

System Approach to Sustainability In The Anthropocene

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Abstract

Sustainability is a concept that emerges from the intersection of human, earth, and development systems. Understanding these systems' interconnectedness is vital for system analysts and policy makers. Human behavior plays a crucial role in sustainability. The number of studies undertaken on sustainability and sustainable development has been increasing, and several studies on sustainability have stressed advancing theory and practice, but there are theoretical, methodological, and practical gaps in the existing studies.

Methodology

The study aims to examine the interconnectedness of human, earth, and development systems and develop a human behavior change model for Sustainability in the Anthropocene. Methods of system analysis, such as problem and decision tree analyses, were used for the study on the human, the earth, and development systems, followed by scenario analysis and model development for sustainability. The study was focused on nature, root causes, and impacts of the Anthropocene rather than natural causes. Relationships between humans, the earth, and development systems were identified.

Results and Discussion

The study found the root causes and consequences of sustainability problems, identified possible future scenarios for sustainability, and developed Integrated Human behavior change models, including system thinking and a system approach to sustainability in the Anthropocene.

Keywords: Sustainability, the Anthropocene, Scenario, and Human Behavior Change Model

Introduction

The current situation of social, economic, and environmental development challenges has brought sustainability studies to the crossroads of development, sustainability, and anthropogenic issues, which require an interdisciplinary and systematic approach to the system's relationships in the Anthropocene.

Numerous theories and concepts of development currently exist, focusing on the evolutionary process of human capacity, modernization, dependency, world system, and globalization, multidimensional and major change processes in social and economic spheres [1,2,3].

Several authors suggest that sustainability is the capacity to maintain resources, processes, and outcomes of the system over time [4]. Others highlight that sustainability is the process of improving and maintaining healthy economic, social, and ecological systems for human development [5]. Stordart. H addresses the dimensions of sustainability in the efficient, equitable distribution of resources intra-generationally and inter-generationally [6]. Hak.T and others define sustainability as the process of transforming global society, environment, and economy to a sustainable one [7]. Mensah, J and others emphasize the importance of gross generational equity [8].

Authors argue that sustainable development is simply development continued over a given time [9,10]. Others suggest it aims to balance the relationships between social progress, environmental equilibrium, and economic growth [11], while Porter and others consider development choices that meet society's needs [12].

The Anthropocene has been used intensively since the 2000s, when sustainable development was introduced to the global development agenda [13]. Although some authors have been utilized in sustainability research, particularly in the Anthropocene's integrated system-oriented approach and system thinking from a social-ecological perspective [14,15], the main challenges for conducting sustainable research in the Anthropocene are a lack of a system approach to sustainability and weak relationships between the other systems and the sustainability system.

Filippo Giorgi proposes climate modelling of the Anthropocene, addressing twenty-first-century climate projection, and the human component of climate change [16], John and others [17] conceptualize World-Earth System Resilience and Social-Ecological Systems Theory and Governance.

Human activities and their impact play a crucial role in sustainability, environmