and men, including the role they can play in food security, employment and poverty reduction.

To sum up, not only does women's empowerment leads to the fulfilment of SDG5 – ensuring gender equality, but also it positively impacts many other sustainable development dimensions. Considering the immense gender gap in the central Asian region, namely in Uzbekistan, the author would like to focus more on the topic of gender equality and female empowerment further in this research.

It is known that gender inequalities, as well as inequalities between rural and urban areas, are present even in states with good economic indicators (Richter, 2017). Despite the good geopolitical location (historically a centre of the Great Silk Road) and the abundance of natural resources, people in Uzbekistan lack the means for sustainable development. Additionally, considering the fact that Uzbekistan is primarily agricultural, climate change has had a measurable impact.

Many scholars (Butler et al., 2017, Macdonald, 2017; Kusnandar et al., 2019; Warburton, 2018) suggest that reaching sustainable development depends heavily on community participation, empowerment, and self-organization. It is clear now that the role and work of females have been primarily underestimated previously (Cole, 2017; Adams et al., 2018). The engagement of female leaders may enable an expansive interpretation of sustainable development (Barrios et al., 2020).

According to the secondary research, women in industrialized and developing nations have different leadership styles. It is taken into account in the context of the government, banking, business, and finance sectors in industrialized nations (Hoobler et al., 2018). In contrast, female leadership in developing nations is primarily examined in relation to public services like healthcare and education (Dhatt et al., 2017); involvement in local governance (Evans et al., 2019); and microfinance and small- and medium-sized business (Strom et al., 2014) entrepreneurship. When it comes to women's leadership in sustainable development, there are studies on women-to-women entrepreneurial networks in energy use (Heuer, 2017), water use for tourism (Cole, 2017), and pathways to leadership in urban governance (Adams et al., 2018). The latter discussed how social norms and outside influences, such as tourism, conspire with a range of other socio-political factors to promote gender inequalities. In his research, Shinbrot et al. (2019) found that it is more productive for women to work with their male allies in order to change existing structures and perceptions of female leadership.

An approach to thinking about how social and environmental elements interact with identity concepts and how those concepts relate to ecological processes is known as the feminist political ecology approach (Gillespie and Perry, 2018). This strategy was created to combat the current gender disparity in rights and responsibilities for resource management and how it affects human capacity to safeguard the ecosystem on which they rely (Rocheleau, 1995). According to recent resource management research, gender effects persist when efforts are made to meet the needs and desires of women (Barrios et al., 2020).

Empowering factors	Disempowering factors
• Economic and natural resources • Good healthcare systems • Networks • Protection of rights • Sanitation • Support from local government	• Climate change • Malicious working terms • Difficult family situations • Inequality • Insecurity • Lack of education • Lack of infrastrucutre • Damaging tourism

Figure 1.18 Female empowering and disempowering factors (Developed by the author based on Barrios, 2020)

All the arguments above were based on the resource-based view; however, the capabilities approach proposes a non-recourse-based model: equity of resources is not what is sought but rather the equity of freedom to expand capabilities. Expansion of individual abilities can be the positive consequence of education, derived from personal experiences, or be reached through a shift in social norms and values. Spahn (2018) criticizes this approach as being individualistic and suggests that the collectivist approach may be more efficient. Nevertheless, an individual choice may subsequently lead to collective action.

In societies, male leadership has historically tended to come naturally (Born et al., 2019). Nonetheless, there are several reasons why female leaders can promote a more comprehensive understanding of community leadership that guarantees avenues for long-term communal livelihoods (Shinbrot et al., 2019). It is obvious that laws should support women in leadership roles, but what more is needed to encourage women to take up leadership roles?

In their research, Barrios et al. (2020) came up with several factors that empower and disempower female leadership. The author summarized their findings and presented in figure 1.18. Additionally, they revealed evidence of women's perceptions of their capabilities interacting with areas of impact in a number of ways (Fig. 1.19).

Climate change

Tourism

Economic resources

Education

The economy

Health care system

increase awareness of

support
develop

support

Sanitation

address

inequality

Women leaders'capabilites

address

Safety

local government

Rights

support acquisiton of

increase awareness of
support

Infrastructure

support
develop

Natural resources

Opportunities

Networks

Note: arrow represents links that were explicitly mentioned by the women leaders. Each arrow includes the type and direction if the links. Spaces where there are no arrows demonstrate that these links were not mentioned by the female leaders.

Figure 1.19 Women leaders' capabilities (Barrios, 2020)

As shown in the Figure 1.19, education and networks had reciprocal relationships with capabilities. This link between leadership, education, and empowerment was also discussed by Pullen and Vachhani (2018).

It is obvious that inequality must be addressed while also promoting female empowerment. To do this, we must advance ecological understanding and the region's economic vitality. Therefore, when establishing frameworks to support education for sustainable development in the emerging nations of the Central Asian region, a major focus should be on the capacities of female leaders.

It is evident that gender equality is central to sustainable development, and female empowerment is a crucial factor when it comes to gender equality, as women tend to be discriminated against much more often than men. In developing countries of the Central Asian

region, women are hampered by gender stereotypes and discrimination, and they suffer from environmental degradation more than men due to their unique physical traits. Thus, it can be concluded, that it is crucial to promote female empowerment in order to achieve sustainability. In the next chapter another important factor – sustainability awareness will be explored.

1.2.3. Awareness as a factor of sustainability

Value-belief-norm theorists argue that the intention to perform pro-environmental behaviours is strongly linked to the awareness of adverse environmental consequences (Hansla et al., 2008). From the same point of view, sustainability awareness is key to reaching sustainable development. Environmental Kuznets curve claims that economic development inevitably leads to environmental degradation; nevertheless, some researchers state that the extent to which this happens depends on moral values and laws within the investigated communities (Stern, 2018).

Since the theory of needs is mostly used to predict behaviours, it is only natural to question whether sustainability awareness may be described at the country or town level; for instance, wealthier countries and cities tend to demonstrate higher awareness levels when it comes to sustainability and sustainable development (Jun et al., 2018). A hierarchy of needs proposed by Maslow suggests that humans need to fulfil their basic needs first before proceeding to higher levels on the pyramid; thus, sustainable development requires meeting all the basic needs, including food, shelter, clothing, and jobs, prior to extending their aspiration for a sustainable life (Clarivate Analytics, 2018).

Following this theoretical framework, it can be presumed that compared to developing states, wealthy countries have fewer people with unfulfilled lower-level needs, and therefore they move up the pyramid reaching a higher level of sustainability awareness and consequently sustainable development (Li et al., 2021). This, however, does not mean that sustainable development should become a prerogative of developed nations only; on the contrary, this means that we should invest more time and money into raising awareness of sustainability and the importance of sustainable development among those that would otherwise take decades to reach a higher level of Maslow's hierarchy.
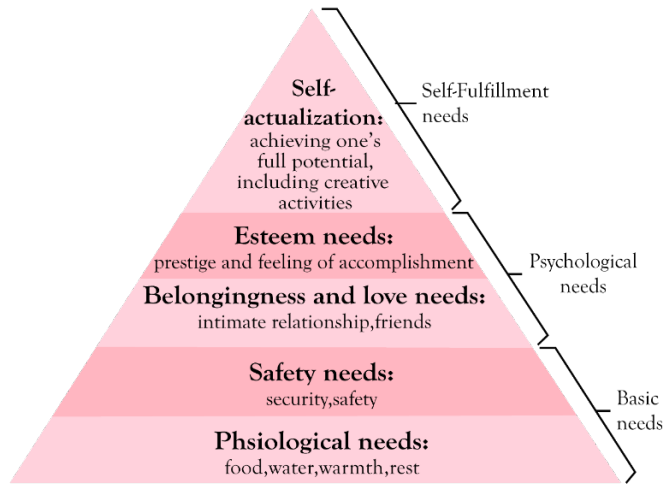
Figure 1.20 Maslow's Hierarchy of Needs (Pichere and Cadiat, 2015)

To ensure the implementation of Sustainable Development Goals, societies have to make complex fundamental transformations (The Bertelsmann Stiftung and Sustainable Development Solutions Network, 2018). To achieve such transformations, people need to change their daily behavior in order to lead more sustainable lifestyles (Rauschmayer et al., 2015). This, however, takes a significant amount of time and is impacted by market, political and individual factors (Lubowiecki-Vikuk et al., 2021). Pavalache-Ilie and Cazan (2018) argue that the enhancement of responsible environmental behavior can be achieved through raising awareness. This idea is backed up by Guan et al. (2019), who claim that raising public awareness of sustainability goals is one of the key factors of their successful implementation.

In addition to that, businesses should be expected to become more active in the implementation of sustainable practices, which also can be achieved through the spread of awareness on both corporate and individual levels (Scott and McGill, 2018). Companies can contribute to sustainable development in various ways, for instance, through Corporate Social Responsibility practices (Ye et al., 2020). Sustainable Development Goals may be appealing for private companies due to the possible return on investment; however, businesses can also create value through corporate social responsibility projects because individual stakeholders reward companies engaged in CSR activities (Buerke et al., 2017).

Figure 1.21 Education for Sustainable Development (Cottafava et al., 2019)

Another way to raise citizens' awareness of sustainable development is education. In the past few decades, more and more people have been enrolling at educational institutions at all levels (UN, 2021). Education is expected to improve social and economic indicators (UN, 2021) and eliminate poverty (UNESCO, 2019), which consequently leads to a reduction in inequality levels. Moreover, education allows people to live healthier and more sustainable lives (Ma et al., 2019). Last but not least, education is pivotal to promoting tolerance and making societies more peaceful (UN, 2021). To achieve all the aforementioned benefits of education, many institutions today include education for sustainable development in their programs.

The focus on ESD has increased in the daily practices of many schools across the globe (Pauw et al., 2015). Such education is transformative and learning-oriented (Cottafava et al., 2019). ESD can be very efficient in raising students' awareness. The framework of ESD implementation is presented in figure 1.21. It is clear today that raising awareness is an extremely important thing to do when aiming for sustainable development. Thus, we should do that on each level of personal development – from schools to continuous training at the workplace. When more and more people become aware of their contribution to environmental and societal degradation, they will alter their daily behavior to lead more sustainable lifestyles.

In conclusion, the intention to perform pro-environmental behaviours is closely tied to the awareness of adverse environmental consequences. Studies emphasize the importance of

sustainability awareness in achieving sustainable development, in which the role of education, businesses, and policy is critical. As societies fulfil their basic needs, they can move up Maslow's hierarchy, potentially leading to higher levels of sustainability awareness and sustainable development. However, it is essential not to limit sustainable development to developed nations but instead invest in raising awareness among developing states. Achieving sustainable development goals necessitates a multi-faceted approach, including education for sustainable development, corporate social responsibility, and individual behavioral changes. By raising awareness at all levels of personal development, we can encourage more individuals to recognize their impact on the environment and society, ultimately leading to the adoption of more sustainable lifestyles and the realization of global sustainable development goals. In the next part of this research the author will address the issues of sustainable development in a context specific to Uzbekistan.

1.3. Sustainable development in a region-specific context

1.3.1. Theoretical and methodological foundations of the management of sustainable development of the territories

It is commonly acknowledged that strategic management is a necessary component of the region's sustainable development process. Decision-making requires pertinent information, which is impossible to obtain without it in the case of effective territorial management. To oversee the sustainability of the regional system's development and track changes in the values of the chosen criterion indicator, it is thus required to create an appropriate system of indicators, also known as an integral indicator (Martin & Rice, 2013). In addition, judgments about the necessity of modifying the socioeconomic growth of the region's trajectory in order to get the best indicator values can be made in light of the monitoring data.

Remember that one of the theories of sustainable development should serve as the primary guide while looking for sustainability indicators. The concepts of strong sustainability and weak sustainability are the two theoretical frameworks used to assess the sustainability of development. According to Pearce et al. (1989) and Pezzey (1989), sustainable development is any measure of human well-being that does not decline over time. The only thing that separates these strategies is the set of prerequisites for achieving sustainable development. Strong sustainability is fundamentally predicated on environmental imperatives, which also dictate the forms of economic analysis that follow. Conversely, weak sustainability begins with

conventional economic presumptions and further establishes the structure in which environmental relations are studied (the relationship between the environment and humans).

The fundamental differences between strong and weak resilience relate to the set of conditions for capital and are as follows:

1. Natural and other assets (labor and manufactured assets) cannot be substituted in bigger or smaller amounts when there is weak stability. Since it is currently considered that all types of capital are fungible, the largest limitation is the overall amount of capital. A type of well-being known as natural capital comprises services that aren't really important in this particular situation.

2. Strong resilience leads to "non-smoothness" and "heterogeneity" in ecological systems, which in turn leads to economic damage, which is made worse by the deteriorating ecological conditions. Sustainable development is achieved by preserving certain components of natural capital (in this case, only the remainder of the resource can be exploited) or by setting restrictions on the non-decrease in the total volume of natural capital (if the resource stock falls below a certain critical level, then this can lead to disastrous consequences) (Resilience and Sustainability, 2019).

Therefore, while weak resilience would concentrate on assets in general without a specific allocation of natural capital assessment, great resilience will appeal to environmentally focused metrics.

It should be noted that non-fungibility of assets causes aggregation issues in the event of strong stability (Faucheux et al., 1994). Natural capital should be created in incomparable units and quantified independently from human capital. According to Pearce et al. (1990), natural capital has the following characteristics, which call for the application of certain evaluation techniques:

- Irreversibility. In contrast to natural assets, produced capital can be generated, destroyed, and recreated in ways that are unique to living things. In addition, the development of a new technology or commodity is seen as sufficient recompense for permanent changes in natural resource availability for future generations, presuming that future relative pricing are well known (Hamilton, 1995). However, such compensation will be insufficient if nature is valued much more highly by future generations.

- Uncertainty. There is a significant degree of uncertainty about the functioning of ecological systems and the consequences of their current mode of functioning.

- Scale. The existence of thresholds can lead to widespread damage if exceeded.

Within the context of both strong and weak resilience, the combination of these characteristics characterizes a "preventive approach" to the problem of natural capital degradation (Dasgupta, 1982). As a result, in order to achieve sustainable development, some actions must be taken. It has been observed that indicators of sustainable development should ideally help decision-makers understand complex processes.

According to the robust resilience paradigm, environmental assets, functions, and processes are the main focus of the indicators. Consequently, these indicators play a more important role in preserving important natural resources by establishing "limits" on the degradation of environmental resources (Swilling et al., 2013).

Indicators in this category include:

1. Measures of elasticity, most of which have not yet been developed. One proposal includes biodiversity indicators, as elasticity appears to be a function of diversity (Common and Perrings, 1992; Arrow et al., 1995).

2. Measures of the transferred volume (carrying capacity). The concept of the transferred volume is borrowed from biology. It means that a given territory can support a given population of certain species, and at its highest level - the transferred volume - the population will reach a maximum sustainable level. In order to apply this concept of saturation point for human populations, we must consider not only the size of the population but also the level of its economic activity. In ecological economics, the volume to be carried is generally defined in terms of limits that must be set in the form of ecological limits. The indicators of the transferred volume can be formulated as follows: pollution should not exceed the assimilation potential of the environment; the withdrawal of a renewable resource should not be greater than natural growth.

3. Distance-to-goal approaches, in which the deviations of environmental concentrations from stable "targets" are aggregated to provide a comprehensive indicator of performance (Hammond et al., 1995).

Weak resilience indicators are defined by aggregated indicators such environmentally adjusted GDP, a more productive subset of the so-called "natural and produced asset

substitutability," which is emphasized heavily in the weak resilience paradigm. The measurement of true savings (savings adjusted for the quantity of lost assets) is known as "green" bookkeeping. It is not necessary for the values of true savings to always be negative in order to attain sustainable development.

Once a fundamental theory of sustainable development has been established, one must choose from among the current methods for creating indicators that best represent the sustainability of the region's growth. There are now two most popular methods, both of which take into account signs of "weak resilience."

Let us consider the first approach to the formation of sustainable development indicators- an approach based on a system of sustainable development indicators.

The need to develop indicators of sustainable development was noted already in 1992 in the "Agenda for the 21st century" adopted at the UN Conference on Environment and Development in Rio de Janeiro. The chapter "Information for decision-making" of this document states: "In order to create a reliable basis for the decision-making process at all levels and to facilitate the self-regulatory sustainability of complex ecological systems and development systems, it is necessary to develop indicators of sustainable development" (Agenda 21, 1992).

Currently, the world is actively developing criteria and indicators of sustainable development. Leading international organizations are engaged in this: the UN, the World Bank, the Organization of the Countries for Economic Cooperation and Development (OECD), the European Commission, the Scientific Committee on the Environment (SCOPE), etc. The problem of developing indicators of sustainable development is considered in different international conferences and seminars. Scientists from all countries of the world are involved in its solution.

The part of the research comprehensively explored the strategic management of sustainable development within territories, emphasizing the criticality of informed decision-making through pertinent information and effective indicator systems. Two theoretical paradigms, namely strong and weak sustainability, were dissected, offering divergent approaches in accommodating environmental and economic considerations into sustainable development strategies. The ensuing discourse on sustainability indicators underscored their paramountcy in monitoring and potentially recalibrating territorial development trajectories, thereby embodying a foundational instrument in realizing theoretical frameworks practically.

This interplay between theory, strategic management, and applied methodology unveils a pathway toward achieving sustainability across territories, entwining environmental imperatives with socio-economic objectives to forge a future where development does not compromise future generational needs.

1.3.2. Female employment and political empowerment in developing countries

In many developed countries, the political empowerment of women is increasingly recognized as critical (Sundstrom et al., 2017). Even though women account for over 50 percent of the global population, they only make up less than a quarter of the membership of national parliaments worldwide (Iyer and Mani, 2019). In 2019 a global gap in women's political empowerment was over 75 percent, while economic participation equalled 42 percent (World Economic Forum, 2020). In developing countries, women's political empowerment is far from global goals (Awoa, 2022). Regional performance indicates that central Asia, with 15 percent, is one of the worst performing regions regarding female political empowerment (World Economic Forum, 2022).

Not only is political empowerment of women a salient measure of social change, but also a priority embedded in SDGs (Miedema et al., 2016). Female empowerment is defined as a process that enables women to make choices that were previously denied. Recent studies show a bidirectional relationship between female empowerment and economic development (Duflo, 2012). Political empowerment of women leads to advancements in institutional quality (Esarey et al., 2018), economic growth, and an increase in human capital (Jayasuriya and Burke, 2013) as well as environmental policy (Mavisakalyan and Tarverdi, 2019).

Simmons (2019) states that sceptics of the natural resource curse, faced with slow progress towards gender equality, warn against patriarchal attitudes, premier institutions, and antisocial policies promoting women's subjugation in resource-reach countries. The natural resource curse is that countries rich in natural resources demonstrate lower development outcomes than their resource-poor counterparts (Atanga Ondoa, 2019). Meanwhile, some studies extend this concept to female political empowerment. Ross (2008) states that the natural resources per capita rate reduces female empowerment in politics in the Arabian Peninsula. This happens mainly through the Dutch Disease; however, abundant natural resources can also impact female political empowerment through state's characteristics, such as cultural norms and geography, and the quality of public policies and institutions (Simmons, 2019, Rorbaek, 2016).

Liou and Musgrave (2016) propose that autocratic governments of resource-rich countries adopt antisocial policies to inflict prejudices on targeted groups, namely women.

Wejnert (2019) claimed that women's participation in the family decision-making process and their political awareness would eventually lead to their political empowerment. Another factor that influences political empowerment is education. Ghosh et al. (2015) empirically proved that the lack of education in India hindered females' political empowerment. Salhi and Golzard (2019) analyzed the role of Internet access in female political empowerment. The Internet helped to bring females together, promoted education, and, perhaps most importantly, allowed women to run online businesses, making them feel more secure and empowered. Al-Mallihan (2019) states that the political empowerment of women positively influences managerial and economic empowerment. It, however, does not affect social empowerment directly but rather through academic empowerment (Al-Qahtani, 2020).

Some scholars argue that there is a strong relationship between the political empowerment of women and financial inclusion. While nearly 240 million women had a bank account in 2017, almost a billion females did not have access to financial institutions and their services (Demirguc-Kunt et al., 2018). Due to these challenges being compounded by laws and societal norms, basic women's rights to participate in the labor market or make their own economic decisions are undermined (World Bank, 2020). It is believed that the political empowerment of women will eventually lead to higher financial inclusion. Additionally, women's active participation in political leadership and decision-making processes may positively influence economic empowerment (Sunstrom et al., 2017). When we expand women's presence in administration and political contribution, we can expect further growth in overall female empowerment (Ostry et al., 2018). To sum up, the political empowerment of women is expected to bring about a lot of positive outcomes; the means of promoting such empowerment are, however, not yet precisely clear.

In the past few decades, globalization has caused an increased integration of developing countries into modern supply chains. The tendency to consolidate the production units to better control-imposed standards ushered in the foundation of labor-intensive production sites (Maertens and Swinnen, 2013). Such advancements are closely associated with feminized employment patterns because companies prefer female workers to their male counterparts due to their perceived dexterity in handling delicate produce (Barrientos et al., 2003). On the contrary, firms tend to perceive females as more docile – accepting lower wages and adverse working conditions. A recent study by the World Bank displays that gender equality in earning

could increase human capital wealth by over 20 percent worldwide and total wealth by nearly 15 percent (Wodon and de la Briere, 2018).

Some studies provide evidence that female workers have greater self-reliance, financial independence, and improved resistance to the domination of males (Said-Allsopp and Tallontire, 2014). Other studies show that 94 percent of women employed in export-oriented horticultural companies state that their decision-making power in their household increased. In comparison, 67 percent report that they get more respect within their communities, and finally, 78 percent mention that they benefit from meeting and exchanging with other women (Maertens and Swinnen, 2013). Van den Broeck and Maertens (2017) concluded that females' inclusion in the labor market improves the subjective well-being of the poorest women, mainly through the income effect.

When men and women both earn income, decision-making power in households often shifts toward women due to their income enabling them access to new resources and control over current household assets (Pratley, 2016). In developing countries, where women are less likely to have much of the decision-making power, this is a critical issue (Bichieri and McNally, 2018).

Some studies, however, show that even when included in the labor market and receiving relatively equal salaries to their male counterparts, women tend to have fewer opportunities to accumulate wealth and purchase property because of higher financial responsibilities in their households (Friedemann-Sanchez, 2006). Additionally, many men cannot withstand changing roles, and therefore there is an increase in violence against female workers and emotional abuse from their spouses (Hjort and Villanger, 2011; Heath, 2014). Thus, despite being a critical factor in empowering women and therefore bringing us closer to sustainable development, women should be guaranteed not only equal employment opportunities but also ensured protection in the workplace and households.

Despite female empowerment being recognized as an essential element of sustainable development, for every 100 men, there are 104 women in poor households (Boudet et al., 2018). It is well known that women are more vulnerable to poverty than men because of cultural norms and values, gendered division of assets, and the power dynamics between males and females (Atozou et al., 2017). Women tend to bear the burden of household activities that they usually are not paid for.

Empowering women is a pivotal tool in addressing poverty across the globe (Faborode and Alao, 2016). In the short-term perspective, increasing women's productivity (Diiro et al., 2018), employment (Maligalig et al., 2019), and earnings (Rui and Feng-ying, 2021) can benefit economic growth and poverty reduction. Whereas in the long run, female empowerment and gender equality prevent the intergenerational transmission of poverty (Holland and Rammohan, 2019; Jones et al., 2019). Nevertheless, current poverty reduction policies are primarily focused on men, which leads to a further increase in the gap in income and productivity between the two genders.

In spite of the theoretical potential of various development strategies to reduce poverty while promoting women's empowerment, the existing literature sends us mixed messages. For instance, some studies claim that microfinance, a very effective tool in reducing poverty, positively influences women's empowerment (Raphael and Mrema, 2017); other experts argue that the effect of such financing is somewhat unfavorable (Hossain et al., 2016). Agricultural cooperatives, another tool promoted as both poverty-reducing and female empowering, especially for those, living in rural areas, are found to be both positive (Biru, 2014) and negative (Paryab et al., 2014). In addition, Wossen et al. (2017) argue that membership in such cooperatives may improve farmers' productivity and welfare.

Empowerment of women has its unique concerns, for instance, cross-cutting category and intra-household relations (Malhotra and Shuler, 2005). Meanwhile, various development programs aimed at reaching empowerment and fighting poverty are very likely to be experienced and be affected differently by men and women. Buvinic (2019) suggests that financial services and different training programs are not gender-neutral, and therefore gender-specific design may be of better help in reaching more positive economic outcomes for females.

The reduction of poverty and female empowerment are intertwined with one another under the empowerment framework (Fig. 1.23). A growing amount of evidence proves that empowerment is a crucial tool in the reduction of income and consumption poverty (Wei et al., 2021). Empowering a woman from a poor household has a strong potential to empower the entire household. Further in this research the author will analyse the importance of sustainability awareness for reaching sustainable development.
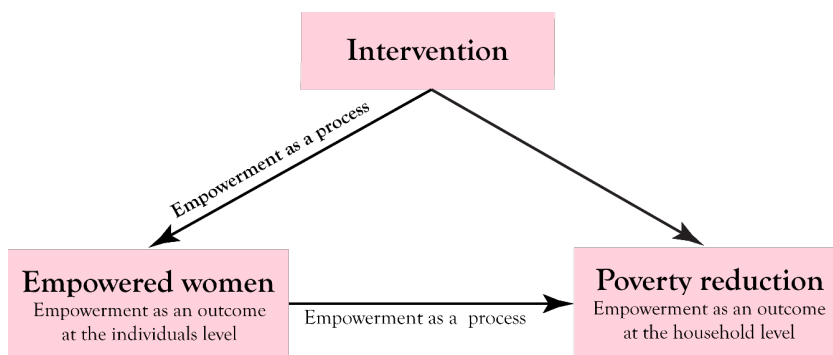
Figure 1.22 Interconnection between women empowerment and poverty reduction
(Rui et al, 2021)

In this chapter, it is discussed that women should be guaranteed not only equal employment opportunities but also ensured protection in the workplace and households. Despite being a critical factor in empowering women, the means of promoting such empowerment are, however, not yet precisely clear. Furthermore, the current literature provides a lot of contradictory findings. Nevertheless, promoting equal rights when it comes to labour market and participation in politics is a necessary step towards a more sustainable society. In the following chapter the author offers the analysis of sustainable development in Uzbekistan.

1.3.3. Prerequisites for sustainable development in Uzbekistan

Sustainable development as a new model of domestic policy, which is becoming a part of policymaking topics in an increasing number of countries globally, suggests a number of fundamental principles that reveal features of the new vision of socio-political and social-economic progress. According to Issadjanov (2020), sustainable development must be based on the following general principles:

- complexity and consistency;

- harmonious movement of all components of sustainable development;

- focus on a person as a central subject and object of sustainable development (socialization and humanization of economic growth with environmental restrictions);

- greening of economic and social human activity;

- rationalization of nature management and restoration of disturbed ecosystems at micro and macro levels;

- choice of a basic social group.

Uzbekistan has its peculiarities in choosing a social base of development. The fact is that in Uzbekistan, the leading social base for implementing the Sustainability Program is not a social group but instead the socio-territorial community known as "mahalla." The mahalla, as a form of territorial-communal settlement of the Uzbek people, has a strong potential for resilience and a socio-psychological framework for families living in it (Sharyi et al., 2019).

Ruzmetov et al. (2020) argue that for the Republic of Uzbekistan, the strategic goals of sustainable development are determined by:

- ensuring a healthy and fruitful life for each of its citizens with progressive and stable socio-economic growth and spiritual rebirth of the nation based on completed structural and institutional transformation;

- the formation of a socially-oriented market economy in a well-functioning secular legal democratic state, integrated on worthy terms into the system of world economic connections;

- overcoming the consequences of the environmental crisis of the Aral Sea and improvement of the ecological situation in other zones of the republic,

- preservation and improvement of a favorable environment;

- rationalization and efficient land and water use and other natural resources while preserving them for future generations of Uzbekistan.

Priorities for sustainable development of the country in the long run and characteristic stages of the republic's entry into sustainable development correspond in many aspects to the priorities of structural changes imposed on market reforms. The similarity of priorities is due to the target landmarks suggesting an increase in the level and quality of life, ensuring conditions for economic growth based on the modernization of production apparatus and rational use of natural resources (Iymanov, 2020).

The result of the first stage of market transformations in Uzbekistan on the way to sustainable development was the formation of new market institutions that were absent in the pre-reform period: stock and commodity exchanges, real estate exchanges, Chambers of

commodity producers and entrepreneurs, new banking system, privatization and investment funds, insurance, and leasing companies (Kobilov, 2020). The organizational and legal basis of a socially-oriented market economy aimed at multiple structures, freedom of private entrepreneurship, and development of market methods of economic management in firm social policy were created.

Meanwhile, ensuring sustainable economic development requires solutions to a number of complex economic, social, and environmental problems. The unstable financial situation of many enterprises still remains, as well as the balance of payments deficit, the predominance of raw materials economy, the imperfection of macroeconomic regulation policy, and the low efficiency of institutional transformations (Botirov, 2019). Moreover, the problems of transition economies are compounded by ineffective use of land-water and mineral resources, and the terrible ecological situation in the Aral Sea region is present. The transition to sustainable development is carried out in an environment of an increasing number of problems of social stratification, which require support for socially vulnerable segments of the population and sharing responsibility in social policy between central and local authorities (Kulbekova, 2019).

The key features of demographic development are a large share of the rural population, low migration of the indigenous population, and the uneven population density between various country's regions. Currently, the republic has a strong labor force potential. The labor force accounts for almost 50 percent of all population and annually grows by 210-220 thousand people. The age structure of the population allows having labor potential, characterized by high labor activity and excellent mobility (UN Sustainable Development Goals, 2015). A significant reserve of labor potential lies in the structural redistribution of the employed population, in particular, surplus labor resources employed in agriculture into other industries.

It is important for the development of the economy that the republic possesses such significantly strategic resources as oil and gas condensate, natural gas, coal, and precious metals. A wide range of their use opens up great opportunities for expansion of export as well as the creation of a wide range of joint ventures sponsored by foreign direct investment. Favorable agro-climatic conditions and irrigated agriculture have created good preconditions for the development of the agricultural sector of the economy and the agricultural resource base (cotton-fiber, grain, fruits, vegetables, cocoons, fur, wool) that serve as important products for export (CAREC, 2006). The reserve of various natural resources, many of which are unique and are broadly demanded in the global market, creates favorable conditions for the future sustainable development of the country's economy (OECD, 2004). At the same time, it

increases requirements for ensuring the sustainability of the natural landscape and social-economic environment when attracting foreign capital.

Since 1991, a new, modern control system for sustainability has been forming in the country. The process of formation of the organizational structures is generally completed. The bodies that make up the core of the administrative command system have been removed. In contrast to them, new structures were created, which became the initiators of the new market relations. Uzbekistan's reform program included a governance economy at the macro level as well as structural and sectoral restructuring. The new role of the state assumes, instead of detailed management, typical for the command economy, ensuring the proper level of macroeconomic governance, legal framework, and regulation of commercial activities, as well as the organization of an effective system of social protection of the population.

The key element of the current stage of the reform is the restructuring of enterprises. The foundation for the institutional transformation of the economy is privatization. The agriculture sector has undergone radical changes in terms of institutional structure. The most noticeable change in its structure was the abolition of state farms and their transformation into cooperative farms (shirkats), the development of farming and private property. An important issue of institutional reform is the revision and redistribution of functions, rights, and responsibilities of all the existing subjects of management - from central economic departments, ministries, and bodies of territorial leadership, to associations, enterprises, and organizations - in such a way as to ensure their interaction following the new content of market relations.

Like many other countries with transitional economies, Uzbekistan inherited a problematic ecological situation, an economy with material and energy-intensive production, outdated technologies, and an imperfect structure of the economy. Extensive development of the economy, regional policy specialization that increases the dependence of the outskirts on the metropolis, long-term practice of environmental management without taking into account the permissible maximum loads on the natural environment, residual financing principle environmental protection measures, low efficiency economic regulation mechanisms of environmental management, as well as imperfect legal and regulatory framework, had a negative impact not only on the ecological situation but also in general on the state of the economy in the republic (Kim & Park, 2019).

In connection with the transition from centrally planned to the market economy, new problems arise, such as employment problems, state budget deficit, inflation, and the need to

find new foreign trade markets. It should be borne in mind that the main goal of the transition is not just the improvement of the efficiency of the economy in the short and long run but rather progress towards sustainable economic development. To achieve the goals and objectives of sustainable development, it is necessary to form a set of adequate legislative and other regulatory acts at different levels of action - international, regional, and national (Rasulov, 2020). The creation of legislative normative acts at the international and regional level should provide:

- maximum possible use of benefits and levelling negative aspects of the country's geopolitical position;

- ensuring national, economic, and environmental security and creation of a system for the protection of national interests;

- fulfillment of obligations assumed by the Republic of Uzbekistan on international agreements in the field of political, economic, and environmental cooperation;

- development of common approaches to the problems of regional cooperation in interrelated areas of activity;

- creation of a mechanism for the settlement of interstate and intraregional disagreements on decision-making in the field use of natural resources and transboundary impact, financial guarantee systems for environmental compensation, and public health due to the deterioration of the environmental situation in the region.

The aim of improving national legislation is, first of all, the creation of legal support for the whole complex of market transformations carried out in the country. The development of national legislation should be carried out considering an integrated approach to economic growth, human development, protection of the environment, regulation of nature management, and ensure the following:

- improving the package of legislative documents in order to rationally divide power, functions, and delineation responsibility of all hierarchical levels of government economy in transition according to a specific role;

- formation of a legal framework that enshrines the rights of business subjects for complete economic independence using systems of market levers and incentives;

- creation of an adequate legal structure to consolidate the achieved results of structural restructuring of the agrarian sector of the economy;

- development of legal documents for successful completion of the implementation of the fundamental principle of market reforms - privatization;

- improvement of industrial, commercial, and tax legislation to make the existing directions of systems of standards more sustainable and environmentally friendlier;

- creation of legislative and regulatory acts on the economic assessment of the natural environment, the definition of its ecological capacity, possibilities and the limits of the use of natural resources, and the amount of damage, caused to the environment and human health in the process of economic activities and their protection;

- creation of a regulatory framework to stimulate the production of environmentally friendly products, including tax and credit benefits, use of non-traditional renewable sources of energy, and industrial waste processing;

- legal justification for the creation of specialized banking, investment, and financial structures for financing: activities (projects) to rationalize environmental management; development of social infrastructure; creation of funds for social and environmental insurance of the population (Abduganiev & Abdurakhmanov, 2020).

Given the growing role of non-state actors (NGOs) in solving the socio-economic and environmental problems of the transition period, it is vital to develop an appropriate mechanism as well as necessary conditions and legislation that allows NGOs receive reliable information on all aspects of activities to ensure sustainable development.

Uzbekistan is a country with a transitional economy, an economy with material and energy-intensive production, outdated technologies, and an imperfect structure of the economy. The transition from centrally planned to the market economy results in new problems, such as employment problems, state budget deficit, high inflation, and the need to find new foreign trade markets. The country's reform program includes a governance economy at the macro level as well as structural and sectoral restructuring. Ensuring sustainable economic development requires solutions to a number of complex economic, social, and environmental problems. It is vital to develop an appropriate mechanism and necessary conditions and legislation that allows

transparency in all aspects of activities to ensure sustainable development. The next chapter offers exploration of this thesis' research subjects.

2. ASSESSMENT OF URBAN SUSTAINABILITY

2.1. Literature analysis of urban sustainability assessment

2.1.1. Bibliometric analysis of evaluation of sustainable urban development literature

To examine various approaches to and methods of evaluation of sustainable urban development, we first need to look at how well this subject is studied in the existing sources of literature. To do so, the author performed a bibliometric analysis that provided insight into this theme through visualized graphs and maps.

First of all, the phrase "evaluation of sustainable urban development" was inserted into Google NGram Viewer to see the tendency of publications on this topic within several decades; however, there was not a single result under this key phrase. Then the word "evaluation" was replaced with "assessment," making a search term "assessment of sustainable urban development." The interest in this field has gone through some fluctuations over time. The phrase was first mentioned in books around the 1990s and maintained popularity for several years up until about 1997-1998 when the interest in the assessment of sustainable urban development declined dramatically. In the first decade of 2000, it can be observed a significant incline in the number of books published on the aforementioned topic, followed by a steep decrease between 2008 and 2010 and continued to decline slightly steadier up until the present times.

Further research was conducted via the Scopus Database, where the author analyzed scientific articles about the "evaluation of sustainable urban development." When it comes to scientific papers, it can be observed an overall positive trend, with the first publications being presented somewhere around 1993 and reaching almost 500 papers in 2020.

The following step was to use the collected from Scopus metadata to create a map of keywords co-occurrence in the selected articles. Through the VosViewer analysis, 488 items were selected and grouped into 8 clusters, the first containing 102 items and the last one with only one item.

Figure 2.1 Co-occurrence of keywords in "evaluation of sustainable urban development" articles from Scopus (VosViewer, 2021)

The keywords used the most were "sustainable development," "urban development," "urban area," "environmental impact," etc. However, when looking closer at the map, it is possible to detect some of the methods and approaches to the evaluation of sustainable urban development that has occurred a lot more often than the other ones: spatiotemporal analysis, fuzzy logic analysis, life cycle assessment, indicator system analysis, and other. This gives us an idea of how scholars tend to evaluate sustainability level when it comes to urban territories.

In conclusion, the examination of various approaches and methods for evaluating sustainable urban development requires a thorough analysis of existing literature. The bibliometric analysis, which utilized visualized graphs and maps, has revealed some trends in the publications on this topic. In the next chapter the author will analyse a typology of urban sustainability indicators, which is a vital step towards creation of an urban sustainability evaluation methodology.

2.1.2. Indices and Indicators of sustainable development

The need for the development of sustainable development indicators was highlighted in Agenda 21, which was adopted by the UN conference on environment and development in in Rio-de-Janeiro (1992). In the 40th chapter of this report, it was stated that in order to create a foundation for sustainable development decision making there is an urge to develop sustainable development indicators (UN Commission on Human Rights, 1993). This is needed for the control and monitoring of the sustainable development goals achievement, managing related processes, and evaluation of the efficiency of the used tools and methods. The development of various sustainable development tools actively takes place worldwide, involving lead researchers from the UN, World Bank, OECD, European mission, SCOPE, and others. The problem of the creation of such indicators is discussed in many international conferences, both business and science, and seminars. Although the development of such indicators is far from being concluded, there are already a number of proposed indicators projects from systems of different volumes: regional, national, local, global, industry-wise, and even neighbourhood (district-wise). Some of the most notable projects are listed below:

- The sustainable development indicator system developed by the UN Commission for Sustainable Development includes 132 indicators;

- System for Integrated Environmental and Economic Accounting, proposed by the UN statistical department, which aims at the monitoring ecological factor in the nationals statistics of genuine savings;

- Developed by the World Bank program of ecological indicators OECD;

The development of sustainable development indicators is a complex and expensive procedure that requires a lot of data, which is oftentimes hard or even impossible to obtain (Kovacic, 2017). Moreover, the variety of indicators that are included in the system makes it harder to be used in many countries due to the absence of necessary statistical data.

The indicator is significative, which comes from the primary data that does not allow interpretation of the changes that help analyze the condition and shifts in the economic, social, and ecological variables. Index- is an aggregate or weighted indicator based on the number of other indicators. The use of indices is reasonable when the causal relationship is clear. Usually, indicators describe the phenomenon or condition of the environment and always highlight something that is out of direct sight (Lyytimaki et al., 2020). There are many reasons explaining

this: direct observation tends to be overly expensive, area of observation that is out of direct sight is the representation of the future. However, for the decisions that are being made in the present, the information related to the future is of vital importance (Sebastien, 2014). That is possible that the wide variety of developed indicators will enable getting information about the future; for instance, when planning future events, we turn to the weather forecast, look at the barometer, and pay attention to the air pressure that indicates the future weather conditions (Morse, 2016). Another example can be the stock market index, which indicates the general trends in the stock market for the future and is a very valuable tool for investors. Indicators of the future are obligatory for many day-to-day decisions; however, they can have a lot of drawbacks, and even after detailed adjustments, they will still remain imperfect as the future is terra incognita.

There are many ways in which indicators are used:

1. Indicators are used to justify decision-making through quantifiable evaluation and simplification;

2. Indicators can help interpret changes;

3. Indicators help detect the flows of natural resources use;

4. Indicators help ease data access for various users' categories;

5. Indicators ease the exchange of scientific and technical information.

Being the decision-making and planning tool indicators can also perform an important communicative function. This way, environment-related indicators inform society and attract attention to prominent ecological threats. This often helps mobilize people for independent actions or cooperation with authorities or businesses to address the risks.

Global experience in the development of sustainable development indicators demonstrates that there are two approaches to doing that:

1. Building the system of indicators, each of which represents different aspects of sustainable development. Most of the time, in the frame of the general system, the following indicator sub-systems are made up: ecologic, economic, social, and institutional.

2. Building the integral aggregated indicator based on which we can find out the level of sustainability of socio-economic development. The aggregation is usually based

on the three groups of significates: ecologic-economic, ecologic-economic-social and economical.

One of the most sophisticated systems of sustainable development indicators was developed by the UN Commission on Sustainable Development. The indicators are split into critical groups: indicators of social aspects of sustainable development, indicators of economic aspects of sustainable development, indicators of ecologic aspects of sustainable development (including characteristics of water, land, atmosphere, natural resources, and waste), indicators of institutional aspects of sustainable development (planning and programming of political agenda, scientific advancements, international law instruments, information support, etc.) (Lehtonen, 2017). These indicators require special transformations and adaptations to the specific conditions and, in some cases, extensions for some countries.

The selection of indicators was first made through the OECD scheme, where four types of indicators are offered: pressure on the environment, the current state of the environment, influence on the environment, and reaction (necessary measures). The final list consisted of 134 indicators. Discussions and pilot projects demonstrated that the list is overly long, which makes the evaluation and analysis on the national level very complicated. This was followed by the partial renouncement of the indicators scheme in favor of the scheme of topic-subtopic-indicator (Indicator of Sustainable Development, UN, 2001). Each of the selected topics has key themes that are sorted according to sub-themes and then boiled down to the minimal indicator set. The opportunity to implement political decisions is especially emphasized. On the topic of the economy, two themes are offered: economic structure and production consumption. The economic structure contains the following sub-themes: economy, finance, and trade; consumption-production – 4 subthemes: material resources consumption, energy consumption, waste generation and disposal, and transportation. The list of indicators is relatively short:

- GDP per capita;

- Share of investment, % of GDP;

- Trade balance of goods and services;

- Share of debt, % of GDP;

- Four indicators of energy and material use;

- Four waste-related indicators;

- Transport use.

A minimal list of basic indicators is offered to countries for approbation and development of national programs.

A prevalent worldwide system of ecological indicators was developed by the OECD. The members of this organization are the 30 economically developed countries of Europe, North America, and the Asian-Pacific Region. OECD countries developed a program of ecologic indicators from the beginning of the 1990s based on the following criteria:

- Reconciliation of terminology and conceptual frames common for the OECD countries,

- Identification and definition of indicators according to the following criteria: topicality of the realized political agenda, assessment of these criteria in the majority of countries, and regular use of these indicators in the analytical reviews and studies of the environment.

The indicators are used for the three key goals: tracking the progress in the environment significates, better integration of the ecological interests in sectoral politics, and better integration of ecology interests in economic politics. The types of OECD indicators and their implementation areas are presented in the figure 2.3.

It is believed that the OECD indicator system will allow tracking down the relationship between the economy and environment preservation, which will help increase the level of societal awareness and will promote integral policy-making (Chen et al., 2021). The OECD indicator system is based on the pressure-state-response model (Figure 2.4). This model indicates the causal relationship between economic activity and ecological and social conditions as well as helps individuals in charge and the public see the interrelatedness of these spheres and consequently develop the policy that addresses related issues. Thus, it is the mechanism of selection and organization of indicators in a convenient form. This, however, does not mean ignoring more complex relations in the ecosystems and economic-ecological and socio-ecological relations.

Types and area of use of sustainable development indicators developed by OECD

| Adopted for different countries | Used for:: | Key indicators of Environment Condition | Data on the state of environment |

Adopted for different countries

Correspond to national requirements

Used for::

Monitoring of progress in environment preservation

Analysis of environment preservation efficiency

Change in Sustainable Development Progress

Societal Awareness

Key indicators of Environment Condition

Key set of OECD Indicators

40-50 key indicators

Environmental Issues

Socio-economic and general Indicators

Data on the state of environment
Ecological Monitoring:
~Monitoring of material inflows
~Monitoring of National Resources
~Consumption of nature resources

Sectoral Indicators of environmental state-one set of indicators per sector (i.e. transport, energy. agriculture, etc.)

Main indicators of environmental state

10-13 key indicators

Dissociating indicators of environmental state

Figure 2.3 Types and areas of use of sustainable development indicators developed by OECD
(OECD, 1993)

Human activity significantly pressures the environment and impacts the quality and quantity of natural resources (its state); society, in turn, reacts to the changes through nature preservation, economic and sectoral politics, and through the changes in societal awareness and behavior (response to pressure). Pressure can be indirect and direct, meaning that it can be represented through resource use and through waste generation and disposal that harms the environment. Indicators of ecological pressure are closely related to the characteristics of production and consumption (Smith et al., 2014). They often represent the intensity of the pollution and resource, and the tendencies of development and changes are due to these processes. They can be used to illustrate the process of disconnection between economic activity and ecological problems related to it. They can also be used to evaluate the efficiency of the national goals' achievement and execution of international obligations.
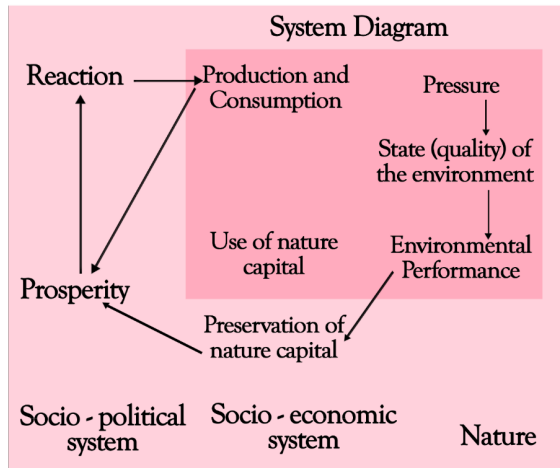
Figure 2.4. Modified Pressure-State-Response Model (OECD, 1993)

Ecologic condition is related to the quality of the environment and the number of natural resources. As such, they represent the final goal of the nature preservation policy. Ecological state indicators are created in such a manner that they provide an overview of the environmental state and its development over time, for instance, the concentration of pollutants in the environment, the influence of pollution on the population, and the decline in the quality of the environment and the subsequent impact on health, flora, fauna, and resources.

Indicators of impact demonstrate the consequences of changes in the environment for those who directly or indirectly use the resources, for instance, indicators that affect health, expenditure for clearing the water, changes in the agricultural productivity of land, etc. Impact indicators also include time parameters, and indices of influence on aspects of human wellbeing, the most popular examples are the GNP index of human potential development, which indicates the quality of life.

Indicators of reaction represent the reaction of society to ecological problems. They are related to the collective and individual actions and reactions aimed at adaptation or prevention of negative impacts on the environment caused by human activity (Bell & Morse, 2018). Examples of such indicators are expenditure on nature preservation, environment taxes, and subsidies, pricing structure, market share of ecologically clean goods and services, recycling level, etc.

The Pressure-State-Response model acted as a base model for many other indicator systems, including the European Indicators of Eurostat. Ecologic indicators of OECD are often used in the reviews of nature preservation activities and other analytical work. These indicators help track the integration of economic and nature preservation decision-making and analyze policies in the field of environmental preservation as well as evaluate it (Rogmans & Ghunaim, 2016). Besides, they are used in the broader OECD program for the development of sustainable development indicators.

The system of indicators developed for the improvement of natural resource use introduced in Central America was based on the same four indicators as the OECD scheme. The research for the development of this system was conducted by the World Bank together with UNEP and CIAT. What is special in this project is the representation of geoinformation systems that makes the material more visual and eases the process of planning and decision making. Indicators reflect all the spheres of society functioning: economic, ecologic, social, egologic-social, ecologic-economic, social-ecologic, and social-economic and their interconnection (Harrison et al., 2012). To go along with the institutional structure, indicators are organized according to the key challenges of development – land use, deforestation, fresh water use, infrastructure, and natural catastrophes. The analysis is made in three steps: employment of indices, followed by the basic indicators, and finally, additional indicators. Overall, there were introduced 11 indices, 68 basic indicators, and 114 additional indicators that were supposed to promote analysis for decision making. Indices fix the problem and are a necessity for further analysis.

The following 10 indices have been introduced according to the problems and subjects of the analysis:

1. Index of land use
2. Index of forest risk
3. Index of water risk
4. Biodiversity index
5. Index of coastal area risk
6. Greenhouse level
7. Energy uses per capita
8. Human development index

9. GDP per capita

10. Climate risk index.

These indices are vastly used in many researches, including the annual report of the World Resources Institute. They are built upon the generalization of information on each selected problem and subject, for instance, Human Development Index that represents the life expectancy, income, and education level. The selection of indicators was also applied to the forestry sector in Central American countries.

World Bank is by many seen as the world leader for sustainable development indicators. The annual World Bank report "The World Development Indicators" enables the assessment of proposed UN goals. Indicators are split into six groups:

1. General;

2. Population;

3. Environment;

4. Economy;

5. Government:

6. Market.

To study and compare the development of countries across the globe, data on over 550 indicators are analyzed. Based on "The World Development Indicators," World Bank publishes "The Little Green Data Book."

After examining the comprehensive content of the different methods, it is clear that there is a commonality in the types of indicators used across multiple frameworks, regardless of the nuances in their composition. The recurrence of these indicators underpins their essential role in measuring and evaluating sustainable development.

Economic indicators: Gross Domestic Product (GDP) per capita and investment as a percentage of GDP are prevalent in almost all models. These indicators provide a snapshot of the economic health and growth of a country, correlating with its sustainability ambitions.

Social indicators: Human Development Index (HDI) is a common indicator representing social sustainability. This composite index measures average achievement in key dimensions of human development: a long and healthy life, education, and a decent standard of living.

Environmental indicators: Variables such as greenhouse gas emissions, energy use per capita, and biodiversity index are frequently used across multiple models. These indicators reflect the environmental dimension of sustainability, providing insights into a country's ecological footprint and commitment to biodiversity conservation.

Institutional Indicators: The institutional aspects of sustainable development are often represented by indicators related to policy responses and societal behavior towards environmental issues. Examples can include environmental expenditure, eco-friendly market share, recycling levels, and the implementation of environmental taxes and subsidies.

Although the above indicators are consistently employed across various methodologies, it should be noted that the choice of specific indicators in any model should reflect the context, priorities, and specific goals of a particular region or country. The effectiveness of sustainable development indicators lies in their flexibility and adaptability to cater to various sustainability aspects and geographical variations.

This chapter presents the development of sustainable development indicators in the context of the United Nations Sustainable Development Goals and focuses on the study of countries across the globe. Here the author explored the sustainability of socio-economic development indicators and the effectiveness of the used tools and methods. This analysis is crucial for the empirical part of this research, specifically the selection and classification of the indicators for evaluation of urban sustainability in Uzbekistan.

2.1.3. Integral indicators of sustainable development

Integral indicators or composite resources are metrics with volume dimensions of sustainability, including economic, social, and environmental components. These indices are vital prisms in measuring the overall development status towards sustainability because they present a comprehensive panorama of how development issues are linked, and only by looking at all these elements from several perspectives can sustainable progress be achieved. However, although it is critical to have integral indicators for implementing policies and measuring their outcomes, introducing such indicators entails several challenges, including unsettled methodological issues. This argumentative selection can weigh one indicator higher than another regarding its reflectiveness capacity and transparency requirements in the aggregation process. Nonetheless, the limitations provide ecosystems of innovation to revisit measurement tooling, the pillar of robust selection encompassed in manifestation communiqué. This paper

focuses on sustainable development's concept, importance, challenges, and opportunities with integral neutral socioeconomic factors.

Many methodologies have been used in building indices for aggregating indicators from various directions for sustainable development. Three approaches can be named leading: the Delfi Method, Multi-criteria Analysis, and the Destination Goal Method. Thus, the Delfi Method involves cycles of one-on-one interviews with experts, with respective answers as input and output during overall evaluation (Abu-Rayash & Dincer, 2021). The weighing coefficients for indicators are drawn from diverse sources, including international laws, societal norms, and surveys like the Eurobarometer that depict social choices. The Destination Goal Methods establish alignments between indicators and international or national laws using a structured procedure governed by quantitative determination of the weights. In the weighing stage, issues are not limited to specific legal frameworks but also involve social norms and criteria like short-term vs. long-term and global vs. local perspectives and varying complexities and depth of matters. However, it is essential to mention that unbalanced weights in all the indicators should be avoided as this would lead to less nuanced representations (Coscieme et al., 2020). Civil index transparency from the aggregation process is highlighted so that users can see where results come to an understanding and be aware of the limitations of the index. It is an essential element in constructing a usable and fair strategy towards winning success when implanting the issues that come with linked sustainable development markers.

Aggregating all the data to broader indicators representing sustainable development is a somewhat acceptable procedure where several crucial stages are precious—first embedded like the process is weaving weights with each indicator and aspect that gives life to different dimensions, including features, economic balances, social structure, and institutions. This creates a comprehensive, reliable gauging process as an equilibrium descriptive, integrative method due to the multi-dimensional dimensions of sustainable development (Tolstykh et al., 2020). Specifically focused intermediate indices are then aggregated following the weights that have been predetermined for all relevant dimensions. Such crossroads of challenges with spheres of interest guarantee the required focus and evaluation that reveals critical aspects of sustainability. Onward, the weighting process captures secondary-level indices, which opens up a broader perspective of dimensions to analyze effectively. At each level of weighting, the result forms a part of achieving a comprehensive understanding of the sustainability landscape (Eckelman et al., 2020). Once again, carefully considering the weight level, this is affected by choosing a single index as an equilibrium indicator of sustainable development. This index

measures how comprehensive this indicator is by representing ecologic, economic, social, and institutional aspects through one number.

Starting in the early 1980s, the United Nations (UN) and World Bank began to work on measurements and assessments of sustainable development using integral indicators. They have won their respective projects some critical acclaim because they marked significant global developments in measuring sustainable development. Even though initiatives are of such proportions, creating a unified, comparable integral indicator raises serious challenges, mainly due to methodological and statistical sophistication (Alaimo & Maggino, 2020). The multidimensional aspect of sustainable development, which includes ecologic, eco-sociology, and social equity within the unique complexity, is reflected in confection and interpretation. Changes in the EPAC practices of Member States contribute to this challenge, together with the need for detailed statistical data that may sometimes take work to come by because of the structure of international information sources. One of the notable models established by the UN Statistical Department is the Integrated Environmental and Economic Accounting system, launched in 1993. This framework is designed for tracing ecological conditions at the national level, as far as statistics are concerned, both market and non-market appraisals.

Nevertheless, although Tsui argues that it is potentially a support tool for national monitoring, the SNA still needs to replace the conventional federal budget (Tolstykh et al., 2020). The framework consists of blocks concerning nature use and conservation practices, the link between environment and economics, evaluating tangible costs associated with natural assets inputs, and further details regarding the product branch in macroeconomic analysis. However, despite the resultant progress in sustainable development, more than understanding such initiatives is needed to overcome the demanding task of finding an integral indicator acceptable to all.

As an essential part of the comprehensive sustainable development evaluation, environmental sustainability pointers help us assess whether nature is healthy and well-balanced. The Living Planet Index, an annual report by the World Wildlife Fund, can be a prominent measurement. It is based on understanding natural ecosystems determined by forest capital, water bodies, and sea ecosystems. The trends prevailing over the past five decades, as shown by the given index, clearly showed an alarming 68 percent decline, pointing to worldwide problems of resource exploitation. Another significant parameter is the Ecological footprint, which estimates human consumption by measuring the area of biologically productive land and sea needed for resource production to absorb waste (Alaimo & Maggino,

2020). The concept of "overshoot days" indicates an over-exploitation direction, meaning the day when human demand for natural resources in a year is more than Earth's regenerating capacity. Developed countries' consumers consumed four times that in lower-income nations, with the per capita Ecological Footprint varying wildly. This indicator is, therefore, a clear demonstration of the eco-unbalances occasioned by human activities.

The Environmental Sustainability Index, called by scientists from Yale and Columbia Universities over two decades ago, is characterized by five groups that reflect their sustainability. They are the quality of the environmental pollution levels and impacts on society losses and social and institutional capacities, making mitigating global economic issues possible by preserving the environment (Tolstykh et al., 2020). The index, computed on 22 criteria of varying weights, contains the facets of managing for preservation with environmental sustainability and society's needs while considering economic conditions, both reflecting what is arguably a gross underestimation eluded to earlier.

As a key structural characteristic and component, the HDI appears once more as a distinctive parameter or dataset classification, featuring several important aspects necessary for defining sustainable development from a human-oriented angle. Belonging to life expectancies and education rates with the adjusted real GDP, HDI underlines the interdependence among indices in estimating the level of a nation's development (Kharazishvili et al., 2010). The formulation used in calculating an index involves setting bound minimum/maximal values for one component and adding all the single values to obtain a final overall value. The analysis of the life expectancy that forms one of the HDI pillars also evidences the high health and development level concerning those people. Literacy and college enrollment rates, as a part of the educational level, form not only several parts of the aggregate but also create an intricate picture of academic achievements within any national structure. Real GDP per capita, adjusted for deviation from mixed success norms, is a benchmark for measuring economic performance and how that is interrelated with human sustainability development.

To determine the HDI supply, each component's index is calculated by normalizing its actual value concerning the minimum and maximum values placed. The indices are summed up to get the overall HDI. Therefore, this derived index is essential for defining country categories in terms of their level of development. The human development index has an upper cut-off value of 0.8 and a lower threshold of 0.5, whereby all those with values above the cut-off are deemed as having a high level of human development. In contrast, any individual's value below the threshold is considered underdeveloped (Kharazishvili et al., 2020). HDI classifies a

country and guides the policies and programs by providing a clear picture of the strengths and weaknesses that need attention and implementing solutions to achieve the required sustainable human development. Thus, The Human Development Index effectively designs socioeconomic policies and advances intended development towards all-round development.

The reviewed indices and metrics, namely, the PHI and GPI, are crucial elements to be integrated into sustainable development assessment, making it possible to comprehend the dynamics of population health and economic aspects. Moreover, a closely-knit relationship between the component of the Population Health Index related to environmentally determined disease and environmental quality is revealed, demonstrating a connection with public health (Kwatra et al., 2020). It includes mortality rates in which respiratory diseases and intestinal Infections are the focus. Showing how to integrate the infant mortality rate and intestine death with PHI indicates interestingly that environmental factors remain observed changes in health. The PHI is a valuable tool to reflect the interplay of public health and ecological sustainability.

On the other hand, Generic Progress Indicators aim to go to the root of the problem by analyzing monetary transactions and various circumstances that impact economic welfare besides money circulation. Critical components of GPI comprise crime and family decline, home and volunteer work, income inequality, resource depletion, pollution, and corruption for long-term ecosystem damage. This index should help estimate the nuances of the economy that work beyond the models known within a traditional monetary framework (Rasoolimanesh et al., 2023). With the recognition of non-financial inputs to wellness, the GPI indicates a wider socioeconomic arena. However, accumulating demographically varied factors to be expressed in a single index meets challenges, arousing doubts on objectivity since there are questions of determining the weight to apportion each element. Despite notable differences in their focus, the Population Health Index and Genuine Progress Indicators contribute considerably to a more peripheral understanding of sustainable development by considering health and non-pecuniary aspects for the evaluation framework.

The articulation and merging of numerous functions into a singular index, even though it may seek to provide for a generalized measurement of sustainable development, is within criticism due to accounts that such an endeavor will be flawed. The unprecedented debates that have dominated the concept and procedure revolve around subjectivity and contradictions, which question what is happening if it serves any purpose (Kharazishvili et al., 2020). However, the subjectivity in determining parameter values assigned to different indicators and functions should draw attention. Since the scientific debates continue today, as well as those within and

between policymakers, we can observe significant gaps in consensus regarding the sides of many factors. This subjectivity brings an element of uncertainty into the final decision, and it may create disparate opinions on how regions or countries score concerning their sustainability. The aggregation of functions can either take a positive or negative form.

On the other hand, such a form helps for a full assessment, applying to many sustainable development features, such as economic ones, social matters, and environmental direction (Tolstykh et al., 2020). However, the process is very complicated and involves contradictions between several pointers that could distort the clarity and simplicity of your final index. Also, the constant issue of finding a balance between having as complete an evaluation as possible and including enough simplicity for effective communication is very much present.

Challenges related to methodological strategies aggravate the criticism. Successful regard to ensuring rigor in data aggregation must be supported by a robust methodological tool and meaningful framework. The methodologies, however, should be transparent since the aggregated index is commonly used for such decision-making (Gunnarsdóttir et al., 2020). Strict validation procedures coupled with constant re-estimation can be utilized to address the methodological issues and improve the validity of the resulting consolidated index. Aggregation of functions in a single index demonstrates promising lines to view overall sustainability. Still, the critiques on subjectivity, balance, and structural issues through methodological complexities suggest the need for constant minimization and analytical investigations of such integral markers. Given that, it is vital to find a way of dealing with these issues, ensuring that the working of such indices is effective and reliable in driving policy decisions to achieve sustainable development.

Thus, an integral analysis of integral indicators in sustainable development makes it clear that the landscape is complicated due to different methodologies, challenges, and improvement measurement practices. There has been a critical evaluation of vital, among other things, integral indicators that address economic, social, and other relevant dimensions that play the roles and limitations of providing holistic sustainability (Meadows, 2021). Analyzing the changing sphere of development in sustainability measurement, it becomes clear that joining various factors within one index reflects an inevitable and intrinsic difficulty. The importance of these indicators as a guide in policy decisions and the information they provide into level growth towards sustainability must be balanced. On the other hand, identifying their weaknesses, among which there should be highlighted limitations connected with its subjectiveness that implies the involvement of analysis not originating within a particular

methodology as well as complexity and intricacies inherent in methodological means are no less important.

It is important to note that the field of SDGs measurement is very volatile and is constantly adjusting to new challenges and emerging findings. Therefore, the pursuit of convincing further research and improvement of integral indicators is a primary factor. To respond to such critiques, bring in some rigor and relevance by staying aware of the dynamic needs of a fast-changing world – stepping on this will ensure that these pointers remain valuable for policymakers, researchers, and, ultimately, all the people around the globe. The perfection of integral indicators is a pivot of sustainable evolution and reinvention, whose pillars are the economy's transition to saving resources and reducing pollution by neutralizing negligent habits, social justice based on rearranging free nature for all people, and environmental protection that goes beyond the obsolete industrial system's boundaries. Over a sustained effort in research, collaboration, and the process of innovating methods, we can reference better and all-embracing measures of sustainable development. Only with such developments can we successfully navigate the intricacies of this networked globe while making wise decisions toward a robust and cost-effective future.

Based on the detailed analysis and descriptions provided in the preceding chapters, it's clear that there are several key indicators that are commonly used across multiple methods to assess and quantify sustainable development, economic growth, and environmental impacts. Among those are GDP and its adjustments, HDI, as well as indicators of natural resource depletion and ecological impact such as carbon emissions and water/land use. These are often considered critical components in gauging the sustainable development of a region or country.

In the previous chapters the author has discussed various indicators and integral indices aimed at evaluating sustainable development. In the next chapter various approaches to regional development are investigated.

2.2. Regional development strategies and approaches

2.2.1. Approaches to regional development

In countries with a market economy, regional development is usually seen as unvital, as it tends to be viewed as a tool to fix market imperfections. Regional development is not analyzed as external to the market; therefore, regional development is not given enough attention. Even in developed countries, such as the USA, for example, regional development is a relatively new

direction. In mixed economies, regional development is traditionally used to eliminate inter-regional income disparities and employment opportunities (Silva et al., 2021). It is aimed at welfare improvement, not just efficiency. When examining the long-term effect of regional development planning, most of the attention goes to employment indicators. In a planned economy, regional development was always used as a pathway to increased economic efficiency.

Without a doubt, regional development calls for a sophisticated strategy. The goal is to simultaneously analyze and influence many aspects of economic, ecologic, and social processes, regardless of the geographic, economic, or political structure of a place (Mityagin et al., 2017). The interconnection of location and time contributes to the complexity of regional development, which must be taken into account. Since many regional processes are inactive and contain temporal indivisibility, it is necessary to investigate uncertainty and long-term possibilities (Cziráky et al., 2006). We might propose that it is helpful to assess how systems-analytical methodologies fit into the process of regional development based on the logic that has been established. Following a brief overview, a foundation for practical research can be established with the use of historical analysis and comparison of various methodologies.

Leontyev (1951) introduced his work on regional development modeling with the "input-output" concept. Meanwhile, Isard (1951) adapted this method to formulate an interregional "input-output" model. Despite this model being introduced such a long time ago, up to the present day, it has not become widely spread, unlike Leontyev's concept, which was quite successful. It was applied in different countries at all geographic levels. Spatial models of general equality are insufficient due to the lack of statistical data for their acceptance or rejection. LaFeber (1958) introduced this type of model; however, its trial in the transportation sector created drawbacks. Theoretical location analysis conducted by Koopmans and Beckmann (1957), as well as classic research by Hotelling (1929), point out various reasons for the fact that market relations cannot, even theoretically, be sustained in a multi-regional system. Koopmans and Beckmann highlight the indivisibility of some factors as one of the explanations for this, while Hotelling sees the problem in the small number of shareholders. Despite the general equilibrium of regional development, models are rare, and some of the newest theories and concepts are indirectly based on the equilibrium concept.

Later, there was a noticeable development of equilibrium models in research of inner-regional models of land use. These models, also known as "new models of urban economics," come from the works of Alonso (1964) and Muth (1969) on the functioning of the urban real

estate market. These models were applied to many territories, especially together with models of urban transport. On the regional and municipal level, there is an increased interest in various models of land- and transport use. First large-scale models of urban and regional processes fall under this category. Some of them, including the "urban multiplication" model introduced by Loury (1964), were quite successful, leading to the development of new models named "special interaction models."

Moreover, there is no fundamental difference between regional development models in different countries, whether it is East or West. On the other hand, in the past few decades, there have been many changes in the problems that shareholders undergo at both regional and national levels. Due to economic development, regions have become more vulnerable to external changes that are outside of regional or even national control (Shahraki, 2017). The problem of resource depletion becomes frontal, and stakeholders are fighting for increased standards regarding natural resources use and environmental preservation, especially when it comes to their regions.

The strategy of economic development of regions is the system of actions aimed at the implementation of long-term goals of socio-economic development of the country, taking into account rational input of regions into a solution of various problems. The strategy of regional economic development changes according to the socio-economic and political orientation of the country during the indicated development period. Regional development strategies tend to vary from region to region, which is due to the noticeable differences in resource allocation, the structure of the economy, the level of development of various industries, and other factors. In the last few decades, there was an increase in regional independence that brings along higher responsibility for the results of regional economic development (Umanto, 2019). The socio-economic situation within regions is identified via both objective (macroeconomic conditions, natural resources, geographic location, etc.) and subjective factors, as well as via methods of regional management.

Recently, after a number of economic reforms across the globe, it became clear that regions that apply progressive methods of development management are less affected by crisis tendencies. When it came to a fighting crisis, the most successful regions were those that used adequate methods and instruments of development management (Berglund & Johansson, 2007). Socio-economic regional development - is a central function of the regional government, which becomes especially topical during crisis times and continuous structural alternations (Makkonen, 2011). Regional development management can be performed via a wide spectrum

of actions, through which local government stimulates economic development, creates new jobs, increases tax budget, etc.

When analyzing the quality of regional development, it is useful to apply the concept of growth stages. According to this concept economic development goes through three main stages: pre-industrial, industrial, and post-industrial. When it comes to the pre-industrial stage, the dominating industries include agriculture, fishery, forestry, and extractive industries (Lonska, 2021). On the industrial stage – processing industries, such as automobile, chemical, food industry, etc. Finally, the post-industrial stage focuses on intangible production – science, education, trade finance, insurance, healthcare, etc. (Brekke, 2015). Key characteristics of post-industrial society are a relative decline in production of goods and increase in the provision of services, increased science intensity of production, rise in the personnel qualification level, as well as outstripping internalization of production. From this point of view Uzbekistan is considered to be mainly on the pre-industrial stage.

Trends and tendencies of economic development of modern society lead to a conclusion that intangible production is the predominant area of employment, the predominant direction of investment, and a factor of prosperity for contemporary society. In other words, intangible production is the new paradigm of modern economic development. Economic development at present is not just a quantitative increase but rather qualitative changes. At this stage, the most efficient instruments are believed to be strategic management and regional marketing (Isyanbaev, 2018). Strategic regional management are known to be helpful in industries, as well as in agriculture, transportation, and other areas. Not only can it be used in the development of complex socio-economic development of regions, but also in the application of anti-crisis measures in regions, in management of big infrastructure projects, and in other directions of regional development. The main question that is being addressed by the strategic regional development plan is how to fight the crisis, increase the well-being of the population, and set up a foundation for its further rise (Oktay & Gozgor, 2013). The priority is given to the creation of conditions that provide an optimal level of life quality for people. The cycle of strategic regional development management is presented in the Figure 2.7.
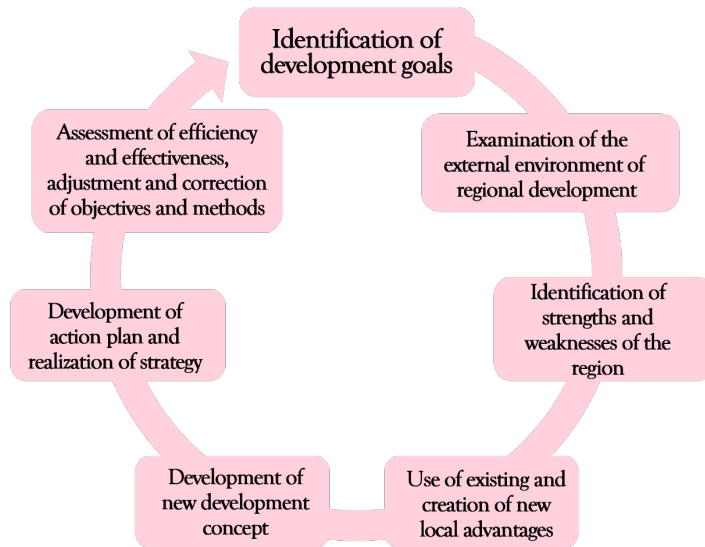
Figure 2.7 The cycle of strategic regional development management

(Developed by the author)

When in many regions, post-industrial tendencies of socio-economic development occur at the present stage, it is vital to identify regional advantages in both tangible and intangible production (Jha, 2013). The region is to "export" its services to other regions. Service production can attract resources and promote welfare development just as well as the production of material goods. Finance, insurance, consultancy, audit, IT, education, and healthcare are among the top economic activities that can promote regional development; therefore, it is important to plan regions based on what the region can potentially offer to its inhabitants as well as to other regions (Silva et al., 2021). One important factor of regional development is the presence of quality communication infrastructure. Regional development is a continuous process that sets the direction for decision-making (Galvão et al, 2020). The presence of a long-term plan allows for carrying out decisions on a well-grounded foundation. Moreover, the information age, characterized by a higher degree of uncertainty, rapid changes in the market, and the impact of globalization, creates new demands. Today, the resources that the region possesses are not as important as the abilities of regional authorities and businesses to respond to market challenges, to quickly adapt existing resources, as well as develop and create new ones.

2.2.2. Regional typology and its use for regional development

One of the key problems of regional development is the identification of developmental goals and the selection of tools for the decomposition of these goals for specific territorially realized programs. One of the reasons for such challenges is due to the incorrect positioning of the region which can be addressed by putting different regions in groups based on their typology, which unites the socio-ecologic-economic development strategy of selected regions and a country as a whole.

Regions from one and the same group tend to have similar conditions, development trends, and indicators of social, ecologic, and economic development. Differentiation of regions allows using similar development models as well as methods and instruments of economic regulations on the macro-management level (Ariaans et al., 2021).

Currently, there are five main approaches to the classification of regions:

1. In the first group, it is suggested to divide regions based on indicators, such as investment volumes, industrialization speed, type of economy, population density, etc.;

2. In the second group, regions are differentiated according to the set of features, for instance, investment risk and potential or Gross Regional product;

3. Regions in the third group are selected in accordance with the problems and challenges of regional development, for example, stagnant regions, depressive regions, pioneer regions;

4. The fourth group is aimed at realization its own economic policies. For example, there are planning regions that have economic management institutions and "planned regions" that do not have such institutions.

5. This approach divides regions according to their goals to tackle specific economic, ecological, or social problems.
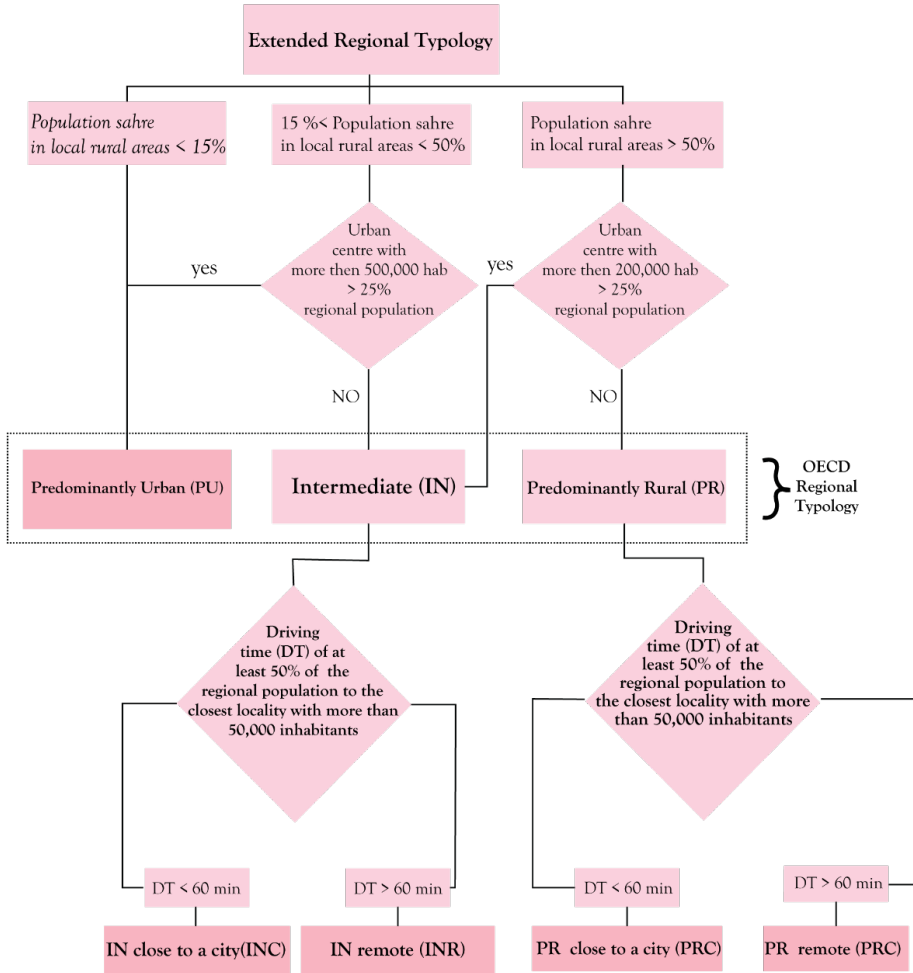
Figure 2.8. Regional Typology (OECD, 2011)

Additionally, OECD proposed dividing regions according to the population density (Figure 2.9). The opportunity to evaluate the region for its further allocation to one of the aforementioned groups is very important for the improvements in regional development planning. The assessment needed for the differentiation helps identify key problems or main indicators of the regions, which can then be used to find the best available techniques used in other regions with the same indicators and proven to be successful.

2.2.3. Female empowerment in regional development context

Urban areas tend to be packed with various business headquarters as most companies prefer either to locate their operations within cities (especially regional capitals) or at least have their branches be present there. Therefore, when looking at possibilities of sustainable management of urban areas, it is pivotal to consider how entrepreneurship fits into the planned prospects. Despite the fact that women comprise over 35 percent of the global workforce, female entrepreneurial activities are still far from being equal to men (World Bank, 2020). There is a number of research done on the topic of the need for more female leaders and entrepreneurs, due to many factors, for instance better communication within the company, introduction of new ideas, and a transformational style of management (Milliken et al., 1996). Agarwal et al. (2020) argue that women display better capabilities, including creativity and innovative mindset, social awareness, and better abilities to identify opportunities, along with excellent leadership skills. These abilities are vital to achieving sustainability and improving the well-being of societies.

Entrepreneurial activities are essential for ensuring regional economic vibrancy and are directly linked to job creation. Some studies show that social and environmental objectives involved in sustainable entrepreneurship activities are attractive for female entrepreneurs (McKinsey, 2021). Sustainable entrepreneurship, in turn, empowers more women, as women's motivation for sustainability and entrepreneurship comes from the example of other successful women (Outsios and Farooqi, 2017). Thus, the creation of a safe space for sustainable entrepreneurship for women brings about a domino effect of positive outcomes:

1. When women are encouraged to run their business and are given enough resources to do so, they become more financially secure, which consequently leads to a higher power in decision-making in households and thus better life conditions for the kids in this household;

2. When women open their businesses or are in leadership positions in other companies, they are more likely to hire women to work for them and are less likely to offer them lower salaries than their male counterparts. This way, the effect of better decision-making chances and better living conditions for everyone in households' spreads to all the employed women;

3. Seeing a number of women that succeed in their business, more and more women will be encouraged to follow their paths; therefore, everything mentioned above will be multiplied;

4. When there are enough women in power, they will be able to adjust the conditions so that they attract more and more women, creating more and more jobs. In simpler terms, when most businesses are run by men and women barely have any power, they have little-to-none opportunities to change the toxic and unwelcoming environment around them. However, when there are more women entrepreneurs, that can make some changes in the existing structure of things, making regions more sustainable.

There is evidence that women tend to ground businesses based on the social problems or ecological challenges they identify around the area they live in (Spiegler, Halbestadt, 2018). Not only does female entrepreneurship focus on financial benefits, but also on social impact. Male entrepreneurs, on the other hand, are traditionally focused on profit maximization, ignoring the possible negative externalities. All the evidence proves the importance of incorporating women's needs for starting their businesses when planning regions.

There are several organizations and programs that promote female economic empowerment. In such organizations, women are encouraged to gain autonomy and build social capital through collective action around remunerated economic activities (Kabeer, 2018). One of the most widespread intervention strategies is Self-Help Groups as well as various associative forms, such as producer cooperatives. Self-Help Groups (SHGs) are small groups of women in which members save up small amounts of money. Additionally, the access to financial credits, when possible, training, and local and international cooperation. This collective growth eventually leads them to further involvement in political, social, and economic activities (Brody et al., 2017).

Such groups are quite common in Asian countries, where they work in areas ranging from public health campaigns to consumer associations. In their extensive meta-analysis, Brody et al. (2017) demonstrate a positive impact of such groups on the political and economic empowerment of women that happens due to their access to training, resource, exposure to financial management and discussion, feeling of safety, solidarity and trust within groups and other factors. Nevertheless, since women become more autonomous when participating in such

groups in the long term, they may become more exposed to domestic violence (Castiblanco and Raigosa, 2020).

Unlike SHGs that try to build social and economic capital, cooperatives start from the existence of such endowments. They offer the possibility to benefit from economies of scale through participation in collective property projects and accessing training and education while working on tasks that contribute to the community (Dohmwirth and Liu, 2020). Cooperatives enable the acquisition of capital goods for production, increase productivity and have the potential to improve bargaining power (Othman et al., 2020). Additionally, they make it possible to develop marketing strategies focused on the gender of the producers (Cuellar-Gomez, 2009). Such benefits help females increase their income, become more valued in their communities, and overcome gender-based discrimination (Bastida et al., 2020, Okechukwu and Agbodike, 2016).

There are, however, some disadvantages of cooperatives. Duguid and Weber (2016) state that most cooperatives have entry criteria that usually imply having land or other resources. This practice excludes the poorest and, thus, the most vulnerable women from the cooperative scheme. Additionally, women must face triple working hours -care, cooperative work, and cultivation and lack chances to participate in management and decision-making because of gender discrimination, lower education, and self-confidence levels (Lyon et al., 2017; Montanari and Bergh, 2019).
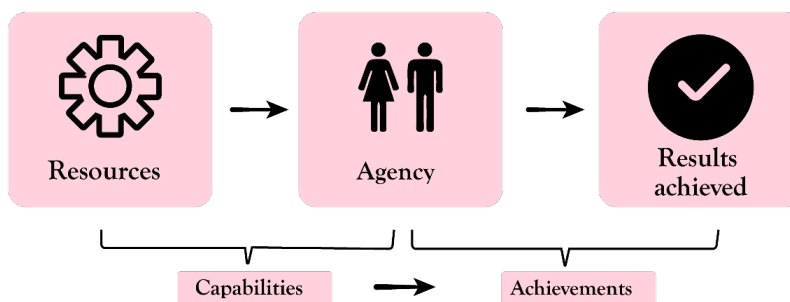
Figure 2.12 Dimensions of ability to choose. Empowerment process
(Castiblanco Moreno & Pineda Duque, 2021)

Empowerment can be described as an ability to make strategic decisions (Kabeer and Huq, 2010). This ability can only be acquired from controlling resources that enable women to develop their sense of agency. The historical oppression and subordination of women, however,

restricted them from exercising their choice. The ability to choose, on the other hand, incorporates three interlinked dimensions: agency, resources, and achievements (Figure 2.12). Thus, if we want to plan regions in such a way that we empower women and get closer to sustainability, we must ensure that women at least have access to resources. This can be achieved through building centres in which women can go through training, share skills and knowledge, ask for psychological or other help, etc.

Urban areas, being hubs for business operations, require sustainable planning that incorporates entrepreneurship, particularly promoting female entrepreneurship. Research shows that women possess vital skills for sustainability and societal well-being, and their involvement in sustainable entrepreneurship can create a domino effect of positive outcomes.

Organizations and programs promoting female economic empowerment, such as Self-Help Groups and cooperatives, offer opportunities for financial growth, education, and community involvement. Therefore, such programs and organisations shall be paid enough attention when planning regions. In the next chapter the author presents an empirical analysis with a proposition of urban sustainability evaluation methodology.

3. EVALUATION OF URBAN SUSTAINABILITY IN UZBEKISTAN

3.1. Research methodology

As was previously mentioned, this research aims to develop a methodological approach to assessing the level of sustainability of the development of the ecological, social and economic systems in urban areas of Uzbekistan. In order to fulfil this purpose, the research evolved through two approaches.

The first stage is a literature review, which is based on the analysis of those theoretical concepts that allow the gathering of the required information related to the topic of the research (Fellow and Liu, 2008). This part of the current research was presented in the previous chapters of this work. The second stage constitutes a collection of empirical data that elaborates on the findings from the literature review and promotes further in-depth analysis of the topic.
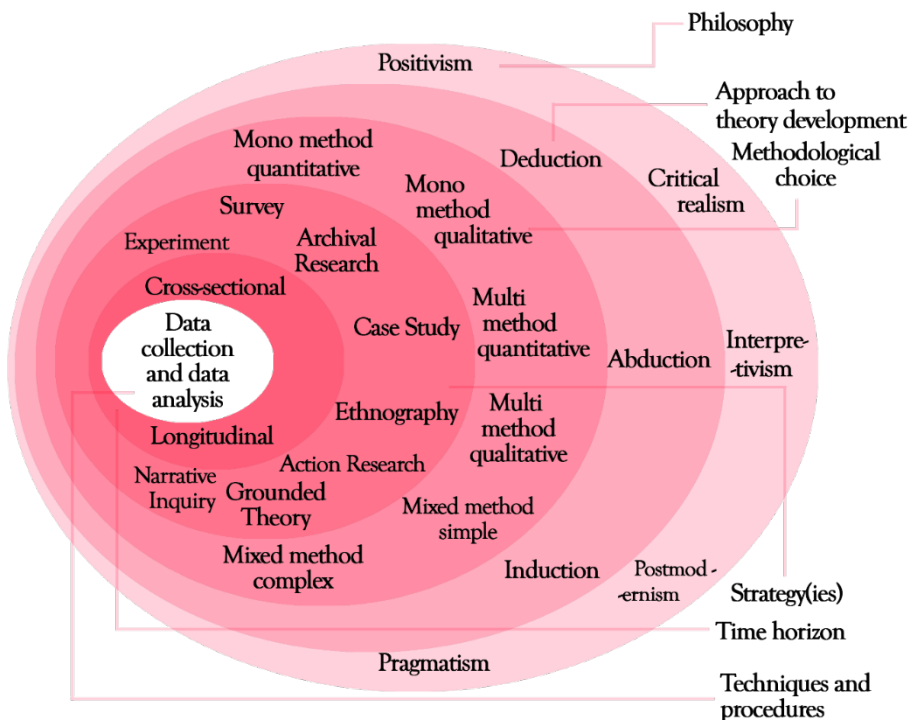
Figure 3.1 Saunders' Research Onion Ring Diagram (Saunders et al., 2007)

The methodology applied in this thesis used Saunder's Research Onion Ring model (Saunders et al., 2019). According to this concept, the methodology of research is defined by a specific:

- Research philosophy;
- Philosophical stance;
- Research approach;
- Strategy;
- Method;
- Time horizon.

As is seen in the diagram (Fig. 3.1), the first step when developing a methodology for the research is choosing the appropriate research philosophy. There are two philosophies generally used in research: ontology and epistemology. Ontology, or the "study of being," is concerned with something that already exists in the world and what humans can collect information about. Epistemology, on the other hand, is the "study of knowledge." It is concerned with the aspects of validity scope and methods of acquiring knowledge. Key questions when it comes to epistemology are:

- What makes up a knowledge claim;
- How can it be acquired or produced;
- How can we access the extent of the transferability of the knowledge.

When looking at the relationship between a subject and an object, the idea of epistemology and how it impacts the research design can be explored.

In this research, the author use epistemology, which is believed to address the issue of knowledge's nature and states that knowledge should be produced in an objective manner and independently from the ethics of those conducting research (Killam, 2013). The next step would be selecting the philosophical stance.

As this step derives from the previous one, there are interpretivism, positivism, and critical realism to select from. The most applicable to the current research would be critical realism, according to which: a) the research is autonomous from the research object; b) the research is conducted via the production of one or more questions/hypotheses that are supposed either approved or conflict the existing knowledge after testing, and finally c) an existing belief or theory can be questioned at any time due to the development of state-of-art research methods

(Killam, 2013). One of the reasons for choosing exactly this stance is that it allows us to understand how different factors of a certain phenomenon are intertwined, leading to specific data within the experimental field. Additionally, critical realism enables analyzing the circumstances in the most creative manner, allowing to avoid potential complications while reaching theories that are simultaneously modified in the ultimate target of the revelation of the truth behind circumstances (Frauley and Pearce, 2007). Thus, this philosophical stance is the most appropriate for the following research.

The next step is making a choice between deductive and inductive approaches. Considering the fact that the aim of this research is to progress the investigation via collecting data by closely linking it to the purpose and objectives of this research, meaning to unfold the research from more general issues and concepts to more specific ones, it has been decided to follow the deductive approach. A step-by-step structure of research methodology is presented in Figure 3.2.
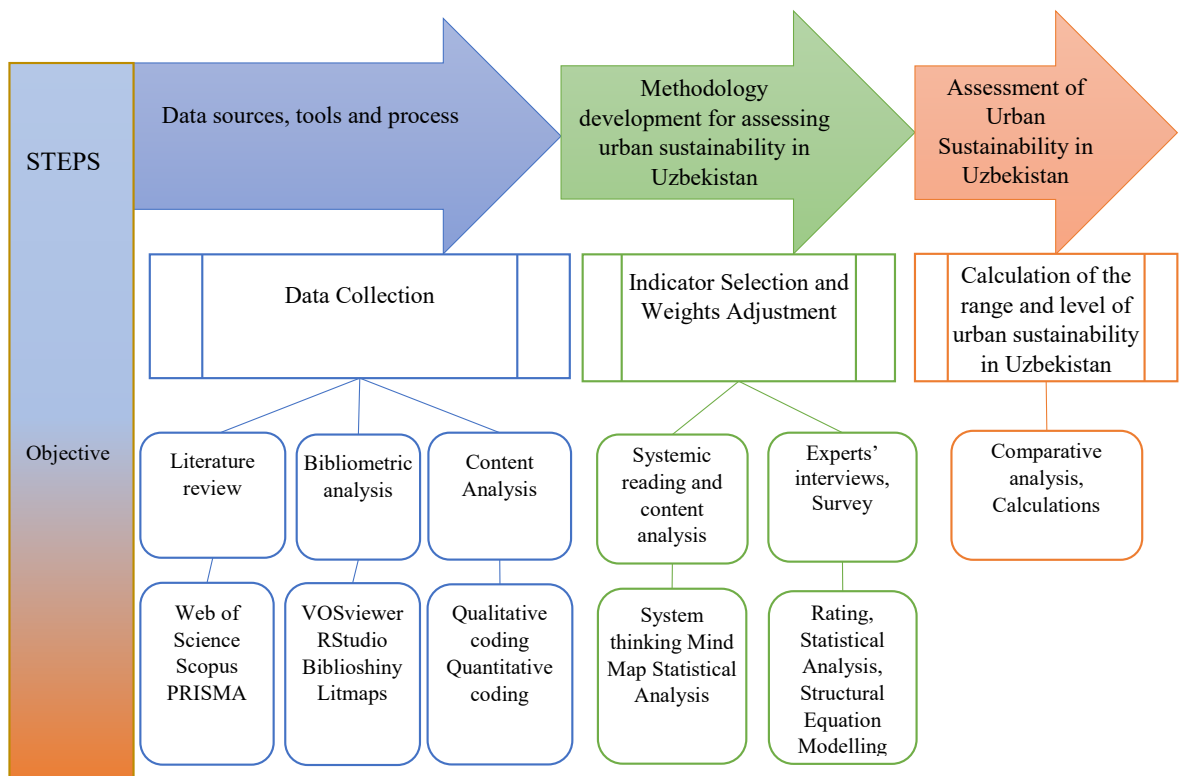
Figure 3.2 The step-by-step structure of the research methodology.

The methodology of this research is mainly based on indicators of great significance since they help examine the vast amount of data and assist in retrieving the necessary information. The selection of the indicators is a complex task because they need to meet a number of requirements, for instance, comprehensiveness, representativeness, independence, availability of data, and relevance (Tao et al., 2019). The indicator selection process applied in this research can be grouped into four consecutive steps, considering the aforementioned criteria (Figure 3.3).
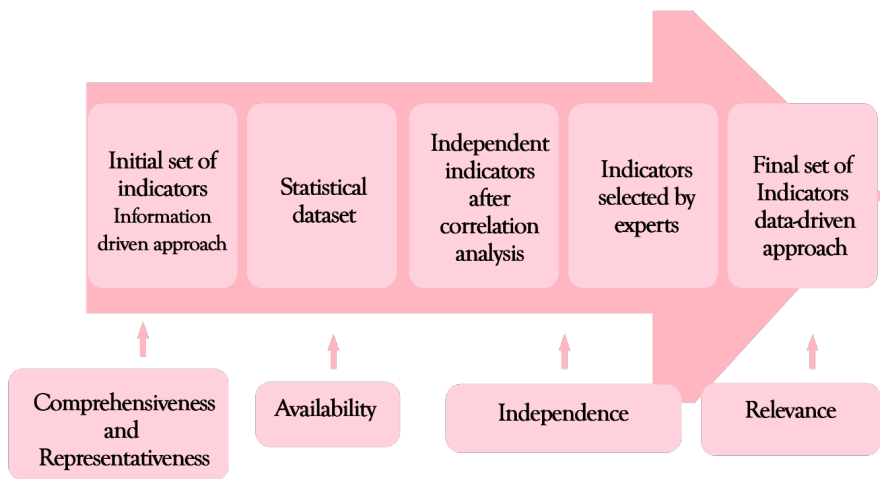
Figure 3.3 Indicator selection process (Developed by the author)

A step-by-step flow-chart of methodology development that comes after final selection of indicators is presented in Figure 3.4.

First, comprehensiveness and relevance were the primary factors for collecting variables and setting up the initial set of indicators. All of the analyzed in the previous research sustainability dimensions were to be covered. The author have selected 58 indicators to access urban sustainability in Uzbekistan. This information-driven selection process presents a comprehensive set of variables that need to be reduced, considering further requirements and developing a data-driven set of indicators (Buzasi and Csete, 2017). Secondly, the author had to check the availability of the statistical data and reduce the number of previously selected variables, which left us with 32 indicators. At this stage, the data sources are screened to reveal potential gaps in the information for the applied methodology and time series. Then, the correlation analysis is computed to ensure statistical independence throughout the variables to

exclude potential duplications. The next step was to conduct a qualitative analysis with the experts to sort out which of the selected indicators were the most applicable to the indicated for the analysis region and weigh them.
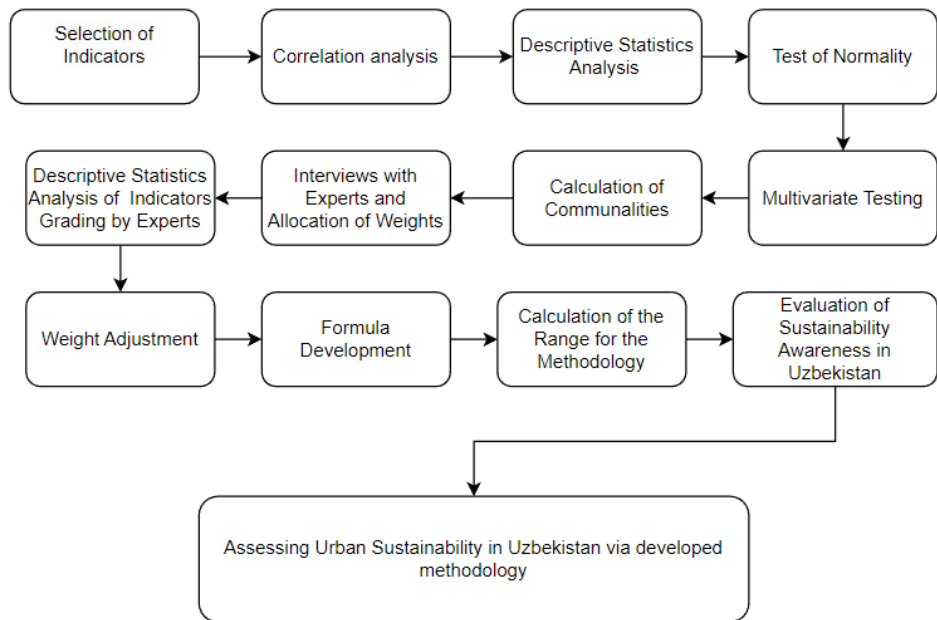
Figure 3.4 Process of formula development (Developed by the author)

The use of quantitative indicators is highly recommended in sustainability studies (Ali-Toudert et al., 2019). Thus, the author has applied quantitative variables in this research. The process of selecting relevant indicators is one of the most challenging parts of the evaluation of urban sustainability (Huovila et al., 2019). It is essential to exclude subjectivity from this process; however, in analytical studies, personal experiences and knowledge are virtually impossible to be dismissed, hence the analysis of experts' opinions, which aims to the elimination of subjective pressure on the outcome of the research.

This research aims to develop a methodological approach for assessing the sustainability of ecological, social, and economic systems in urban areas of Uzbekistan. The study involves a literature review and the collection of empirical data. The research methodology relies on indicators to examine data and retrieve necessary information. In the next chapter the author

will attempt to select indicators relevant to Uzbekistan context and develop a formula to evaluate urban sustainability in the country.

3.2. Development of urban sustainability assessment methodology

3.2.1. Formula development and statistical analysis

At this stage of the research, the author aims to design an evaluation formula to assess the degree of sustainability of urban development in Uzbekistan. Figure 3.5 illustrates the research's conceptual model based on the findings from chapters 1 and 2 of the thesis. In the first chapter, the author analyzed the concept of sustainability and the problem of sustainable development in Uzbekistan. Chapters two and three discuss the theoretical principles of urban sustainability, sustainability indicators and their application in regional development planning. Based on these results as well as data availability, the following research model has been developed.

Panel data from Uzbekistan for the years 2007 through 2021 is used to build such a formula. The primary purpose of this investigation is to use panel data regression models to identify the key sustainability factors that change over time. The panel data technique was chosen because it applies all available observations for subsequent time periods, which is superior to cross-section and time-series data (Kumari and Sharma, 2017).

Following the most relevant papers on drivers of sustainability discussed in the theoretical part of this research and analysis of data availability, 32 existing indicators to be included were selected in the formula together with "awareness", an indicator proposed in this research. The rationale for the selection of these indicators is presented in Appendix 9. However, two indicators, gender disparity in primary and secondary education, were omitted because, upon closer inspection, we found that they were not exponential. Additionally, since life expectancy is already included in Human Development index, it was removed as well. Political Rights Index was also taken off the list because it showed no variance. Following the initial exclusion procedure, the author provided the following formula to show how the dependent variable has changed in relation to each of the independent variables, which are listed as follows:

$$S = f\ (HFBD_t,\ PSI_t,\ HRRLI_t,\ HDI_t,\ WP_t,\ RFM_t,\ PUP_t,\ HSpC_t,\ DR_t,\ MM_t, UR_t,\ ID_t,\ PUPADW_t,$$
$$ANE_t,\ RDE_t,\ CPI_t,\ CLI_t,\ EUpC_t,\ CDE_t,\ INR_t,\ RPG_t,$$
$$EG_t,\ CI_t,\ HC_t,\ ERF_t,\ LFF_t,\ FDI_t,\ VAI_t,\ A_t), \tag{3.1}$$

where:

S – urban sustainability;

HFBD=Human flight and brain drain index, 0 (low) - 10 (high);

PSI=Public services index, 0 (high) - 10 (low);

HRRLI=Human rights and rule of law index, 0 (high) - 10 (low);

HDI=Human Development Index (0 - 1);

WP=Women in parliament, percent;

RFM=Ratio of female to male students in tertiary level education;

PUP=Percent urban population;

HSpC=Health spending per capita;

DR=Death rate, per 1000 people;

MM=Maternal mortality per 100,000 live births;

UR= unemployment rate, percent

ID=Infant deaths per 1000 live births;

UPADW=Percent urban population with access to drinking water;

ANE=Alternative and nuclear energy, percent of total energy use;

RDE=Research and development expenditure, percent of GDP;

CPI=Corruption Perceptions Index, 100 = no corruption;

CLI=Civil liberties index, 7 (weak) - 1 (strong);

EUpC=Energy use per capita;

CDE=Carbon dioxide emissions per capita;

INR=Income from natural resources, percent of GDP;

RPG=Renewable power generation, billion kilowatt hours;

EG=Economic growth: the rate of change of real GDP;

CI=Capital investment as percent of GDP;

HC=Household consumption as percent of GDP;

ERF=Unemployment rate for females;

LFF=Labor force, percent female;

FDI=Foreign Direct Investment, percent of GDP;

VAI=Voice and accountability index (-2.5 weak; 2.5 strong);

A=awareness;

t = at year t

The proposed "gender equality and female empowerment group" includes labour force and unemployment among women, women in tertiary education and women in parliament. While there are lower levels of country's management, such as city council and other local administrations, there is no data on women's participation in them. Additionally, considering that governance in Uzbekistan is highly centralized, local administrations mostly represent executive and not legislative power, thus making the parliament the most influential body even when it comes to specific urban areas.

At this stage of the research, the author aims to design an evaluation formula to assess the degree of sustainability of urban development in Uzbekistan. The formula for urban sustainability evaluation is meant to be applied to country's indicators, however it can be used to analyze territorial regions within the country. Currently, the data for Uzbekistan is only available at the state level, no evaluation of separate regions is possible. Although, most indicators can be related to both urban and rural environments, considering the fact that urban areas have a noticeably higher level of consumption and drive the development of regions it can be said that these indicators are appropriate for evaluating urban sustainability (i.e. household consumption, dioxide emissions, brain drain, etc. are higher in urban areas, while economic growths, capital investment, etc. also tend to initiate in urban areas and only after spread to rural areas). Overall, considering the regional peculiarities of Uzbekistan urban development has a very strong influence on the development of rural areas, therefore urban development is seen as a primary step. Additionally, while these indicators can be applied to other countries, especially in the neighboring region, on of the criteria for selecting them was data availability. Thus, the data for some indicators may not be available in other countries, and on the contrary, there maybe a possibility to include other indicators, considering their availability.
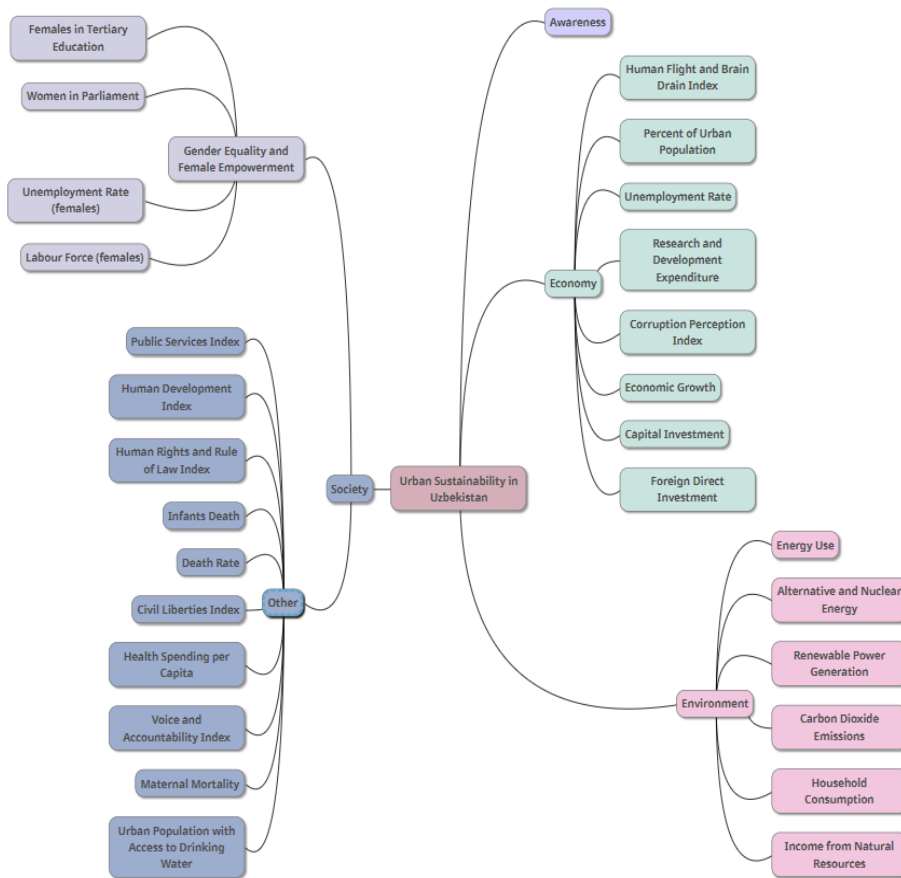
Figure 3.5 Classification of urban sustainability indicators in Uzbekistan context
(Developed by the author)

Before proceeding to the data normalization step, a correlation analysis is to be performed to determine whether all the selected above indicators have statistical significance in the analysis. Since in situations with two independent variables being highly correlated, there is a possibility to run into a multicollinearity conundrum leading to the regression model being unreliable, there is a need to check the level of correlation between various independent variables. Sustainability awareness is the newly proposed indicator; accordingly, there is no panel data for it, so no correlation analysis is done on this indicator. Later in this research, the author will offer an awareness evaluation method and apply it to the Uzbekistan population. The results of the correlation analysis are presented in Appendix 10. It is essential to eliminate

variables with a strong positive correlation to avoid multicollinearity. To do so, the author looks for variables with a correlation that equals or exceeds +0.8. As you can notice in the correlation chart provided in the Appendix 9, there are no such observations.

Once the indicators for further analysis have been selected, there is a need to run a descriptive analysis via SPSS. The definitions of used variables and descriptive statistics for a 15-year period are presented in the table 3.1. Each variable has the same number of observations (n=15), which balances the data.

Table 3.1

Definitions of variables and descriptive statistics for 15 years (Developed by the author)

Variable	Description	Mean	Min>Max	Std. Deviation
HFBDI	Human flight and brain drain index, 0 (low) - 10 (high)	6.200	5.2>7.1	0.6199
PSI	Public services index, 0 (high) - 10 (low)	5.487	4.1>6.8	0.8806
HRRLI	Human rights and rule of law index, 0 (high) - 10 (low)	8.853	7.6>9.4	0.6221
HDI	Human Development Index (0 - 1)	0.68800	0.646>0.720	0.024434
WP	Women in parliament, percent	20.800	16.0>33.0	5.4766
RWMS	The ratio of female to male students in tertiary level education	0.6887	0.60>0.88	0.08911
UP	Percent urban population	50.5767	49.51>51.15	0.42404
HSPC	Health spending per capita	97.7353	46.68>131.83	25.48139
DR	Death rate, per 1000 people	4.973	4.6>5.8	0.2963
MM	Maternal mortality per 100,000 live births	30.53	28>35	2.167
IDR	Infant deaths per 1000 live births	20.907	13.0>32.0	5.7930
UPADW	Percent urban population with access to drinking water	85.747	85.1>86.1	0.3642
AE	Alternative and nuclear energy, percent of total energy use	1.3487	0.79>1.77	0.29890
RDE	Research and development expenditure, percent of GDP	0.1633	0.12>0.22	0.02664
CPR	Corruption Perceptions Index, 100 = no corruption	20.00	16>28	3.928
CLRI	Civil liberties index, 7 (weak) - 1 (strong)	6.80	6>7	0.414
EUPC	Energy use per capita	1502.2573	1300.00>1823.31	151.83816

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CDEPC	Carbon dioxide emissions per capita	3.6113	2.70>4.55	0.61599
INR	Income from natural resources, percent of GDP	16.8647	6.25>34.52	7.97714
RPG	Renewable power generation, billion kilowatt hours	6.3467	4.44>8.35	1.08479
EG	Economic growth: the rate of change of real GDP	6.7113	1.71>9.47	1.91453
CII	Capital investment as percent of GDP	30.7380	25.76>42.07	4.90610
HC	Household consumption as percent of GDP	60.2807	49.45>66.29	5.03438
URF	Unemployment rate for females	6.0113	4.72>13.30	2.11099
LFF	Labor force, percent female	40.4513	39.44>41.61	0.65490
FDI	Foreign Direct Investment, percent of GDP	2.2687	0.95>3.87	0.96531
VCI	Voice and accountability index (-2.5 weak; 2.5 strong)	-1.8993	-2.12>-1.54	0.20974

Then the author performed normality tests to measure the distribution specifics. Normality tests are employed to determine whether a data set is well-modelled by a normal distribution. Additionally, they are used to compute how likely a random variable is to be distributed normally. There are different ways to test normality, but the most common ones are the Kolmogorov-Smirnov and Shapiro-Wilk tests. When conducting these tests, the p-value (Sig. in SPSS) needs to be considered. The null hypothesis that the data are normally distributed is rejected if the generated p-value is less than 0.05. The null hypothesis is not disproved if the p-value is higher than 0.05, indicating that the chosen data is regularly distributed. As you can see in the Table 3.2, the data for each indicator chosen for this research is distributed normally.

Table 3.2

Test of Normality (Developed by the author)

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Voice and accountability index (-2.5 weak; 2.5 strong)	.152	15	.200[*]	.873	15	.047
Human flight and brain drain index, 0 (low) - 10 (high)	.107	15	.200[*]	.942	15	.414

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Foreign Direct Investment, percent of GDP	.197	15	.122	.906	15	.117
Labor force, percent female	.093	15	.200*	.971	15	.869
Unemployment rate for females	.312	15	.045	.555	15	.066
Household consumption as percent of GDP	.242	15	.076	.868	15	.071
Capital investment as percent of GDP	.221	15	.047	.848	15	.068
Economic growth: the rate of change of real GDP	.200	15	.110	.908	15	.128
Renewable power generation, billion kilowatthours	.145	15	.200*	.961	15	.702
Income from natural resources, percent of GDP	.119	15	.200*	.947	15	.478
Carbon dioxide emissions per capita	.143	15	.200*	.931	15	.281
Energy use per capita	.307	15	.065	.841	15	.047
Civil liberties index, 7 (weak) - 1 (strong)	.485	15	.073	.499	15	.062
Corruption Perceptions Index, 100 = no corruption	.228	15	.055	.867	15	.050
Research and development expenditure, percent of GDP	.216	15	.057	.939	15	.373
Alternative and nuclear energy, percent of total energy use	.149	15	.200*	.944	15	.430
Percent urban population with access to drinking water	.196	15	.124	.861	15	.045
Infant deaths per 1000 live births	.162	15	.200*	.948	15	.489
Maternal mortality per 100,000 live births	.160	15	.200*	.920	15	.192
Death rate, per 1000 people	.264	15	.076	.826	15	.048
Health spending per capita	.116	15	.200*	.951	15	.544
Percent urban population	.223	15	.064	.912	15	.145
Ratio of female to male students in tertiary level education	.249	15	.073	.838	15	.112
Women in parliament, percent	.280	15	.082	.778	15	.073
Human Development Index (0 - 1)	.115	15	.200*	.938	15	.356
Human rights and rule of law index, 0 (high) - 10 (low)	.327	15	.073	.724	15	0.72
Public services index, 0 (high) - 10 (low)	.139	15	.200*	.945	15	.456
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Next, the author produced the multivariate analysis. Multivariate testing is a technique for testing a hypothesis in which multiple variables are modified. The goal of multivariate

testing is to determine which combination of variations performs the best out of all of the possible combinations. Pillai's trace is a test statistic produced by a multivariate analysis of variance. It is a value that ranges from 0 to 1. The closer Pillai's trace is to 1, the more substantial the evidence that the explanatory variables have a statistically significant effect. Pillai's trace test statistic gives more robust results than other tests and is considered the most <u>potent</u> and <u>robust</u> statistic for general use; thus, the author will lean on its values in the Table 3.3. As you can see, Pillai's Trace result in the multivariate analysis equals 0.9, meaning that the variables are statistically significant.

Table 3.3

Multivariate Tests (Developed by the author)

Multivariate Tests[a]		Value	F	Hypothesis df	Error df	Sig.
Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.894	4501747.073[b]	14.000	1.000	<.001
	Wilks' Lambda	.671	4501747.058[b]	14.000	1.000	<.001
	Hotelling's Trace	63024458.818	4501747.058[b]	14.000	1.000	<.001
	Roy's Largest Root	63024458.818	4501747.058[b]	14.000	1.000	<.001
a. Design: Intercept						
b. Exact statistic						

Last but not least, the author calculated the communalities. Communalities indicate the amount of variance in each variable that is accounted for. Initial communalities are estimates of the variance in each variable accounted for by all components or factors. For principal components extraction, this is always equal to 1.0 for correlation analyses. A variable's communality ranges from 0 to 1. In general, one way to think of communality is as the proportion of shared variance found in a particular variable:

- A variable with no unique variance (i.e., one with an explained variance that is 100% a result of other variables) has a communality of 1.

- A variable with a variance entirely unexplained by any other variables has a communality of zero.

As shown in the Table 3.4, most of the extracted values are around 0.9, and none is lower than 0.6.

Table 3.4

Communalities (Developed by the author)

Communalities	Initial	Extraction
Human flight and brain drain index, 0 (low) - 10 (high)	1.000	.914
Human Development Index (0 - 1)	1.000	.986
Voice and accountability index (-2.5 weak; 2.5 strong)	1.000	.972
Foreign Direct Investment, percent of GDP	1.000	.837
Labor force, percent female	1.000	.990
The unemployment rate for females	1.000	.714
Household consumption as percent of GDP	1.000	.952
Capital investment as percent of GDP	1.000	.862
Renewable power generation, billion kilowatt/hours	1.000	.921
Economic growth: the rate of change of real GDP	1.000	.648
Income from natural resources, percent of GDP	1.000	.915
Carbon dioxide emissions per capita	1.000	.926
Energy use per capita	1.000	.894
Corruption Perceptions Index, 100 = no corruption	1.000	.944
Civil liberties index, 7 (weak) - 1 (strong)	1.000	.889
Percent urban population with access to drinking water	1.000	.978
Research and development expenditure, percent of GDP	1.000	.802
Alternative and nuclear energy, percent of total energy use	1.000	.906
Infant deaths per 1000 live births	1.000	.981
Maternal mortality per 100,000 live births	1.000	.940
Health spending per capita	1.000	.858
Death rate, per 1000 people	1.000	.662
Ratio of female to male students in tertiary level education	1.000	.917
Public services index, 0 (high) - 10 (low)	1.000	.984
Human rights and rule of law index, 0 (high) - 10 (low)	1.000	.944
Women in parliament, percent	1.000	.944
Percent urban population	1.000	.736
Extraction Method: Principal Component Analysis.		

In this research, the author aims to design an evaluation formula to assess the degree of sustainability of urban development in the country. Based on these results as well as data

availability the author used panel data from the years 2007 through 2021 to build such a formula to identify the key sustainability factors that change over time. 29 indicators were selected to be included in the formula. In the next chapter the author will present results of interviews with experts and adjust weights in the formula according to experts' suggestions.

3.2.2. Experts' interviews and formula adjustment

According to studies on the techniques for creating composite indices (e.g., Becker et al., 2017; Mazziotta and Pareto, 2013; Tripathi and Singal, 2019), the author chose to employ uneven weights for each factor based on the data collected from experts in the next stage of this research:

$$St= f (W1xHFBDIt, W2xPSIt, W3xHRRLIt, W4xHDIt, W5xWPt, W6xRFMt, W7xPUt,$$
$$W8xHSPCt, \ W9xDRt, \ W10xUPADWt, \ W11xMMt, \ W12xIDt, \ W13xANEt, \ W14xRDIt,$$
$$W15xCPRt, W16xCLIt, W17xEUPCt, W18xCDEt, W19xINRt, W20xRPGt, W21xEGt,$$
$$W22xCIt, W23xHCt, W24xURt, W25xERFt, W26xLFFt,$$
$$W27xFDIt, W28xVAIt, W29xAt) \hspace{2cm} (3.2)$$

At this stage, the set of indicators was sent out for evaluation to the experts. Such a data collection method aims to standardize the interview procedure to reduce differences between interviews. Although highly structured interviews may drawback in loss of information, preventing the revelation of further insight, this possible disadvantage of such research method was not particularly applicable to current research for the reasons explained further in this chapter. The advantages of standardized interviews are grounded in the speed and reliability of findings.

Experts are individuals who possess extensive expertise in the researched area. The key characteristics of interviews with experts are as follows:

1. Experts can be considered mediums through which the researcher collects new knowledge on some particular topic. Thus, experts cannot be regarded as objects of research but rather hold the necessary information;

2. Experts have a unique position in research.

Singh (2007) states that expert sampling is an approach to identifying individuals with knowledge and experience in a researched field and can be applied to justify the validity of other research approaches.
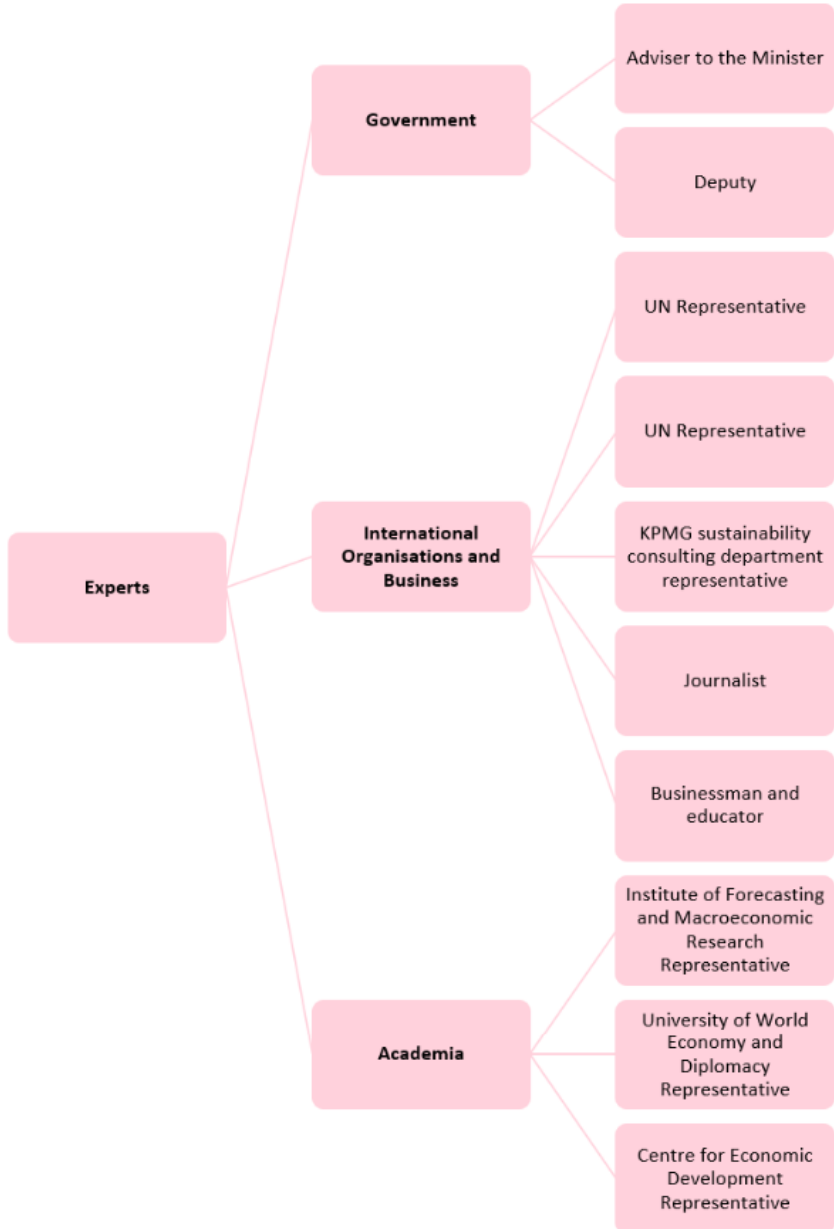
Figure 3.6 Experts participating in the interviews (Developed by the author)

For this part of the research, the author has addressed ten individuals with expertise in the field of sustainable development in Uzbekistan. They have been contacted online in writing via email or Linkedin. While some experts come from academic backgrounds, others have applied knowledge on the matter. Such selection lies in the desire to collect different prospectives that occur due to differences between practitioners' and scientists' experiences. Two of the selected experts were representatives of city's administration. The total number of female experts is 3. The expert interviews were conducted from the 1st to the 13th of August 2022. The author aimed for at least eight responses and managed to collect ten. Interview form can be found in Appendix 10.

The experts were asked to rate the importance of each indicator in Uzbekistan context from 1 to 10, where 1 was the least important and 10 – the most important. After the collection of responses from selected experts, the following evaluation was received.

Table 3.5

Expert evaluation of the selected indicators (Developed by the author)

Indicator	Ex1	Ex2	Ex3	Ex4	Ex5	Ex6	Ex7	Ex8	Ex9	Ex10
Human flight and brain drain index	6	7	7	8	10	5	7	6	6	6
Public services index	9	6	6	8	7	9	8	9	6	10
Human rights and the rule of law index	10	9	9	8	10	7	8	9	10	10
Human development index	8	9	7	7	6	8	9	8	8	10
Women in parliament	5	3	8	8	9	10	9	10	10	8
Ration of women to men in tertiary education	8	7	6	8	8	9	7	8	8	9
Percent of urban population	5	2	5	4	1	5	7	6	4	5
Health spending per capita	5	7	6	6	8	7	8	9	9	6
Death rate	1	2	2	1	3	1	1	1	2	1
Urban population with access to drinking water	2	3	3	4	2	2	2	1	2	4
Maternal mortality	5	5	6	7	7	5	4	4	5	5
Infant death	5	2	2	3	5	5	4	3	4	5
Alternative energy	7	8	8	6	10	7	8	7	7	7
Research and development index	6	4	8	8	9	5	6	6	6	7
Corruption perception index	10	4	6	6	8	9	9	9	10	5
Civil liberties rights index	9	8	6	10	6	6	8	8	8	9
Energy use per capita	7	10	10	8	8	7	6	8	6	6
Carbon dioxide per capita	6	8	7	7	5	6	6	6	5	8

Income from natural resources	6	9	6	5	5	9	9	8	5	6
Renewable power generation	8	10	8	8	9	6	7	8	8	7
Economic growth	10	6	8	7	7	9	8	10	9	8
Capital investment index	5	2	5	4	1	5	7	6	4	5
Household consumption	5	8	7	9	9	6	6	7	8	8
Unemployment	10	7	8	8	8	9	7	10	9	8
Employment for females	9	10	8	9	8	8	9	10	10	9
Labour force females	9	9	8	8	9	10	9	9	8	9
Foreign direct investment	10	6	8	8	7	7	9	8	7	6
Voice and accountability index	6	8	8	10	7	9	6	6	5	8
Sustainability awareness	6	8	7	5	10	10	10	9	8	8

As it is seen from the interviews with experts, among the top important indicators are: Human Rights and the Rule of Law Index (average grade - 9), Employment for Females (average - 9), Women in Labour Force (average – 8.8) and Unemployment (average -8.4). On the other hand, the least important factors were voted Death Rate (average – 1.5), Urban Population with Access to Drinking Water (average – 2.5), and infant death (average – 3.8). This demonstrates the importance of building a region-specific evaluation methodology, as for many countries, especially in the developing world indicators like access to drinking water, infant mortality and death rate would be of a very high importance. However, in Uzbekistan, where drinking water is available almost everywhere, and death rate among infants and elderly population is not very high these become less-prevailing issues. A high dependency ratio, on contrary, attracts more attention to women in labour force and employed.

When running this data set through SPSS, the statistical outcomes presented in Table 3.6 were received.

Table 3.6

Statistical analysis of expert evaluations of indicators (Developed by the author)

Descriptive Statistics						
	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
human flight and brain drain index	5.0	10.0	6.8	0.4	1.4	2.0
public services index	6.0	10.0	7.8	0.5	1.5	2.2

human rights and rule of law index	7.0	10.0	9.0	0.3	1.1	1.1
human development index	6.0	10.0	8.0	0.4	1.2	1.3
women in parliament	3.0	10.0	8.0	0.7	2.3	5.3
ration of women to men in tertiary education	6.0	9.0	7.8	0.3	0.9	0.8
percent of urban population	1.0	7.0	4.4	0.6	1.8	3.2
health spending per capita	5.0	9.0	7.1	0.4	1.4	1.9
death rate	1.0	3.0	1.5	0.2	0.7	0.5
urban population with access to drinking water	1.0	4.0	2.5	0.3	1.0	0.9
maternal mortality	4.0	7.0	5.3	0.3	1.1	1.1
infant death	2.0	5.0	3.8	0.4	1.2	1.5
alternative energy	6.0	10.0	7.5	0.3	1.1	1.2
research and development index	4.0	9.0	6.5	0.5	1.5	2.3
corruption perception index	4.0	10.0	7.6	0.7	2.2	4.7
civil liberties rights index	6.0	10.0	7.8	0.4	1.4	2.0
energy use per capita	6.0	10.0	7.6	0.5	1.5	2.3
carbon dioxide per capita	5.0	8.0	6.4	0.3	1.1	1.2
income from natural resources	5.0	9.0	6.8	0.6	1.8	3.1
renewable power generation	6.0	10.0	7.9	0.3	1.1	1.2
economic growth	6.0	10.0	8.2	0.4	1.3	1.7
capital investment index	1.0	7.0	4.4	0.6	1.8	3.2
household consumption	5.0	9.0	7.3	0.4	1.3	1.8

unemployment	7.0	10.0	8.4	0.3	1.1	1.2
employment for females	8.0	10.0	9.0	0.3	0.8	0.7
labour force females	8.0	10.0	8.8	0.2	0.6	0.4
foreign direct investment	6.0	10.0	7.6	0.4	1.3	1.6
voice and accountability index	5.0	10.0	7.3	0.5	1.6	2.5
sustainability awareness	5.0	10.0	8.1	0.5	1.7	3.0

Additionally, the calculation of the weights based on the experts' interviews got us the following results.

Table 3.7

Weight adjustment based on the expert evaluations (Developed by the author)

				Weights
	Indicator-Sample Minimum	**Max-Min**	**I/J**	**(I/J)/14.42095**
human flight and brain drain index	1.8	5	0.36	0.025
public services index	1.8	4	0.45	0.031
human rights and rule of law index	2.0	3	0.666667	0.046
human development index	2.0	4	0.5	0.035
women in parliament	5.0	7	0.714286	0.050
ration of women to men in tertiary education	1.8	3	0.6	0.042
percent of urban population	3.4	6	0.566667	0.039
health spending per capita	2.1	4	0.525	0.036
death rate	0.5	2	0.25	0.017
urban population with access to drinking water	1.5	3	0.5	0.035
maternal mortality	1.3	3	0.433333	0.030
infant death	1.8	3	0.6	0.042
alternative energy	1.5	4	0.375	0.026
research and development index	2.5	5	0.5	0.035

corruption perception index	3.6	6	0.6	0.042
civil liberties rights index	1.8	4	0.45	0.031
energy use per capita	1.6	4	0.4	0.028
carbon dioxide per capita	1.4	3	0.466667	0.032
income from natural resources	1.8	4	0.45	0.031
renewable power generation	1.9	4	0.475	0.033
economic growth	2.2	4	0.55	0.038
capital investment index	3.4	6	0.566667	0.039
household consumption	2.3	4	0.575	0.040
unemployment	1.4	3	0.466667	0.032
employment for females	1.0	2	0.5	0.035
labour force females	0.8	2	0.4	0.028
foreign direct investment	1.6	4	0.4	0.028
voice and accountability index	2.3	5	0.46	0.032
sustainability awareness	3.1	5	0.62	0.043
Notes: I/J - (indicator-sample minimum)/(sample maximum-sample minimum);				
14.42095 – sum of all I/J				

When adjusting weights to the indicators based on the expert's evaluation, the individual indicators in each area are normalized on a 1-to-7 scale and aggregated by averaging the normalized scores so that all indicators scores are calculated for each year (De Montis et al., 2021). In the second step, these scores are normalized again so that the sum of weights equals to 1. To achieve this each weight is divided by the sum of all the weights (Table 3.7).

Thus, the author has an adjusted formula for evaluation of urban sustainability in Uzbekistan:

$$S_t = 0.025\ HFBDI_t + 0.031\ PSI_t + 0.046\ HRRLI_t + 0.035\ HDI_t + 0.05\ WP_t + 0.042\ RWMTE_t$$
$$+ 0.039\ PUP_t + 0.036\ HSpC_t + 0.017\ DR_t + 0.035\ UPDW_t + 0.03\ MM_t + 0.042\ ID_t + 0.026$$
$$AE_t + 0.035\ RDI_t + 0.042\ CPI_t + 0.031\ CLRI_t + 0.028\ EpC_t + 0.032\ CDpC_t + 0.031\ INR_t +$$
$$0.033\ RPG_t + 0.038\ EG_t + 0.039\ CII_t + 0.04\ HC_t + 0.032\ U_t + 0.035\ UF_t + 0.028\ LFF_t +$$
$$0.028\ FDI_t + 0.032\ VAI_t + 0.043\ A_t \tag{3.4}$$

In this chapter the author attempted to develop a formula for evaluation of sustainable development in Uzbekistan. Considering the fact that a lot of data for Uzbekistan is either not

available or cannot be trusted, the use of commonly accepted formulas emerged primarily in the developed western countries is not always possible. Additionally, specifics of Uzbek culture, social norms, ecological conditions, political state and many other factors makes these formulas not very reliable, as they often do not take into consideration such dissimilarities. The proposed here formula accounts for peculiarities common to Uzbekistan. In the following chapter the sustainability awareness level among Uzbek citizens will be evaluated to later use it in the approbation of the developed formula.

3.2.3. Calculation a range for urban sustainability evaluation formula

In the previous chapter the author proposed a formula for evaluating urban sustainability in Uzbekistan. However, for the final results of such evaluations to make sense there is a need for a range, or the maximum and the minimum possible values that would act as a reference to the actual level of urban sustainability. While some indicators already provide possible maximum and minimum values, as for instance, Human Development Index, or Corruption Perception Index, others, such as Research and Development Expenditure, Economic growth, etc., do not. So to provide such values the author had to conduct a comparative analysis.

To obtain minimum values (or the worst possible result) the author took some data from Afghanistan. It is one of the countries Uzbekistan borders on and it is the least developed in that region. The choice of this country can be additionally explained in the following reason:

1. Historically Afghanistan and Uzbekistan have a lot in common. These two states share a border and have some cultural ties (Weinbaum, 2006);

2. Afghanistan is home to over 3.5 million ethnic Uzbeks, which is the second-largest Uzbek population (Minorityrights.org, 2021). These many Uzbeks in Afghanistan have some power to form cultural and social norms there, which are similar to the ones in Uzbekistan;

3. While Uzbekistan was a part of USSR, for many years Afghanistan experienced the rise of Communism and was ruled by the Communist Party, which was supported by USSR (Weinbaum, 2006). This fact brings along similarities in political background. Nowadays, with the rise of Taliban in Afghanistan, the influence of Islam is becoming stronger and stronger in Uzbekistan with each coming day, that shows the interconnection between these two countries (Schmitz, 2021);

4. These two countries are very similar in terms of nature reserves (Indexmundi, 2019).

Once the necessary data is obtained the author had to do the calculation. The first step is to multiply each indicator by the weight previously gotten from the experts. Finally, the data was normalized. For data normalization the following formula was used (Sachs et al., 2021):

$$x_n^S = \frac{x_{tk} - x_{min}}{x_{max} - x_{min}} \qquad (3.5)$$

where x_n^S – the normalized value of stimulative variable; x_{min} – a minimum value of stimulative raw data value; x_{max} – a maximum value of stimulative raw data value; k – the country, t – year.

Table 3.8

Calculation of minimum values for the urban sustainability evaluation

(Developed by the author)

Indicator	Min Value	Weights	Min Value*Weight	Normalized
Human flight and brain drain index	10	0.025	0.25	0.013401
Public services index	10	0.031	0.31	0.016618
Human rights and rule of law index	10	0.046	0.46	0.024658
Human development index	1	0.035	0.035	0.001876
Women in parliament	1	0.05	0.05	0.134012
Ratio of female to male students in tertiary level education	0.5	0.042	0.021	0.001126
Percent urban population	100	0.039	3.9	0.209059
Health spending per capita	1.53	0.036	0.3312	0.017754
Death rate, per 1000 people	15.4	0.017	0.2618	0.014034
Maternal mortality per 100,000 live births	533	0.035	18.655	1
Infant deaths per 1000 live births	27	0.03	0.81	0.04342
Percent urban population with access to drinking water	19.3	0.042	2.5	0.134012
Alternative and nuclear energy, percent of total energy use	1	0.026	0.026	0.139373
Research and development expenditure, percent of GDP	0.27	0.035	0.1015	0.005441
Corruption perceptions index	1	0.042	4.2	0.225141
Civil liberties index	0	0.031	0	0

Energy use per capita	7	0.028	0.196	0.010507
Carbon dioxide emissions per capita	37	0.032	1.184	0.063468
Income from natural resources, percent of GDP	80.65	0.031	2.5	0.134012
Renewable power generation, billion kilowatthours	0	0.033	2.1978	0.117813
Economic growth: the rate of change of real GDP	-3.73	0.038	0.152	0.008148
Capital investment as percent of GDP	3.46	0.039	0.95394	0.051136
Household consumption as percent of GDP	143.7	0.04	5.748	0.308121
Unemployment rate	29.2	0.032	0.9344	0.050088
Unemployment rate for females	40	0.035	3.5	0.187617
Labor force, percent female	17.4	0.028	2.5	0.134012
Foreign Direct Investment, percent of GDP	-22.28	0.028	0.07	0.003752
Voice and accountability index	-2.5	0.032	1.344	0.072045
Sustainability awareness	0	0.043	0.172	0.00922
				Sum=3.116463

Once the normalized values were obtained the author summed them up and got the minimum value in the range – 3. Then followed the same procedure to calculate the maximum values (or the best possible result).

Table 3.9

Calculation of maximum values for the urban sustainability evaluation

(Developed by the author)

Indicator	Max value	Weights	Max Value*Weight	Normalized
Human flight and brain drain index	0	0.025	0	0.003746
Public services index	0	0.031	0	0.003746
Human rights and rule of law index	0	0.046	0	0.003746
Human development index	1	0.035	0.035	0.003746
Women in parliament	50	0.05	2.5	0.01876
Ratio of female to male students in tertiary level education	0.5	0.042	0.01638	0.003845
Percent urban population	50	0.039	1.95	0.015457
Health spending per capita	4450	0.036	0.05508	0.004077

Death rate, per 1000 people	9.9	0.017	0.1683	0.004757
Maternal mortality per 100,000 live births	3	0.035	0.105	0.004377
Infant deaths per 1000 live births	1.9	0.03	0.057	0.004089
Percent urban population with access to drinking water	100	0.042	2.5	0.01876
Alternative and nuclear energy, percent of total energy use	100	0.026	2.6	0.003746
Research and development expenditure, percent of GDP	2.9	0.035	0.00945	0.003803
Corruption perceptions index	100	0.042	0.042	0.003999
Civil liberties index	1	0.031	0.031	0.003933
Energy use per capita	5924.7	0.028	165.8916	1
Carbon dioxide emissions per capita	8.04	0.032	0.25728	0.005292
Income from natural resources, percent of GDP	0.4	0.031	2.5	0.01876
Renewable power generation, billion kilowatthours	66.6	0.033	2,1978	0.003746
Economic growth: the rate of change of real GDP	4	0.038	0.152	0.002895
Capital investment as percent of GDP	24.46	0.039	0.13494	0.004557
Household consumption as percent of GDP	51	0.04	2.04	0.015998
Unemployment rate	4	0.032	0.128	0.004515
Unemployment rate for females	4	0.035	0.14	0.004587
Labor force, percent female	100	0.028	2.5	0.01876
Foreign Direct Investment, percent of GDP	31	0.028	0.868	0
Voice and accountability index	2.5	0.032	0.08	0.003266
Sustainability awareness	42	0.043	1,806	0.003746
				Sum=1.1907

As the reference for maximum values data on Finland was taken, because it was voted the most successful in reaching sustainability goals (Sustainable Development Report, 2021) and second most sustainably competitive country (The Global Sustainability Competitiveness Index, 2021). The process of calculation is shown in the table 3.9. The maximum possible value is 1, which gives us a range from 1 to 3. Now, when there is a scaling range the level of urban sustainability in Uzbekistan can be measured. In the following chapters sustainability

awareness among Uzbek citizens will be measured to later use it for calculation of urban sustainability level in Uzbekistan.

3.3. Evaluation of sustainability awareness in Uzbekistan

3.3.1. Survey design

Research design describes the methodological approach of research while serving as a framework for capturing and evaluating sets of data (Cohen et al., 2018; Bryman and Bell, 2015). Below, you can see the table demonstrating the research design of this thesis. Survey questions with rationale are presented in Appendix 11, and survey form in Appendix 12.

Table 3.10

Research Methodology (Developed by the author)

Methodological approach	Research design
Research method	Mixed method
Type of Study	Empirical
Data collection	Primary data from the survey
Type and scope of research	Explanatory research
Survey approach	Sample study

At this step, the author must determine the target group of the survey, survey development as well as ways of its distribution. Empirical research requires a detailed analysis of part-taking individuals, as they represent the studied population (Babbie, 2021). The sample of this empirical research represents citizens of Uzbekistan that are allowed to participate in the labor market, thus contributing to the country's budget, which is then used for various sustainability projects. The pension age in Uzbekistan starts at 55 years for women and 60 years for men. 45-55 years was considered as the last age group because it would include both males and females participating in the research.

Table 3.11

Survey Description (Developed by the author)

Level of analysis	Survey development and evaluation
Degree of structuring	High
Scale	Dichotomous, Likert, checkbox, ranking
Survey method	Online survey via Surveymonkey
Data evaluation	SmartPLS

Some scholars argue that structured surveys are the most prominent form of research surveys (Bryman and Bell, 2015). Such surveys aim at distributing the questions in the exact same form to all the participants. Some advantages of structured surveys include the ease of reaching out to a large number of participants and their comparability. Additionally, such surveys allow statistical analysis that offers deep insights into complex research areas. All the questions used in the survey were close-ended due to them being less time-consuming and easier to answer for participants while improving comparability (Cargan, 2007).

In this research, the author conducted surveys with the citizens of Uzbekistan to get insight into their level of sustainability awareness. The survey starts with an introduction that states the purpose of the research. It is also noted that the results will be processed anonymously. The survey contains 20 questions, some of which offer a dichotomous scale for an answer, some on a Likert scale, some are presented in the form of a checkbox, and some ask a participant to rank answers. The survey was distributed online via various social media channels: personal accounts on Instagram and Facebook, posts in different groups on Facebook, and direct messaging to potential participants. Surveys were conducted between 3[d] and 24th of July 2022. Overall, 440 responses were collected. The participation rate equalled 100%, which can be explained by the fact that only people interested in participating followed the survey link. Some participants, however, refused to answer some questions within the survey.

Reinartz et al. (2009) state that 100 responses tend to be sufficient for statistical analysis. However, the author used a sample calculating formula to determine the adequate size of the sample. The sample size represents a part of the researched group, also known as the target population. Random sampling was used, meaning that respondents were chosen entirely by chance from the population at large. To calculate the appropriate sample size, first the size of the Uzbekistan population is required. In 2020 Uzbekistan's population was slightly above 34

million people, with approximately 23 million people between 18 and 55 years of age (UZStat, 2021). The next step would be choosing the margin error, which is a percentage that shows how much survey results reflect the views of the overall population. The smaller the margin error, the more accurate the results are. The author chose a margin error of 5 percent. Then a sampling confidence level is to be selected that reveals how confident we can be that the population would pick an answer within a certain range. 95 percent confidence level was selected, which means that the author can be 95 percent certain that the results lie between x and y numbers. Finally, using the formula, the necessary size of the sample can be calculated.

$$Sample\ size = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 N})} \qquad (3.6)$$

Where n – population size, e - margin of error, z – z-score, p – sample proportion.

The z-score is the number of standard deviations a given proportion is away from the mean.

Following the aforementioned formula, the sample size was calculated at 385 desired respondents. After the distribution of surveys, 440 responses were received that can be considered sufficient for this research. In the next chapter the findings from the surveys will be discussed.

3.3.2. Demographic profile

The Figure 3.7 demonstrates the age distribution of the participants in the survey. As is seen on the chart, the major group of participants consists of people 25-34 years of age (53.41%). This fully corresponds with the actual population metrics, as the average age of Uzbek citizens equals 29.1 (UZStat, 2022). It is followed by the age group of 35-44 years with 21.59 percent, 18-24 with 13.64 percent, and finally, 11.36 percent of participants aged between 45 and 55.
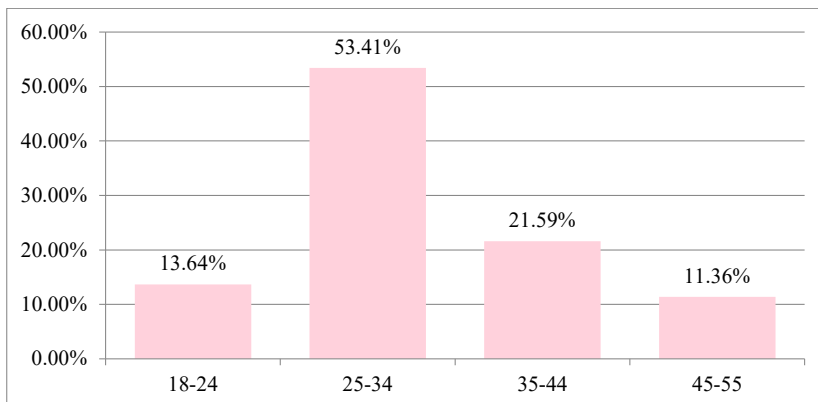
Figure 3.7 The age span of survey participants (Developed by the author)

The Figure 3.8 shows the gender distribution among participants. There were 67.27 percent of female respondents and 32.73 percent of male respondents. None of the respondents identify as the other gender.
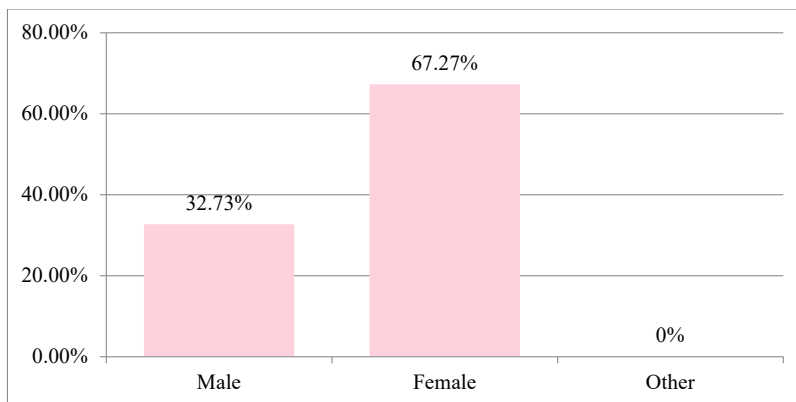
Figure 3.8 Gender distribution of survey participants (Developed by the author)

Only 7.95 percent of people taking part in the survey lived outside of the city, while 92.05 percent lived in cities. Although, in reality, the urban population in Uzbekistan slightly exceeds 50 percent, it is essential for us to gather the majority of responses from urban dwellers, since this research aims to evaluate the sustainability of urban areas.

To determine respondents' level of understanding of sustainability and sustainable development, they were asked what they believed made up sustainable development. A checkbox was offered with the three pillars of sustainability and the "I do not know" option. Surprisingly, the majority considered the social aspect as the one responsible for sustainable development. 61.36 percent of people chose this option. This slightly contradicts findings from a bibliometric analysis, which shows that people mostly associate the term sustainability with environmental concerns (Veckalne and Tambovceva, 2021). 48.86 percent of survey participants associate sustainable development with economic growth and 27.27 percent with environmental aspects. 6.82 percent did not know what aspects make up sustainable development.
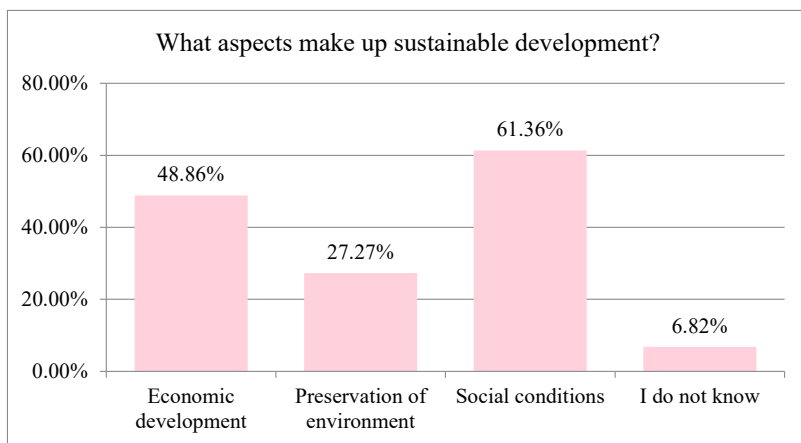
Figure 3.9 Understanding of sustainable development concept

(Developed by the author)

The following question that will be discussed here was presented in the Likert scale format. The participants were asked to mark how often they did some of the actions commonly related to sustainability in the past year.
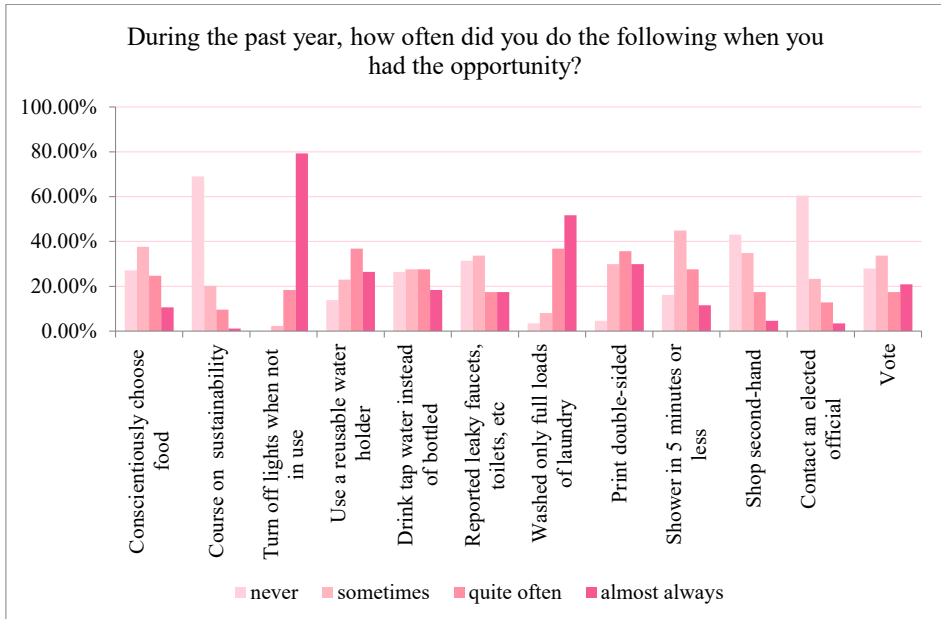
Figure 3.10 Sustainability actions performed by participants

(Developed by the author)

The most common answer was that people almost always turned off lights when those were not in use. On the opposite, the least chosen answer was that people never took a course on the topic of sustainability. When it comes to consciously choosing food, for instance, buying eco-labels or opting for non-meat options, the majority of people do it sometimes, and the minority – almost always. Most people tend to wash their clothes by fully loading the washing machine. Additionally, the majority replied that they never contacted the elected official or other representatives to discuss sustainability-related issues they cared about.

In another question, participants were asked to rank the outreach method on the topic of sustainability based on its effectiveness. The best method to educate citizens of Uzbekistan on the subject of sustainability is via social network platforms. It is followed by getting information through educational institutions – schools, universities, etc. Then comes word-of-mouth – or obtaining information from friends, relatives, and acquaintances. The TV comes next with a score of 3.37, followed by learning about sustainability at training at work (3.01), and finally, the least effective method of sustainability outreach was voted radio.
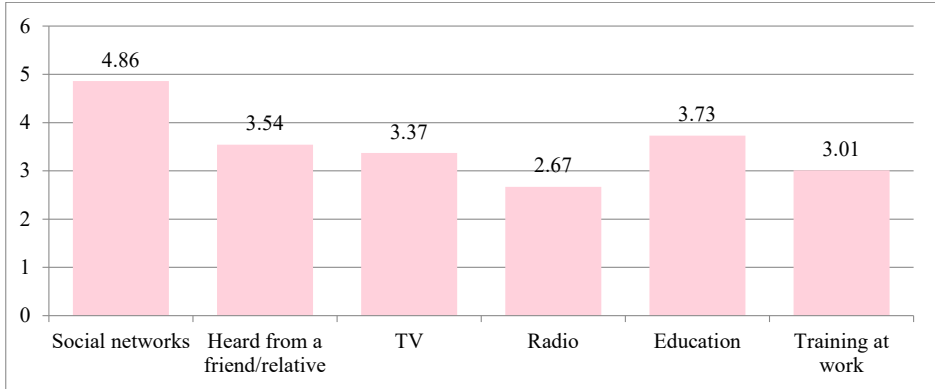
Figure 3.11 Sustainability outreach methods by effectiveness

(Developed by the author)

Another set of questions was introduced to measure people's perception of the importance of their personal contribution to sustainable development in the country. Personal responsibility is a great metric for a person's awareness of the matter.

Almost 87 percent of all the respondents believe that they hold personal responsibility in making a difference on environmental issues like waste minimization, resource consumption, and the use of water and energy. 13 percent believe that they hold no such responsibility.

When it comes to the perception of personal responsibility for making a difference on social issues, such as ensuring equality and inclusion, the spread of environmental education, and support for activities promoting human health and wellness, it can be seen that the percentage of those who consider themselves responsible slightly decreased. Thus, 83.33 percent of respondents consider themselves accountable for social issues, while 16.67 percent answered "no" to this question.

Since gender equality was indicated as one of the leading sustainability factors and the experts partaking in the indicator ranking procedure ranked gender equality among the top, the authors had to find out the perception of the importance of gender equality among the respondents. Even though the majority of people taking part in this survey are women, nearly 20 percent believe that gender equality is not essential for sustainable development. This clearly shows the lack of awareness of Uzbek citizens when it comes to sustainability and sustainable development.

Finally, the author wanted to find out whether people in Uzbekistan believed that women there have similar rights in reality, not just on paper, and are being empowered. While those who answered "yes" make up the minority of the sample (43.68 %), these findings can be seen as an indirect indicator of lack of awareness. This is because Uzbekistan is considered to be a highly patriarchal society with a lack of female rights and voice (Ibrahim, 2013); only 32 percent of women in parliament (prior to 2020, it was held at 16% for five consecutive years) (The World Bank, 2020), gross enrolment rate in tertiary education only 6.33 percent (Philipp, 2018), child marriage rate of 7% (Girls not Brides Project, 2015; Thelwell, 2021), domestic violence not being a crime (Thelwell, 2021), and many other factors. The idea of almost half of the respondents considering women empowered and having equal rights when in reality this is far from being the truth only demonstrates a lack of understanding of the concepts of equal rights and empowerment, and since gender equality is a big part of sustainability – lack of sustainability awareness.

While the survey consists of ten more questions, they are not very exponential for the descriptive analysis presented above; thus, they will not be discussed here. They, however, will be used later in the statistical analysis of the survey results to measure the level of sustainability awareness of Uzbek citizens.

To measure the level of sustainability based on the discussed above surveys points were allocated to each question. For example, when a survey participant answered "Yes" to question number 20 plus one point was added, when, on the other hand, the answer was "No" zero points were added. In the similar mode points were allocated to each answer in each of the 20 questions. The table with maximum number of points for each question is presented in Appendix 13. One survey respondent could score a maximum of 42 points in this survey. After the allocation the author had to measure the average number of points scored by the research participants. It was calculated that Uzbek citizens scored on average 27.2 points in the sustainability awareness survey. Although this is not a terrible result, that there is still a big room for improvement. Additionally, it is known that people tend to lie in surveys to improve their image (Brenner & DeLamater, 2016; Mayer, 2019). This means, that actual level of sustainability awareness can be somewhat lower than reported in the survey.

3.3.3. Survey results

In this chapter the author further describes the results of the conducted survey, using SmartPLS software for analysis. Such analysis depends greatly on the correctness and validity

of the studies dataset; thus data screening is key to ensuring that existing data is entered correctly (Kristensen and Eskildsen, 2010). It is quite common in surveys to have missing data. It can occur because of many reasons, including failure to understand questions (Sekaran and Bougie, 2010). In this case, the author could see some missing answers on the questions with Likert scale, namely on the questions that asked respondents to rank their knowledge about the sustainability goals. While Tabachnick et al. (2007) suggests skipping the analysis of missing data, it had been decided to proceed analysing it by allocating the lowest possible point (in this case - 1) to each of the missing answer. If a person failed to rank their knowledge on a 1 to 5 scale, while answering all the other questions, it can be assumed that the person is so unaware of it that the ranking cannot be made, thus allocating the lowest possible point seems logical. The analysis of the collected data, despite some of it being missing is advocated by Hair Jr et al (2017). It is argued, that some of the missing values can be changed, as long as the remaining number of responses is sufficient for the statistical analysis (Hair et al., 2010). Considering the fact that 19 of 20 questions were answered fully and the number of missing responses in one of the questions was still relatively small this approach to handling it is justified.

One of the most essential aspects of data analysis if finding the point of view of the survey respondents on each of the variables/dimensions considered in the research. This can be measured by the amplitude of the statistical data, such as standard deviation, variation, etc. Sekaran and Bougie (2019) state that it is necessary to present a general concept of survey participants responses.

For the analysis of the survey the author first divided the questions in 6 groups, creating study variables. These variables are: Environmental awareness, Energy Conservation, Outreach Method, Knowledge of environmental Issues, knowledge of sustainability issues and Overall Sustainability Awareness. The outcomes of the descriptive statistics are presented in Table 3.13. The variables and their dimensions are in the range from 2.6 to 3.4. The standard deviations of all dimensions are from 0.9 to 1.2, which is considered acceptable in statistical analysis. Therefore, based on this, it is established that the views of the respondents are at a satisfactory level.

Table 3.13

Descriptive statistics of variables (Developed by the author)

Construct	N	Mean	Std. Deviation
Environmental awareness	440	2.880	0.935
Consumption consciousness (energy conservation)	440	3.273	1.069
Outreach Method	440	3.373	1.095
Environmental Issues	440	2.626	1.177
Awareness	440	3.153	1.155
Sustainability issues	440	3.196	1.136

Further in this research the author applied structural equation modelling (SEM) to test the hypotheses developed from the theoretical analysis. Two of the most common approaches to SEM are covariance-based (AMOS, LISREL) and variance-based (Partial Least Squares). In this research SmartPLS 3.3 software is used to explain the relationship between dimensions of independent variables for SEM and dependant variables, mediated variables and demographic variables. Modelling has two parts: 1) measurement model; 2) structural model. Furthermore, in terms of operation, the PLS algorithm's study attempts to generate loading between reflective constructs and their corresponding indicators consisting only of all reflective constructs. Overall, PLS always tries to maximize the variability of dependent variables through independent variables (Chin et al., 2003).

Using SmartPLS, the measurement model (outer model) is used to theoretically verify the suitability of loading indicators (items) in the initial phase. Outer models are tested to verify these objects to measure the constructs they were made up to measure, resulting in the instrument's reliability. Furthermore, the outer model assesses the relationship between observable and basic constructs (Shiau et al., 2019). Thus, to ensure the proper operation of a particular construct, it is necessary to trace the appropriate indicators that require different construct estimates for the validity that is justified in the SEM through content validity, convergent validity, and discriminant validity (Hair et al., 2010).

The content validity reflects the suitability and potential of the product to be produced in the measurement of the central study concept (Hair Jr et al., 2017). Furthermore, it is suggested to use the Principal Component Analysis (PCA) - a structural method to estimate the essential element of the indicators. This analysis is based on PCA methodology and factor loading is created for all indicators in SmartPLS. The factor analysis is displayed in Appendix 14. The table in appendix 14 demonstrates the loading of all items related to each construct considered

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in this research which includes: Environmental Awareness, Energy Conservation, Outreach Method, Environmental Issues, Awareness, and Sustainability Issues. According to Chen and Bozeman (2013), item loading can be defective if its value is less than 0.30. As it is seen on the table in Appendix 14 each loading in this study is more significant than 0.6, which indicates moderate or extreme loading for each indicator considered in this research.

To ensure accuracy of variables, researchers check that construct measures that are theoretically related to each other are really related after analysis. Three types of estimates, such as factor loading, composite reliability (CR), and average variance extracted (AVE), are commonly employed to find convergent validity (Hair et al., 2010). First, the loading of all items is checked to be of 0.50 or higher, which is recommended in the literature on multivariate analysis (Fornell& Larcker, 1981). In appendix 15 You can find results of convergent validity analysis. As it is seen on the table in Appendix 15 all items contain a loading greater than 0.50. Second, a composite reliability test is performed showing the degree to which objects want to indicate latent construct (Hair et al., 2010). The recommended outstanding value for CR is 0.70 (Fornell& Larcker, 1981; Hair et al., 2010; Joe F Hair Jr et al., 2017). Moreover, it is shown in Appendix 16 that the CR values for all constructs range from 0.771 to 0.926, which is much higher than the prescribed values. Third, the author had to look at the average variance extracted (AVE) - the limit of the lesser variances in the study's latency, tested the constructs indicators, which value should ideally be higher than 0.50 (Fornell& Larcker, 1981; Hair et al., 2010). As indicated in Appendix 16, this condition is also fulfilled in in this study with values being between 0.505 and 0.675. Thus, the results indicate that there is convergent validity.

Table 3.14

Discriminant Validity Analysis (Developed by the author)

Variable	A	EA	EC	EI	OM	SI
A	**0.667**					
EA	0.751	**0.613**				
CC	0.917	0.730	**0.654**			
EI	0.247	0.338	0.228	**0.636**		
OM	0.653	0.701	0.580	0.294	**0.692**	
SI	0.858	0.825	0.837	0.287	0.670	**0.719**

The purpose of discriminant validity is to verify the validity of the constructs of an external model that seeks to ensure that irrelevant actions are not found to be relevant after analysis. This means that each step is more relevant to their constructs than the other. For this, the square roots of the average variable (AVE) are examined (Fornell& Larcker, 1981).

It is expected that 50 or more variations of the indicators are calculated, which means that the square root of AVE must be greater than 0.50. In this study, Table 3.14 shows that the diagonal values (the square root of the AVE of the corresponding constructs) are higher than the other values of the column and row in which they are located, confirming the discriminant validity of the outer model. Thus, the construct validity of the outer model is confirmed, and it is further speculated that the results are accurate and reliable.

The author had to look at Heterotrait – Monotrait Ratio (Table 3.15). HTMT values are to be lower than 0.90, which shows that the relationship between the two constructs is established.

Table 3.15

Heterotrait – Monotrait Ratio (Developed by the author)

Variable	A	EA	EC	EI	OM
EA	**0.808**				
CC	0.514	**0.850**			
EI	0.304	0.572	**0.689**		
OM	0.762	0.948	0.650	**0.940**	
SI	0.966	1.028	0.897	0.364	**0.773**

The Standardized Root Mean Square Residual (SRMR) indicates that the model is a good fit with value less than 0.10. Table 3.16 demonstrates that the SRMR value is 0.071 used for the saturated model and 0.080 used for the estimated model, showing that the model is a good fit.

Table 3.16

Standardized Root Mean Square Residual (Developed by the author)

	Saturated Model	Estimated Model
SRMR	0.071	0.080

Additionally, the author employed the bootstrapping technique to measure the structural model based on 5,000 samples with a 95% reliability level. Bootstrapping technique uses many samples to replace the original sample data (440).

A structural model is used to work out the collinearity assessment, coefficient of determination, and cross-validated redundancy of endogenous variables. Variable Inflation Factors (VIFs) values are used to observe Collinearity issues. In this research, the values of endogenous variants of VIFs ranged from 1.257 to 2.75, which ensured that relevant issues were not found in the relevant results as they are all less than 0.5 (Hair Junior et al., 2016).

The pathway/path coefficients represent the relationship between investigated constructs. The path coefficients are between the traditional values -1 (small) and +1 (large). The path coefficient near +1 display a significant and robust relationship between the estimated value variables. The estimated value of the path coefficients close to 0 does not show either a weak or significant relationship between the variables (Joseph F Hair Jr et al., 2021). Figure 3.12 presents the coefficient of the model's path and its relation between the variables.
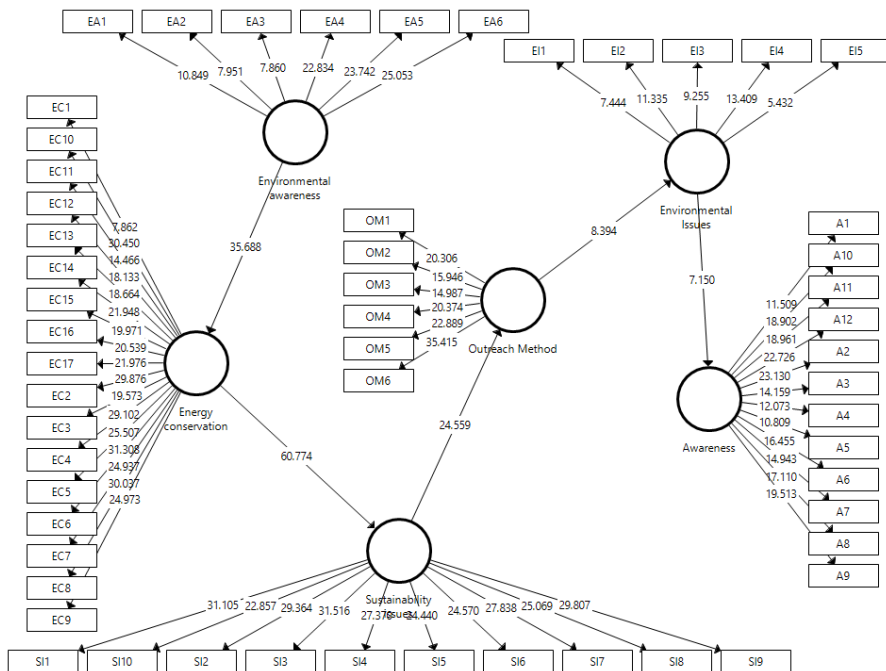
Figure 3.12 Bootstrapping of Structural Model (Developed by the author)

The R^2 value is utilized to evaluate the structural model and model prediction correctness. The R^2 range of all endogenous variables refers to the degree defined in all endogenous variables. The R^2 ranges of 0.75, 0.50, and 0.25 that is sufficient, moderate, and weak respectively (Sarstedt et al., 2014). Table 3.18 presents the R^2 or the adjusted R square of the dependent variables.

Table 3.17

Path coefficients (Developed by the author)

Variable	A	EC	EI	OM	SI
EA		0.730			
EC					0.837
EI	0.247				
OM			0.294		
SI				0.670	

Effect size f^2 estimates all independent variables. The change in the value of R^2 when the independent variables are excluded from the model can be a measure of whether the excluded independent variables have a significant effect on the constructs.

Table 3.18

R^2 value of Model (Developed by the author)

Variable	R Square	R Square Adjusted
A	0.061	0.059
EC	0.532	0.531
EI	0.086	0.084
OM	0.448	0.447
SI	0.701	0.700

This refers to how much f^2 contributes to the R^2 value of f^2 created on the value of R^2. The Effect size f^2, the value of 0.02, offers a small Effect, 0.15 medium, and 0.35 significant Effect. The value of f^2 soft tan 0.02 indicates no effect between the variables (Joe F Hair Jr et al., 2017).

Table 3.19

Effect size of f^2 (Developed by the author)

Variable	A	EC	EI	OM	SI
EA		**1.138**			
EC					**2.342**
EI	0.065				
OM			0.094		
SI				**0.813**	

The Bootstrap technique for testing the proposed hypotheses was applied. First, the author reviewed the hypothetical direct relationship. Table 3.20 displays the direct relationship between key variables: Environmental awareness, Energy conservation, Outreach Method, Knowledge of Environmental Issues, and Awareness and clarifies the direct association between independent and dependent variables.

Table 3.20

Path Model Results: Direct Hypotheses (Developed by the author)

Structural paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EA → EC	0.730	0.733	0.020	36.699	**0.000**
EC → SI	0.837	0.838	0.013	64.022	**0.000**
EI → A	0.247	0.265	0.035	7.082	**0.000**
OM → EI	0.294	0.299	0.037	8.029	**0.000**
SI → OM	0.670	0.671	0.029	23.377	**0.000**

Hypothesis 1: The findings indicate that Environmental awareness (EI) is positively and significantly connected with Consumption Consciousness (EC). This can mean that people with higher environmental awareness chose to use energy more wisely. P value in this case is lower than 0.05, which make the hypothesis acceptable

Hypothesis 2: The findings indicate that Consumption Consciousness (EC) is positively and significantly connected with Sustainability issues (SI), with p value <0.05 this hypothesis is also acceptable.

Hypothesis 3: The findings indicate that the Sustainability issues (SI) are positively and significantly connected with Awareness (A) (p-value<0.05). Again, this means that raising

awareness among population can have positive effect on the number of sustainability issues in the region.

The results presented above as well as in Appendices 10 and 11 demonstrate the statistical significance of the conducted survey. From the results it can be observe a strong connection between environmental and overall sustainability awareness and energy conservation practices and sustainability issues. These results correspond with the findings from theoretical analysis in chapter 1.11 and prove the importance of considering sustainability awareness an important factor of sustainable development. In the next chapter the author will employ all these findings to measure the level of urban sustainability in Uzbekistan.

3.4. Results of evaluation of urban sustainability in Uzbekistan

Using the formula developed in chapter 3.2 the author can now measure the level of urban sustainability in Uzbekistan. Following the process of calculation described in chapter 3.4 the following results were received.

Table 3. 21

Evaluation of urban sustainability in Uzbekistan (Developed by the author)

Indicator	Value	Weights	Value*Weight	Normalized
Human flight and brain drain index	5.2	0.944	4.91	0.0048202
Public services index	4.6	0.98	4.34	0.00439364
Human rights and rule of law index	7.6	1.06667	7.17	0.00652647
Human development index	0.72	1	0.68	0.00163517
Women in parliament	33	1.08571	31.15	0.02458445
Ratio of female to male students in tertiary level education	0.83	1.04	0.78	0.00171338
Percent urban population	50.44	1.03	47.62	0.03698332
Health spending per capita	101.2	1.01	95.53	0.07307085
Death rate, per 1000 people	5.4	0.9	5.10	0.00496239
Maternal mortality per 100,000 live births	28	0.97333	26.43	0.02102973
Infant deaths per 1000 live births	19.6	1.04	18.50	0.0150578
Percent urban population with access to drinking water	86.1	1.03	81.28	0.06233559
Alternative and nuclear energy, percent of total energy use	1.6	1	1.51	0.0022608
Research and development expenditure, percent of GDP	0.12	1	0.11	0.00120861
Corruption perceptions index	28	1.04	26.43	0.02102973

Civil liberties index	6	0.98	5.66	0.00538896
Energy use per capita	1405	0.96	1326.32	1
Carbon dioxide emissions per capita	2.7	0.98667	2.55	0.00304284
Income from natural resources, percent of GDP	13.5	0.98	12.74	0.01072104
Renewable power generation, billion kilowatt/hours	6.4	0.99	6.04	0.00567334
Economic growth: the rate of change of real GDP	7.4	1.02	6.99	0.00638428
Capital investment as percent of GDP	32.4	1.02667	30.59	0.02415789
Household consumption as percent of GDP	62.4	1.03	58.91	0.04548621
Unemployment rate	13.3	0.98667	12.56	0.01057885
Unemployment rate for females	39.44	1	37.23	0.02916293
Labor force, percent female	2.9	0.96	2.74	0.00318503
Foreign Direct Investment, percent of GDP	-1.58	0.96	-1.49	0
Voice and accountability index	27.2	0.984	25.68	0.02046098
Sustainability awareness	7.16	1.048	6.76	0.00621365

When summing up the normalized values presented in the table 3.21 the author got 1.45206814, which can be rounded up to 1.5. On the scale from 1 to 3, where 1 is the highest level of sustainability and 3 is the lowest level of sustainability Uzbekistan is located right in the middle. It means that despite making some substantial progress towards achieving sustainable development Uzbekistan has yet plenty to do to improve its score. To compare, Uzbekistan scored 69.93, on the 100 point scale in Sustainable Development Report Calculations (SDRC, 2021) and 45.2 in Global Sustainability Competitiveness Index (GSCI, 2021). Of course, these indices focus on not simply urban, but rather overall sustainability of the country, however it can be said that the findings roughly correspond to those of the most established sustainability indices.

CONCLUSIONS UN PROPOSALS

The key **conclusions** that can be done from the conducted research are as follows.

1. A comprehensive literature analysis demonstrated that there was no commonly accepted definition of "sustainability", therefore the author proposed a newly developed definition of this term that was accepted by academics, professionals in the field of sustainability and students;

2. A thorough review of the literature revealed that there was also no accepted meaning of "urban," so the author suggested a comprehensive definition of this word that took addressed shortcomings of the existing definitions;

3. The author also proposed a thorough definition of the term "urban sustainability" that synthesized the existing definition, thus taking into account all the complex aspects to it;

4. Gender equality and female empowerment are important factors aiding in achievement of higher levels of urban sustainability, nevertheless they are often overlooked, especially in the developing countries;

5. Sustainability awareness is a crucial factor of reaching sustainability goals, however people in developing countries tend to demonstrate lower levels of awareness, thus to improve urban sustainability it is essential to promote its importance to general public;

6. The best ways to promote sustainability awareness in Uzbekistan according to the surveyed individuals are through social networks, educational institutions, and TV. Radio and newspapers were voted the least promising tools;

7. The conducted theoretical analysis of the existing techniques of evaluation of urban sustainable development enabled to identify that there was no methodology developed specifically for the central Asian region. The use of methodologies proposed by the scholars in the developed countries is not always possible due to the absence of necessary data. On top of that, such methodologies do not address the specific needs of the region;

8. The investigation of various approaches to regional development and analysis of related methodological aspects in the context of sustainability demonstrated that

more attention should be allocated to the issues if social development. These findings from theoretical analysis correspond to the empirical findings from experts interviews, in which indicators of social development were given on average higher importance grades, than those of ecological and economic nature;

9. Spreading awareness of the importance of gender equality and female empowerment is also crucial for achievement of sustainability, especially in Uzbekistan, where cultural norms advocate female discrimination, that not only drawbacks in social injustice, but bring upon a significant negative impact on economic development of the country;

10. Encouraging female entrepreneurship and empowerment is crucial for fostering equitable and prosperous societies, as it leads to financial security, improved decision-making, and better living conditions for families;

11. Organizations and programs that promote female economic empowerment, such as Self-Help Groups and cooperatives, can provide essential resources, training, and support for women to establish and grow their businesses. However they tend to be discriminatory towards less wealthy women;

12. By integrating female entrepreneurship promotion and sustainable urban development practices, cities can become more sustainable, economically vibrant, and inclusive for all members of society. This can be achieved through adequate regional development planning, that accounts for women empowerment needs;

13. Taking into consideration regional specificities and lack of accessible data in Uzbekistan the developed in this research formula allows us to assess the actual level of sustainability in Uzbek cities, while giving us insights into what aspects seek immediate attention for improving sustainability progress in the country;

14. Hypothesis 1 "Sustainability issues are positively and significantly connected with sustainability awareness" was proven by the results of the survey;

15. Hypothesis 2 "Gender equality is positively associated with urban sustainability" was proven by the interviews with experts;

16. Hypothesis 3 "Higher environmental awareness is positively associated with higher level of consumption consciousness" was proven by the survey analysis.

Based on the findings from this research the following **recommendations** are proposed:

To **Government and Policymakers** (Ministry of preschool and school education of the Republic of Uzbekistan, Ministry of higher education, science and innovations of the republic of Uzbekistan, Ministry of poverty reduction and employment):

1. More actions should be undertaken in order to promote sustainability awareness among Uzbek citizens. Education for Sustainable Development should be introduced in all educational institutions, as well as offered as a compulsory training at work. For such trainings, it is advised using Atkisson Sustainability Pyramid, as it was specifically designed for learning purposes. Additionally, launching an online sustainability awareness campaign, as the most effective outreach method was through social networks can be suggested;

2. Uzbek citizens of all ages should be educated on the importance of gender equality and female empowerment. More actions should be undertaken on the higher state and regional management level to demote gender discrimination on both social and legal levels;

3. Female empowerment should be emphasized on the regional development level through introduction of special education institutions for women that allow them acquire education despite marital status and the presence of kids. More community-based productive associations for females should be established in urban and rural areas to help women support each other in personal and professional lives. Such associations as well as cooperatives with no entry criteria should be promoted in and supported by "mahallas", as literature suggests that it is more effective to introduce interventions for urban sustainability transition at a neighbourhood level.

4. Collaborate with the private sector and civil society organizations to create a supportive environment for women entrepreneurs, including fostering partnerships, sharing best practices, and providing funding.

To Private Sector Organizations and Businesses:

1. Encourage diversity and inclusion within the workplace, ensuring equal opportunities for women in leadership positions and promoting gender-sensitive policies;

2. Support female entrepreneurs by investing in their businesses, providing mentorship, and offering resources to help them succeed;

To Non-governmental Organizations and Civil Society:

1. Advocate for gender equality and women's empowerment in entrepreneurship, raising awareness about the importance of female-led businesses in achieving sustainable development;

2. Develop and implement programs that provide training, resources, and support to women entrepreneurs, helping them overcome barriers to entry and success and to raise sustainability awareness among population;

For further research it is suggested to apply the developed formula to separate regions of Uzbekistan (if the data is available) and adjusting the formula to the needs of such regions, as the proper reliable evaluation will consider the specificities of a researched location and the need of various stakeholders. This can be achieved through the adaptation of the proposed methodology.

Summarizing the results of the Doctoral Thesis, the author concluded that the research goal was achieved, the research hypotheses were proven, and the theses supported.

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APPENDIXES

APPENDIX 1

Breakdown of a proposed "sustainability" definition

According to Merriam-Webster Dictionary (2021) the words mentioned in the proposed definition have the following meanings:

Ability - the quality or state of being able;

To maintain - to sustain against opposition or danger; to continue or preserve; to support;

Economic – of or related to economics or economy;

Growth – a process of growing; a stage in the process of growing;

Over – across a barrier; beyond some limit;

Time - the measured or measurable period during which an action, process, or condition exists or continues;

While – during the time that;

Promoting (promote) – to contribute to the growth or prosperity of;

Social - of or relating to human society, the interaction of the individual and the group, or the welfare of human beings as members of society;

Development - the act, process or result of developing;

Preserving (preserve) – to keep safe from injury, harm or destruction;

Environment - the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.

Based on this definition from the dictionary, the author now combines some of this words that are used as phrases to provide meaning for them as well:

Ability to maintain - state of being able to sustain against opposition or danger or to support;

Economic growth – a process of growing related to the economy;

Over time – across a measurable period during which an action, process, or condition exists or continues;

Social development - the act, process or result of developing related to human society;

Preserving environment - to keep safe from harm or destruction the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.

APPENDIX 2

Breakdown of a proposed "urban" definition

According to Merriam-Webster Dictionary (2021) the words mentioned in the proposed definition have the following meanings:

City - an inhabited place of greater size, population, or importance than a town or village

Town - a compactly settled area usually larger than a village but smaller than a city;

Particularly - in a particular manner;

In terms of - with respect to or in relation to;

Its - of or relating to it or itself especially as possessor, agent, or object of an action;

Atmosphere - a surrounding influence or environment;

Culture - the set of shared attitudes, values, goals, and practices that characterizes an institution or organization;

Way - a course of actions;

Of – used as a function word to indicate a point of reckoning;

Life - the sequence of physical and mental experiences that make up the existence of an individual;

Entailing (entail) - to impose, involve, or imply as a necessary accompaniment or result;

Trait - an inherited characteristic;

Such as - used to introduce an example or series of examples;

Diverse - composed of distinct or unlike elements or qualities;

Population - the whole number of people or inhabitants in a country or region;

High - of greater degree, amount, cost, value, or content than average, usual, or expected;

Density - the quality or state of being dense;

Building - a usually roofed and walled structure built for permanent use;

People – human beings;

Focus - a center of activity, attraction, or attention; a point of concentration;

On - — used as a function word to indicate position;

Commerce- the exchange or buying and selling of commodities on a large-scale involving transportation from place to place;

Entertainment - amusement or diversion provided especially by performers;

Other - being the one or ones distinct from that or those first mentioned or implied;

Form - one of the different modes of existence, action, or manifestation of a particular thing or substance;

Cultural – of or relating to culture or culturing;

Expression - an act, process, or instance of representing in a medium (such as words).

Based on this definitions from the dictionary, the author now combines some of this words that are used as phrases to provide meaning for them as well:

Way of life - a course of actions in the sequence of physical and mental experiences that make up the existence of an individual;

Entailing traits – involving an inherited characteristic;

Diverse population- composed of distinct or unlike qualities the whole number of people or inhabitants in a country or region;

High density of people and buldings- being dense of greater degree amount of a usually roofed and walled structure built for permanent use and human beings;

Other forms of cultural expression – an act distinct from the different modes of existence or instance of representing in a medium relating to culture.

APPENDIX 3

Number of "urban sustainability" related publications in different fields on WOS
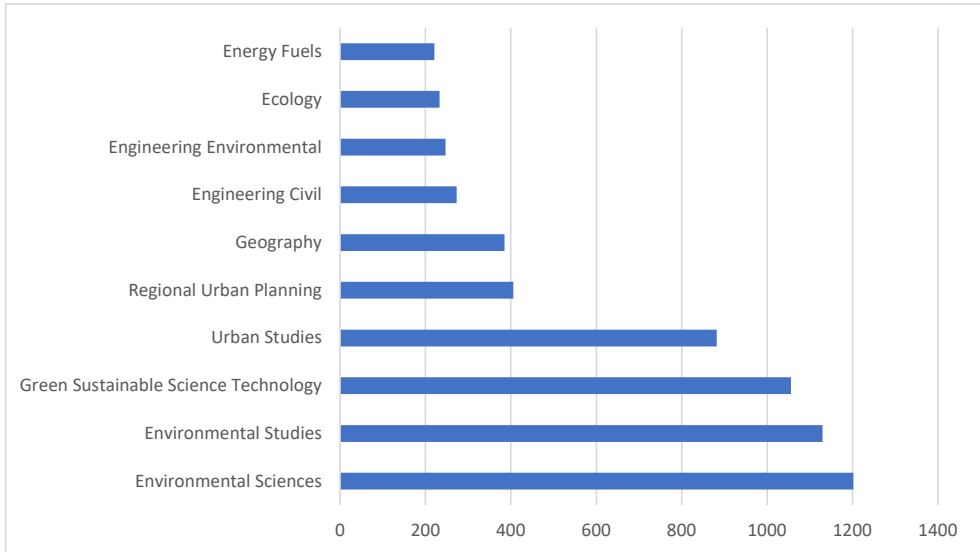
Source: Created by the author

APPENDIX 4

Number of documents on "urban sustainability" published in Scopus from 1980-2021
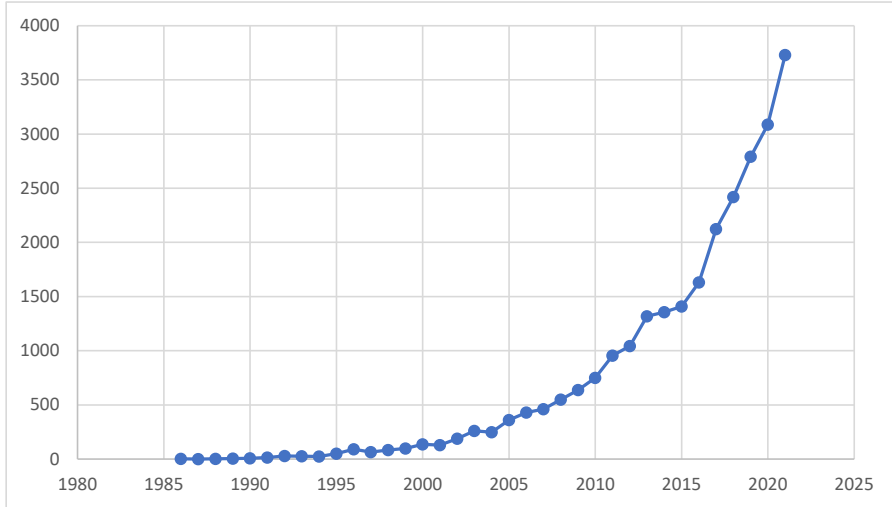
Source: Created by the author

APPENDIX 5

Number of documents on "urban sustainability" published in Scopus sorted by author
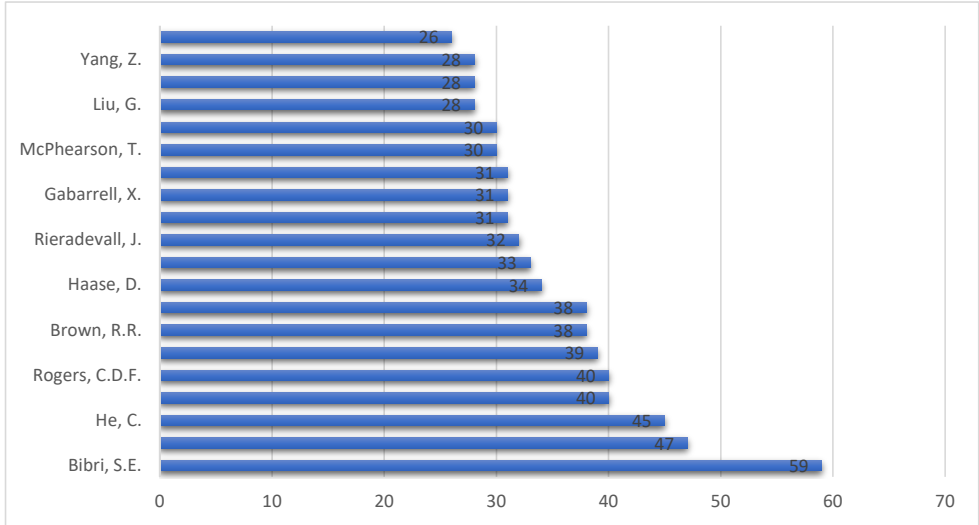
Source: Created by the author

APPENDIX 6

Number of documents on "urban sustainability" AND "definition" published in Web of Science from 1990-2021
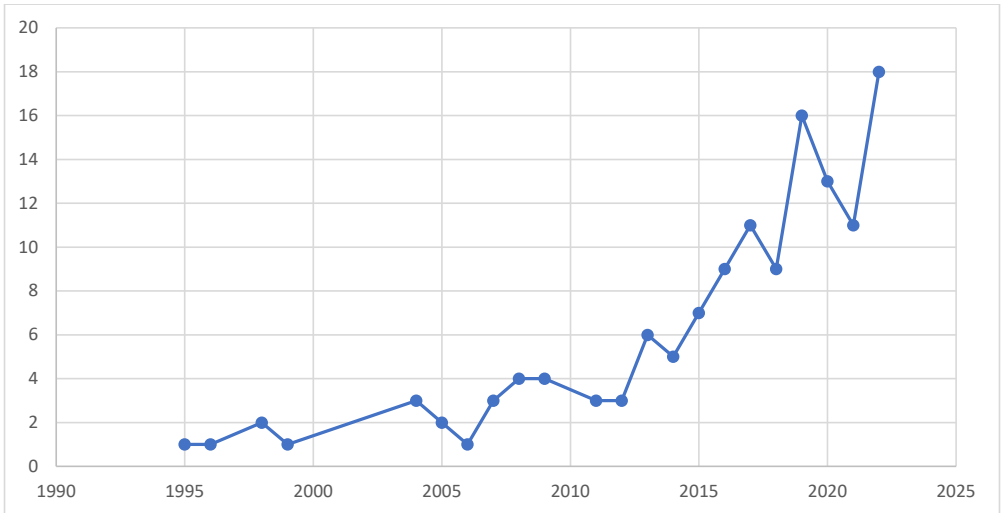
Source: Created by the author

APPENDIX 7

Breakdown of a proposed "urban sustainability" definition

According to Merriam-Webster Dictionary (2021) the words mentioned in the proposed definition have the following meanings:

State – mode or condition of being;

Which - being what one or ones out of a group —used as an interrogative;

Major - greater in dignity, rank, importance, or interest;

Subsystem - a system that is part of a larger system;

City - an inhabited place of greater size, population, or importance than a town or village;

Economic - of or relating to an economy or economics;

Social - of or relating to human society, the interaction of the individual and the group, or the welfare of human beings as members of society;

Physical - having material existence : perceptible especially through the senses and subject to the laws of nature;

Environmental - the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival;

Work - to perform or carry through a task requiring sustained effort or continuous repeated operations;

Harmony – agreement;

To ensure - to make sure, certain, or safe;

Long-term - occurring over or involving a relatively long period of time;

Well-being - the state of being happy, healthy, or prosperous;

Its - of or relating to it or itself especially as possessor, agent, or object of an action;

Inhabitants - one that occupies a particular place regularly, routinely, or for a period of time;

And - used as a function word to indicate connection or addition especially of items within the same class or type;

Preservation - the act, process, or result of <u>preserving</u> something;

Natural - existing in or produced by nature **:** not artificial;

Resource - a source of supply or support;

Growth – a stage in the process of <u>growing</u>;

Prosperity – the condition of being successful or thriving;

Rely – to be dependent.

Based on this definitions from the dictionary, the author now combines some of this words that are used as phrases to provide meaning for them as well:

Major subsystems of a city - greater in importance <u>systems</u> that are part of a larger system in an inhabited place of greater size, population, or importance than a town or village;

Work in harmony - to perform or carry through a task requiring sustained effort or continuous repeated operations in agreement;

Long-term well-being - occurring over or involving a relatively long period of time the state of being happy, healthy, or prosperous;

Preservation of the natural resources - the act, process, or result of <u>preserving</u> existing in or produced by nature sources of supply or support;

City's growth - a stage in the process of <u>growing</u> of an inhabited place of greater size, population, or importance than a town or village.

APPENDIX 8

Rationale for choosing the indicators for formula development

No.	Indicators	Rationale for Inclusion
1.	Human flight and brain drain index	Human flight and brain drain is a condition where intellectual minds leave a country in search of greener pastures (Haque, 2007). The human flight and brain drain index is coherent with the purpose of the research on the basis that it is a factor that affect the Uzbekistan economy.
2.	Public services index	"*The Public services indicator refers to the presence of basic state functions that serve the people. This may include the provision of essential services… and the state's ability to protect its citizens…*" (The global economy, 2022). The PSI is a measure of social wellness. It is therefore indispensable to the evaluation of urban sustainability.
3.	Human rights and rule of law index	"*The Human rights and rule of law indicator considers the relationship between the state and its population insofar as fundamental human rights are protected and freedoms are observed and respected.*" (The global economy, 2022). Social life is preserved when there is peace and human rights are valued (Mensah, 2019). The human rights and rule of law index will help to investigate the social aspect that accounts for a sustainable society using Uzbekistan as a case study.
4.	Human development index	The HDI is a summation of health, education, and standard of living indices. (United Nations, 2022). By making reference to the HDI, the researcher is able to investigate in-depth, the social dimension of sustainability through the aggregation of health, education, and standard of living parameters.
5.	Number of women in parliament	Social sustainability is anchored on equity, empowerment, accessibility, participation, cultural identity, and institutional stability. (Daly, 1992). The number of women in parliament is a test of social sustainability which in turn is a key factor for the evaluation of overall sustainability.
6.	Ration of women to men in primary school	Gender equity is an aspect of sustainability that cannot be ignored or undermined. It is described as the state of ensuring that opportunities, decision-making, and resources are not distributed on the basis of male or female (Pathania, 2017). The ration of women to men in primary school will aid investigation into the level of human capital development and opportunity for all.
7.	Ration of women to men in secondary school	According to Dr. Hilary Landorf, an Associate Professor of Social Studies/Global Education at Florida International University, secondary school education has 2 core roles. The first is to provide requisite skills for those who intend to join the labour market. Secondly, it prepares those who want to further their education to the tertiary level (Landorf). The ratio of women to men in secondary school will provide insight into gender empowerment at the transitional level and human capital development.

8.	Ration of women to men in tertiary school	Of all the factors that contribute to economic and social development, investment in human capital through qualitative education is regarded as the most essential (Barro & Lee, 2013). Tertiary education fosters the development of the intellect. It increases earning capacity and productivity. The ratio of women to men in tertiary school will arm the researcher to carry out an inspection of human capital development and gender equality.
9.	Health spending per capita	Health spending per capita is the total health expenditure per citizen. A country's expenditure on health is affected by several social and economic factors (OECD, 2015). This indicator will explain more about the social and economic characteristics of the target population and how these characteristics transition into the development of a sustainable environment.
10.	Life expectancy	Life expectancy is the average number of years a person is expected to live. This indicator will explain the effect of urbanism on the average life of the people.
11.	Death rate	Death rate is the number of deaths per one thousand people over a 12 months period. The researcher deems this indicator vital because it will explain the effect of urbanism on longevity.
12.	Urban population with access to drinking water	Sustainability is not worth mentioning without the fair distribution of natural and man-made resources (Milan, Uribe-Toril, Ruiz, & De Pablo, 2019). By considering this indicator, the researcher aims to discover how equal basic resource (in this case water) apportionment is achieved.
13.	Maternal mortality	Maternal mortality is the number of death due to issues that arise during pregnancy or birth. According to WHO, 75% of maternal mortality is due to severe bleeding, infections, high blood pressure during pregnancy, complications from delivery, and unsafe abortion. Maternal mortality is both a health and gender-related issue. This indicator is a good appraisal of the issue herein identified.
14.	Infant death	Infant death occurs when children die before their first birthday. Usually, it is expressed as 1 in every 1,000. Infant death mostly occurs during the first 28 days of birth. The major cause of death is diseases suffered due to lack of quality care upon birth and a few days after (World Health Organisation, 2020). Infant mortality is relevant to the study because it will provide more insight into the effectiveness of the health sector.
15.	Alternative energy	The current energy model is fossil fuel dependent. The problem with this is acute. Fossil fuel is not only inequitably distributed, but it also poses a serious threat to the environment through global warming (Vezzoli, Ceschin, Osanjo, & M'Rithaa, 2018). Investigating alternative energy is helpful in assessing the environmental impact of energy consumption.
16.	Research and development index	This index expresses the Research and Development expenditure in relation to Gross Domestic Product. Adequate R&D funding that is commensurate with economic growth and national income is necessary for ensuring sustainable development.

17.	Corruption perception index	Measured annually by the international non-governmental agency, Transparency International organization, CPI is the perceived level of corruption in the public sector. The CPI is applicable to this study because it is a social, economic, cultural, and moral phenomenon that has a linear correlation between per capita income and economic development (Christos, et al., 2018)
18.	Political rights index	The PRI borders on the electoral process, political pluralism and participation, functioning of government, and freedom of expression of belief (Freedom House, 2022). This indicator will assist the researcher to investigate the level of participation within the context of sustainability.
19.	Civil liberties rights index	The civil liberties rights index measures the freedom of citizens to express themselves through their civil privileges. Since freedom of expression of civil rights and liberties is an indisputable criterion for sustainability, it is included in the research.
20.	Energy use per capita	Energy use per capita is the total primary energy use per headcount in a population (OECD, 2010). This indicator will help in the investigation of the environmental impacts of energy use on the focus region, Uzbekistan.
21.	Carbon dioxide per capita	Measured in metric tons, the Carbon dioxide per capital indicator is the emission of CO_2 per population head. This indicator is useful to the study because CO_2 emissions have a huge impact on the environment and a direct correlation with income (Mott, Razo, & Hamwey, 2021)
22.	Income from natural resources	Income from natural resources indicator tracks the performance of companies involved in the exploration of natural resources. The researcher finds the indicator useful on the ground that it will aid an investigation into resource depletion and environmental accountability.
23.	Renewable power generation	Renewable power is a cleaner alternative to fossil fuels. Not only is it environmentally friendly, but it also provides more economic value in the long run. Adding this index to the study will provide a better understanding of how a sustainable urban settlement is being built for all.
24.	Economic growth	For the prosperity and well-being of billions of people to be guaranteed, there must be economic growth (Boldeanu & Constantinescu, 2015). Boldeanu and Constantinescu (2015) also stated that human resources, natural resources, capital formation, and technology are the driving forces of economic development. The factors of economic growth as identified by Boldeanu and Constantinescu (2015) are SD concerns. Hence, the researcher finds this indicator helpful.
25.	Capital investment index	According to the Global Economy, CI index is a measure of fixed assets such as roads, schools, roads, drainage systems, fences… and net inventories of a country. The CI will help the researcher investigate commitment to the capital formation which in turn drives urban sustainability.
26.	Household consumption	In 2015, a study surmised that 60% of greenhouse emissions are caused by the consumption of household goods and services.

		This indicator is applicable to this study because household consumption is a factor that drives climate change.
27.	Unemployment	Unemployment is a dire socio-economic problem that adversely affects the quality of life. This indicator is helpful to aid familiarity with the socio-economic terrain of the study population.
28.	Employment for females	Employment for females is the aggregation of working opportunities available for women. This indicator will stipulate the equitable distribution of opportunities as a key factor for urban sustainability.
29.	Labour force females	The labour force females is the proportion of women in the workforce. It is an important indicator to the study on the ground that it will capture gender participation in the economy.
30.	Foreign direct investment	According to OECD, "*foreign direct investment (FDI) is a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy." "FDI is a key element in international economic integration because it creates stable and long-lasting links between economies."* FDI is an essential tool for measuring sustainable tool.
31.	Voice and accountability index	The index for Voice and Accountability is an estimation of the scope of citizens' participation in selecting their government, as well as freedom of expression, freedom of association, and free media. This index is included in the study because it is an instrument for measuring social equity.

APPENDIX 9

Correlation analysis of the selected indicators

		HFBD	PSI	HRRLI	HDI	WP	RFM	PUP	HSpC	LE	DR	MM	ID	UPADW	ANE	RDE	CPI	CLI	EUpC	CDE	INR	RPG	EG	CI	HC	UR	ERF	LFF	FDI	VAI
HFBD		1.00																												
PSI		.732	1.00																											
HRRLI		.741	.661	1.00																										
HDI		-.617	-.684	-.610	1.00																									
WP		-0.44	-0.26	-.603	0.28	1.00																								
RFM		-.583	-0.49	-.921	0.42	.533	1.00																							
PUP		-0.24	-0.20	0.22	0.25	0.14	-0.39	1.00																						
HSpC		-0.45	-0.51	0.05	.555	0.09	-0.26	.739	1.00																					
LE		-.714	-.984	-.627	.995	0.22	0.46	0.20	0.50	1.00																				

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
DR	-0.35	-0.26	-.550	0.25	.723	.537	-0.31	-0.11	0.22	1.00											
MM	.630	.706	0.50	-.938	-0.16	-0.39	-0.32	-0.51	-.95	-0.02	1.00										
ID	.734	.656	0.28	-.881	0.14	-0.10	-0.41	-.649	-.890	0.20	.708	1.00									
UPADW	-.554	-.967	-0.49	.676	0.14	0.31	0.29	.602	.482	0.13	-.948	-.938	1.00								
ANE	-.695	-.772	-0.32	.728	0.07	0.23	0.25	0.51	.737	0.10	-.863	-.802	.642	1.00							
RDE	.661	.709	.639	-.829	0.50	0.43	0.43	0.42	.805	0.25	-.746	.672	-.775	-.557	1.00						
CPI	-.545	-.836	-.848	.734	0.37	.771	-0.23	0.09	.659	0.46	-.764	-.575	.744	.641	-.676	1.00					
CLI	.741	.658	.740	-.607	-.586	-.918	0.18	-0.04	-.627	0.51	-.525	0.30	-0.50	-0.36	-.583	-.834	1.00				
EUpC	.743	.675	0.41	-.892	-0.26	-0.30	-0.41	-.63	-.883	-0.12	.914	.841	-.910	-.843	.722	-.616	0.45	1.00			
CDE	.686	.744	.712	-.946	-0.33	-.562	-0.12	-0.51	-.948	-0.30	.473	.734	-.915	-.807	.719	-.861	.740	.742	1.00		
INR	.648	.744	0.21	-.788	-0.01	-0.10	-0.47	-.763	-.788	0.08	.730	.733	-.836	-.874	.517	-0.47	0.31	.436	.726	1.00	
RPG	-0.36	-0.36	0.07	0.42	0.01	-0.07	0.49	0.41	0.42	-0.07	-.552	-0.50	0.45	.378	-0.31	0.18	-0.04	-.585	-0.35	-.697	1.00

EG	.743	.726	0.48	-.783	-0.24	-0.41	-0.19	-0.32	-.783	-0.39	.707	.661	-.764	-.684	.632	-.632	0.48	.739	.704	.585	-0.47	1.00							
CI	-.561	-.559	-.767	0.47	0.16	.712	-0.30	-0.24	0.51	0.17	-0.44	-0.33	0.41	0.20	-0.49	.694	-.726	-0.28	-.529	-0.05	-0.15	-0.50	1.00						
HC	-.517	-.575	0.07	.641	0.00	-0.28	.740	.462	.605	-0.21	-.674	-.777	.703	.687	-.538	0.17	0.04	-.734	0.51	.848	.647	0.40	-0.25	1.00					
UR	-.712	-.736	-.876	.740	.636	.715	-0.14	0.01	.748	.647	-.669	0.39	.636	.578	-.738	.609	-.839	-.600	-.756	-0.37	0.26	-.637	.588	0.14	1.00				
ERF	-0.44	-0.26	-.652	0.33	.672	.613	-0.23	-0.15	0.33	.517	-0.31	0.03	0.22	0.24	-0.44	.628	-.628	0.17	0.40	0.04	0.04	0.01	0.23	-0.05	.743	1.00			
LFF	.733	.672	.670	-.991	-0.38	-0.50	-0.24	-.534	-.985	-0.33	.428	.726	-.959	-.817	-.743	-.860	.673	.787	.655	.737	-0.42	.719	-0.48	-.600	-.799	-0.41	1.00		
FDI	-0.11	0.03	-0.44	-0.09	0.14	.609	-0.41	-.550	-0.02	0.22	0.02	0.20	-0.15	0.03	0.06	0.30	-0.51	0.13	0.00	0.11	0.12	-0.06	0.35	-0.42	0.38	0.37	0.03	1.00	
VAI	-.686	-.930	-.797	.716	0.35	.686	-0.07	0.21	.630	0.38	-.851	-.704	.747	.690	-.791	.551	-.763	-.759	-.904	-.552	0.22	-.756	.717	0.31	.574	0.48	-.923	0.12	1.00

APPENDIX 10

Interview with experts (English version)

Dear Sir or Madam,

We would like to thank you for participating with your expert knowledge in this interview. Our research is focused on evaluation of urban sustainable development in Uzbekistan.

Participation in this interview requires approximately ten minutes and is voluntary. The results will be processed anonymously and used only in this research.

Below you will see a number of different indicators that we believe are relevant to sustainability of Uzbek cities. Please rate them on a one to ten scale (1-least important, 10-most important) based on how important an indicator is in evaluation of sustainability of urban development. If you believe that one or another indicator is not relevant please do let us know. Thank you!

1. human flight and brain drain index
2. public services index
3. human rights and rule of law index
4. human development index
5. women in parliament
6. ration of women to men in tertiary education
7. health spending per capita
8. life expectancy
9. death rate
10. urban population with access to drinking water
11. maternal mortality
12. infant death
13. alternative energy generation
14. research and development index
15. corruption perception index

16. civil liberties rights index

17. energy use per capita

18. carbon dioxide per capita

19. income from natural resources

20. renewable power generation

21. economic growth

22. capital investment index

23. household consumption

24. employment for females

25. labour force females

26. foreign direct investment

27. voice and accountability index

28. awareness

Здравствуйте!

Мы хотели бы поблагодарить вас за участие в этом интервью с вашими экспертными знаниями. Наше исследование сосредоточено на оценке устойчивого развития городов Узбекистана.

Участие в этом интервью потребует примерно десять минут вашего времени и является добровольным. Результаты будут обрабатываться анонимно и использоваться только в этом исследовании.

Ниже вы увидите ряд различных показателей, которые, по нашему мнению, имеют отношение к устойчивости городов Узбекистана. Пожалуйста, оцените их по шкале от одного до десяти (1-наименее важный, 10-наиболее важный) в зависимости от того, насколько важен показатель для оценки устойчивости городского развития. Если вы считаете, что тот или иной показатель не актуален, сообщите нам об этом. Благодарю вас!

1. Индекс бегства людей и утечки мозгов

2. Индекс государственных услуг

3. Индекс прав человека и верховенства права

4. Индекс человеческого развития

5. Количество женщин в парламенте

6. Соотношение женщин и мужчин в высшем образовании

7. Расходы на здравоохранение на душу населения

8. Продолжительность жизни

9. Уровень смертности

10. Городское население, имеющее доступ к питьевой воде

11. Материнская смертность

12. Младенческая смертность

13. Альтернативная энергетика

14. Индекс исследований и разработок

15. Индекс восприятия коррупции

16. Индекс прав гражданских свобод

17. Потребление энергии на душу населения

18. Углекислый газ на душу населения

19. Доход от природных ресурсов

20. Производство возобновляемой энергии

21. Экономический рост

22. Индекс капитальных вложений

23. Домашнее потребление

24. Занятость женщин

25. Рабочая сила (женщины)

26. Прямые иностранные инвестиции

27. Индекс голоса и ответственности

28. Осведомленность о практиках устойчивого развития

APPENDIX 11

Rationale for choosing survey questions

№	Survey Question	Rationale
1	Age	Age is one of the variables that report participants' background and demographic information (Tony, 2015). By asking about the age of the participant, the researcher will be equipped with the knowledge of the time of life of the respondents. This will aid in a solid understanding of the characteristics of the survey population.
2.	Gender	Participants' background is better understood and clearer demographic information is provided through the variable, gender (Tony, 2015). Knowing the gender distribution of the sample population is helpful in gathering demographic information. It is also useful in analyzing the data collected.
3.	Where do you currently live?	Understanding sustainable development from the perspective of location which can be either urban or rural is vital. Economic, social, and environmental resilience is not the same in urban and rural settlements (Milan, Uribe-Toril, Ruiz, & De Pablo, 2019). Since we are attempting to evaluate urban sustainable development, it is important for us to have the majority of respondents from urban area.
4.	What aspects make up sustainable development?	The Uzbek Population, much like every other people group, as findings on awareness of sustainable development on the global scene have established, does not have a thorough understanding of what sustainable development entails. This survey question intends to unveil what the participant know about sustainable development, not what they presumed.
5.	How important is the issue of climate change to you?	Providing the participant with options to tick, namely: *Not at all Important, Somewhat Important, and Extremely Important,* this question is included because it is an important, perhaps, the most essential point to consider in ascertaining the attitude (awareness) of the participants towards climate change.
6.	How worried are you about global warming?	Climate change awareness is described as "the concern about and belief in the issue of climate change." (Jurkenbeck, Spiller, & Schulze, 2021). Climate change, on the other hand is one of the key challenges of sustainable development. This question is on the list because the researcher hopes to measure concern about climate change among the Uzbek population.
7.	How much do you think global warming will harm you personally?	The researcher is adding this question on the ground that global warming being a serious climate problem affects everyone on the planet. The rationale can be surmised this way: *is the participant aware of the possibilities of sustaining harm?*
8.	How much do you think global warming	This question is on the list because the researcher aims to discover the picture of the world to come envisioned by the participant, and

	will harm future generations of people?	whether or not that world is capable of being harmed by today's sustainable development actions. This is relevant because it will help to weigh the responsive measures of the participant.
9.	Which comes closest to your own attitude about the current environmental problems we face?	If a participant is of the opinion that global warming will harm the future *(not at all, only a little, a moderate amount, a great deal)* it becomes mandatory to at least, have a clue of what the participant's attitude is towards climate change surmised by the current environmental problems. This question was therefore included as a matter of necessity. The researcher is literally asking: *are you insolent, mindful, bash, or hopeful when you think the stuff the environment is suffering from?*
10.	Rank the following sustainability issues from most important to least (1 being most important, 10 being least)	Nine (9) key issues with the option of allowing the participant to add what he/she feels is an issue in the box marked *others* that resonate with existing literature are addressed. The researcher sees these issues as not just fundamental but also indispensable in discussing sustainable development. Asking the participant to rank these issues in order of importance is helpful to provide answers to the research question.
11.	What would be the single best way to improve recycling in Uzbekistan?	Recycling seen in the context of sustainable development is a way Environment (Ivercian & Ivascu, 2015). This question is included in the participants' position on environmental protection vis-à-vis rec
12.	Please indicate your level of awareness of the following Sustainability goals (1 to 5):	In September 2015, the United Nations General Assembly had a meeting. The meeting resulted in the construction of 17 Sustainable Development Goals (SDGs) that focus on achieving sustainable development for all by 2030 (United Nations, 2015). This question is included on the ground that these goals form the United Nation's vision to create a sustainable goal for all in about less than a decade from now. The researcher seeks to find out the level of the participants' awareness of these goals.
13.	During the past year, how often did you do the following when you had the opportunity?	Organizations and individuals have the responsibility of protecting the environment (Ivercian & Ivascu, 2015). In this section, twelve (12) commonplace questions covering eating decision, laundry, shopping preferences, printing, and other habits were added to the list to access how responsible and committed the participants are to protecting the environment.
14.	From your experience, rank the following sustainability outreach methods by effectiveness (1 being most effective, 15 being least)	The borderline of the research work is centered on awareness. It is invaluable to know from the standpoint of the participants, which method best promotes sustainability awareness.

15.	I have a personal responsibility to help make a difference on environmental issues like minimizing waste, resource consumption, water use and energy use.	In line with Ivercian and Ivascu (2015), the researcher hopes to find out if the participants see environmental protection as their responsibilty. The answer is either *yes* or *no.*
16.	I have a personal responsibility to help make a difference on social issues like ensuring equity and inclusion, spreading environmental education, and supporting activities that promote human health and wellness.	Sustainable development goals are not restricted to the environment alone. They include social issues as well (Milan, Uribe-Toril, Ruiz, & De Pablo, 2019). This question is therefore added to cover the spectrum.
17.	I have become more aware of environmental issues in the past year.	As the years glide towards 2030, it is pertinent to know if the United Nations' 17 SDGs and environmental issues, in general, are gaining more ground. This question is therefore included to succinctly lead the researcher to the conclusion of whether or not progress is made.
18.	I have started caring more about environmental issues in the past year.	This question is included for much the same reason as the one above. The emphasis, however, shifted from *awareness* to *action.*
19.	Do you think gender equality is important for sustainable development?	The third aspect of sustainable development is anchored on economical issues where the equitable distribution of resources is one of the key results aimed at. Research has shown that women, especially in third-world countries are not given fair chances to strive for economic stability. The researcher posits this question to see if it has ever crossed the participants' minds that gender equality is essential for sustainability.
20.	Do you think women in Uzbekistan have same rights as men (in real life) and feel empowered?	Lastly, this question is included to narrow the scope down to the survey population. The researcher intends to measure economical sustainabilty from the Uzbekistan perspective.

APPENDIX 12

Survey for measuring sustainability awareness among Uzbekistan population (English Version)

Dear Sir or Madam,

You are participating in a scientific survey that aims at measuring sustainability awareness of Uzbek citizens.

Please make sure you meet the following prerequisites before taking the survey:

- You fall inside the age range of 18 and 55.
- You are a citizen of Uzbekistan.

This survey takes about 7 minutes to fill out and is completely voluntary. The research findings will only be handled anonymously for this project. We really appreciate your participation in this poll.

Sincerely yours,

Regina Veckalne

1. Age
- o 18-24
- o 25-34
- o 35-44
- o 45-55

2. Gender
- o Male
- o Female
- o Other

3. Where do you currently live
- o Rural area
- o Urban area

4. What aspects make up sustainable development?
- o Economic development

- o Environmental protection
- o Social conditions
- o I don't know

5. How important is the issue of climate change to you

- o Not at all important
- o Somewhat important
- o Extremely important

6. How worried are you about global warming?

- o Not at all worried
- o Somewhat worried
- o Very worried

7. How much do you think global warming will harm you personally?

- o Not at all
- o Only a little
- o A great deal

8. How much do you think global warming will harm future generations of people?

- o Not at all
- o Only a little
- o A moderate amount
- o A great deal

9. Which comes closest to your own attitude about the current environmental problems we face?

- o Environmental problems are not very serious and can be readily solved.
- o Although environmental problems are quite serious, they are not a dire threat to global well-being, and they can be solved by continuing current approaches and efforts.
- o Environmental problems are a dire threat to global well-being, but they can be solved by greatly increasing efforts under the current socioeconomic system.
- o Environmental problems are a dire threat to global well-being, and they can be solved only through radical changes in the current socioeconomic system.
- o Might as well face it, we're doomed.

10. Rank the following sustainability issues from most important to least (5 being most important, 1 being least)

Grounds, Open Space & Conservation Areas (litter, trees, landscaping, trail systems)

Waste Reduction & Recycling (waste minimization, separating recyclables from trash, purchasing recycled and recyclable products)

Water Resources (water consumption, water pollution)

Energy & Buildings (green buildings, LEED, energy efficiency projects)

Climate Change (renewable energy, reducing carbon footprint, achieving carbon neutrality)

Environmental justice (preventing disproportionately negative environmental impacts based on race, gender, social or economic status.)

Food & Food Waste (sustainable dining options - local, organic, community-based and third-party verified, reducing food waste)

Sustainable Purchasing (procuring goods and services that are more beneficial to the environment)

Education & Outreach (sustainability literacy, courses, programs, research)

11. What would be the single best way to improve recycling in Uzbekistan?
- o   More recycling bins in neighbourhoods
- o   More recycling bins in houses
- o   More education and outreach on proper recycling practices
- o   No need for improvement

1. Please indicate your level of awareness of the following Sustainability goals (5 being most aware, 1 being least):

No Poverty

Zero Hunger

Good Health and Well-being

Quality Education

Gender Equality

Clean Water and Sanitation

Affordable and Clean Energy

Decent Work and Economic Growth

Industry, Innovation and Infrastructure

Reduced Inequality

Sustainable Cities and Communities

Responsible Consumption and Production

Climate Action

Life Below Water

Life on Land

Peace and Justice Strong Institutions

Partnerships to achieve the Goal

2. During the past year, how often did you do the following when you had the opportunity?

	Never	Sometimes	Most of the time	Almost always
Conscientiously choose food based on its environmental impacts (local, seasonal, organic, or less meat, etc)				
Taken a course that is focused on or related to sustainability (in its social, environmental, or economic dimensions)				
Turn off lights when not in use (ex. when leaving a room)				
Use a reusable water bottle, coffee cup, or ravel mug, instead of single use options				
Drink tap water instead of bottled				
Reported leaky faucets, toilets, or showerheads				
Washed only full loads of laundry				
Print double-sided				
Limit time in the shower to 5 minutes or less				

Shop in a second-hand store or online sites such as eBay, Craigslist, or Facebook Marketplace (e.g., clothing, furniture, appliances)				
Contact an elected official or other representative to discuss an issue you care about				
Vote				

14. From your experience, rank the following sustainability outreach methods by effectiveness (1 being most effective, 15 being least)

- o Social media
- o Word of mouth
- o TV
- o Radio
- o Education
- o Training at work

15. I have a personal responsibility to help make a difference on environmental issues like minimizing waste, resource consumption, water use and energy use.

- o Yes
- o No

16. I have a personal responsibility to help make a difference on social issues like ensuring equity and inclusion, spreading environmental education, and supporting activities that promote human health and wellness.

- o Yes
- o No

17. I have become more aware of environmental issues in the past year.

- o Yes
- o No

18. I have started caring more about environmental issues in the past year.

- o Yes
- o No

19. Do you think gender equality is important for sustainable development?

o Yes

o No

20. Do you think women in Uzbekistan have same rights as men (in real life) and feel empowered?

o Yes

o No

APPENDIX 12

Survey for measuring sustainability awareness among Uzbekistan population
(Russian Version)

Здравствуйте!

Вы участвуете в научном опросе, целью которого является измерение осведомленности граждан Узбекистана об устойчивом развитии.

Прежде чем пройти опрос, убедитесь, что вы соответствуете следующим требованиям:

- Вы попадаете в возрастной диапазон от 18 до 55 лет.
- Вы гражданин/гражданка Узбекистана.

Этот опрос займет около 7 минут вашего времени и является полностью добровольным. Результаты исследования будут обрабатываться анонимно исключительно для данного исследования. Мы очень ценим ваше участие в этом опросе.

С уважением,

Регина Вецкалне

1. Ваш возраст

- o 18-24
- o 25-34
- o 35-44
- o 45-55

2. Ваш пол

- o Мужской
- o Женский
- o Другой

3. Где вы проживаете

- o За городом
- o В городе

4. Согласно вашему мнению, какие аспекты составляют устойчивое развитие

- o Экономическое развитие
- o Защите окружающей среды
- o Социальные условия
- o Я не знаю

5. Насколько для вас важна проблема изменения климата

- o Совсем не важна
- o Немного важна
- o Очень важна

6. Насколько сильно вас волнует глобальное потепление

- o Совсем не волнует
- o Немного волнует
- o Очень волнует

7. Как вы считаете, насколько сильно глобальное потепление повлияет на вашу жизнь

- o Никак
- o Повлияет совсем немного
- o Очень сильно повлияет

8. Как вы считаете, насколько сильно глобальное потепление повлияет на последующие поколения

- o Никак
- o Повлияет совсем немного
- o Очень сильно повлияет

9. Что ближе всего к вашему отношению к текущим экологическим проблемам, с которыми мы сталкиваемся?

- o Экологические проблемы не очень серьезны и могут быть легко решены.
- o Хотя экологические проблемы достаточно серьезны, они не представляют серьезной угрозы для глобального благополучия и могут быть решены путем сохранения текущих подходов и усилий.
- o Экологические проблемы представляют собой серьезную угрозу глобальному благополучию, но они могут быть решены путем значительного увеличения усилий в условиях существующей социально-экономической системы.
- o Экологические проблемы представляют страшную угрозу глобальному благополучию и могут быть решены только путем радикальных изменений существующей социально-экономической системы.
- o Мы все обречены

10. Расположите следующие проблемы устойчивого развития в порядке убывания важности (5 — наиболее важные, 1 — наименее важные)

Территория, открытое пространство и заповедники (мусор, деревья, озеленение, системы троп)

Минимизация и переработка отходов (минимизация отходов, отделение вторсырья от мусора, покупка переработанных и перерабатываемых продуктов)

Водные ресурсы (водопотребление, загрязнение воды)

Энергоэффективные здания (зеленые здания, проекты по энергоэффективности)

Изменение климата (возобновляемые источники энергии, сокращение углеродного следа, достижение углеродной нейтральности)

Экологическая справедливость (предотвращение непропорционально негативного воздействия на окружающую среду в зависимости от расы, пола, социального или экономического положения).

Еда и пищевые отходы (экологически безопасные варианты питания - местные, органические, общественные и проверенные третьей стороной, сокращающие пищевые отходы)

Устойчивые закупки (закупка товаров и услуг, которые более полезны для окружающей среды)

Образование (грамотность в области устойчивого развития, курсы, программы, исследования)

11. Какой единственный лучший способ улучшить переработку отходов в Узбекистане?

- o Больше мусорных баков в районах
- o Больше мусорных баков в домах
- o Больше образования и информирования о надлежащих методах утилизации
- o Нет необходимости в улучшении

12. Пожалуйста, укажите уровень вашей осведомленности о следующих целях в области устойчивого развития (5 — наиболее осведомлен, 1 — наименее):

Повсеместная ликвидация нищеты во всех её формах

Ликвидация голода, обеспечение продовольственной безопасности и улучшение питания и содействие устойчивому развитию сельского хозяйства

Обеспечение здорового образа жизни и содействие благополучию для всех в любом возрасте

Обеспечение всеохватного и справедливого качественного образования и поощрение возможности обучения на протяжении всей жизни для всех

Обеспечение гендерного равенства и расширение прав и возможностей всех женщин и девочек

Обеспечение наличия и рационального использования водных ресурсов и санитарии для всех

Обеспечение доступа к недорогостоящим, надёжным, устойчивым и современным источникам энергии для всех

Содействие неуклонному, всеохватному и устойчивому экономическому росту, полной и производительной занятости и достойной работе для всех

Создание прочной инфраструктуры, содействие обеспечению всеохватной и устойчивой индустриализации и внедрению инноваций

Снижение уровня неравенства внутри стран и между ними

Обеспечение открытости, безопасности, жизнестойкости и устойчивости городов и населённых пунктов

Обеспечение рациональных моделей потребления и производства

Принятие срочных мер по борьбе с изменением климата и его последствиями

Сохранение и рациональное использование океанов, морей и морских ресурсов в интересах устойчивого развития

Защита, восстановление экосистем суши и содействие их рациональному использованию, рациональное управление лесами, борьба с опустыниванием, прекращение и обращение вспять процесса деградации земель и прекращение процесса утраты биологического разнообразия

Содействие построению миролюбивых и открытых обществ в интересах устойчивого развития, обеспечение доступа к правосудию для всех и создание эффективных, подотчётных и основанных на широком участии учреждений на всех уровнях

Укрепление средств достижения устойчивого развития и активизация работы механизмов глобального партнёрства в интересах устойчивого развития

13. В течение прошлого года, как часто вы делали следующее, когда у вас была возможность?

	Никогда	Иногда	Очень часто	Почти всегда
Сознательно выбирали пищу, основываясь на ее воздействии на окружающую среду (местные, сезонные, органические продукты, не мясные опции).				
Прошли курс, посвященный устойчивому развитию				
Выключали свет, когда он не используется (например, выходя из комнаты)				
Использовали многоразовую бутылку для воды, кофейную чашку или кружку вместо одноразовых вариантов.				
Пили водопроводную воду вместо бутилированной				
Сообщали о протекающих кранах, туалетах или душевых лейках				
Стирали только полную загрузку белья в стиральной машине				
Печатали с двух сторон бумаги				
Ограничивали время пребывания в душе до 5 минут или меньше.				
Делали покупки в секонд-хендах (одежда, техника, другие товары)				
Связывались с избранным должностным лицом или другим представителем, чтобы обсудить волнующий вас вопрос.				
Голосовали				

14. Исходя из своего опыта, ранжируйте следующие методы работы по обеспечению осведомленности об устойчивом развитии по эффективности (1 – наиболее эффективный, 15 – наименее)

- o социальные сети
- o услышал от друга, родственника и т.д.
- o ТВ
- o Радио
- o образование

o Обучение на работе

15. Я несу личную ответственность за то, чтобы помочь изменить ситуацию к лучшему в таких экологических вопросах, как минимизация отходов, потребление ресурсов, использование воды и энергии.

o Да
o Нет

16. Я несу личную ответственность за то, чтобы помочь изменить ситуацию к лучшему в таких социальных вопросах, как обеспечение справедливости и инклюзивности, распространение экологического образования и поддержка деятельности, способствующей укреплению здоровья и благополучия человека.

o Да
o Нет

17. За последний год я стал более осведомлен об экологических проблемах.

o Да
o Нет

18. За последний год я стал больше заботиться об окружающей среде.

o Да
o Нет

19. Считаете ли вы, что гендерное равенство важно для устойчивого развития?

o Да
o Нет

20. Считаете ли вы, что женщины в Узбекистане имеют те же права, что и мужчины (в реальной жизни), и чувствуют поощрение в участии в политике, бизнесе, образовании и других сферах?

o Да
o Нет

APPENDIX 13

Allocation of points in survey

Question №	Maximum number of points
1	0
2	0
3	0
4	3
5	2
6	2
7	2
8	3
9	4
10	5
11	1
12	5
13	3
14	6
15	1
16	1
17	1
18	1
19	1
20	1
Total maximum	42 points

APPENDIX 14

Cross Loadings in Factor Analysis

Variables	A	EA	EC	EI	OM	SI
A1	**0.656**	0.427	0.432	0.142	0.355	0.489
A10	**0.683**	0.477	0.595	0.209	0.479	0.563
A11	**0.757**	0.570	0.623	0.216	0.498	0.613
A12	**0.724**	0.496	0.643	0.220	0.481	0.586
A2	**0.746**	0.684	0.717	0.146	0.554	0.730
A3	**0.625**	0.599	0.573	0.150	0.427	0.634
A4	**0.677**	0.438	0.607	0.144	0.374	0.584
A5	**0.764**	0.448	0.558	0.067	0.323	0.564
A6	**0.656**	0.468	0.628	0.152	0.410	0.502
A7	**0.690**	0.466	0.613	0.148	0.417	0.550
A8	**0.689**	0.423	0.708	0.127	0.398	0.523
A9	**0.693**	0.518	0.690	0.147	0.432	0.570
EA1	0.370	**0.735**	0.352	0.222	0.611	0.444
EA2	0.279	**0.677**	0.268	0.327	0.512	0.364
EA3	0.232	**0.674**	0.276	0.311	0.257	0.355
EA4	0.542	**0.711**	0.530	0.263	0.440	0.597
EA5	0.573	**0.710**	0.556	0.130	0.444	0.577
EA6	0.604	**0.709**	0.566	0.151	0.412	0.615
EC1	0.330	0.132	**0.791**	0.047	0.077	0.253
EC10	0.659	0.549	**0.737**	0.141	0.390	0.668
EC11	0.462	0.367	**0.589**	0.123	0.278	0.403
EC12	0.549	0.441	**0.629**	0.139	0.339	0.504
EC13	0.492	0.340	**0.601**	0.169	0.309	0.429
EC14	0.595	0.431	**0.640**	0.119	0.370	0.461
EC15	0.650	0.462	**0.645**	0.185	0.353	0.524
EC16	0.582	0.371	**0.657**	0.110	0.299	0.465
EC17	0.610	0.439	**0.667**	0.142	0.312	0.507
EC2	0.622	0.595	**0.715**	0.160	0.457	0.634
EC3	0.596	0.398	**0.607**	0.127	0.422	0.477
EC4	0.671	0.484	**0.721**	0.145	0.444	0.551
EC5	0.644	0.469	**0.688**	0.174	0.445	0.565
EC6	0.655	0.515	**0.698**	0.172	0.413	0.612
EC7	0.629	0.609	**0.657**	0.129	0.444	0.631
EC8	0.699	0.689	**0.714**	0.232	0.533	0.727
EC9	0.619	0.485	**0.681**	0.148	0.336	0.620
EI1	0.081	0.190	0.036	**0.689**	0.210	0.125
EI2	0.143	0.269	0.185	**0.679**	0.218	0.218
EI3	0.123	0.235	0.182	**0.631**	0.146	0.188

EI4	0.259	0.227	0.218	**0.728**	0.224	0.236
EI5	0.128	0.145	0.047	**0.597**	0.104	0.112
OM1	0.553	0.459	0.479	0.139	**0.657**	0.479
OM2	0.428	0.444	0.350	0.192	**0.654**	0.380
OM3	0.354	0.376	0.307	0.222	**0.615**	0.327
OM4	0.416	0.435	0.358	0.198	**0.713**	0.401
OM5	0.392	0.521	0.378	0.200	**0.727**	0.495
OM6	0.540	0.619	0.497	0.261	**0.774**	0.620
SI1	0.738	0.584	0.693	0.220	0.511	**0.740**
SI10	0.551	0.513	0.525	0.151	0.501	**0.673**
SI2	0.624	0.590	0.599	0.198	0.553	**0.745**
SI3	0.594	0.650	0.562	0.228	0.574	**0.731**
SI4	0.575	0.569	0.624	0.249	0.451	**0.727**
SI5	0.548	0.619	0.546	0.255	0.433	**0.713**
SI6	0.596	0.633	0.578	0.160	0.478	**0.686**
SI7	0.637	0.648	0.606	0.217	0.433	**0.738**
SI8	0.605	0.534	0.614	0.223	0.416	**0.693**
SI9	0.681	0.600	0.661	0.169	0.454	**0.745**

APPENDIX 15

Convergent Validity Analysis

Variable	Items	Loading	α	CR	AVE
	A1	0.656			
	A10	0.683			
	A11	0.757			
	A12	0.724			
	A2	0.746			
	A3	0.625			
Awareness	A4	0.677	0.886	0.905	0.544
	A5	0.764			
	A6	0.656			
	A7	0.69			
	A8	0.689			
	A9	0.693			
	EA1	0.735			
	EA2	0.677			
	EA3	0.674			
	EA4	0.711			
Environmental awareness	EA5	0.71	0.733	0.777	0.675
	EA6	0.709			
	EC1	0.791			
	EC10	0.737			
	EC11	0.589			
	EC12	0.629			
	EC13	0.601			
	EC14	0.64			
	EC15	0.645			
	EC16	0.657			
	EC17	0.667			
	EC2	0.715			

Energy conservation	EC3	0.607	0.916	0.926	0.528
	EC4	0.721			
	EC5	0.688			
	EC6	0.698			
	EC7	0.657			
	EC8	0.714			
	EC9	0.681			
	EI1	0.689			
	EI2	0.679			
Environmental Issues	EI3	0.631	0.741	0.771	0.505
	EI4	0.728			
	EI5	0.597			
	OM1	0.657			
Outreach Method	OM2	0.654	0.784	0.846	0.579
	OM3	0.615			
	OM4	0.713			
	OM5	0.727			
	OM6	0.774			
	SI1	0.74			
	SI10	0.673			
	SI2	0.745			
	SI3	0.731			
Sustainability issues	SI4	0.727	0.896	0.915	0.518
	SI5	0.713			
	SI6	0.686			
	SI7	0.738			
	SI8	0.693			
	SI9	0.745			

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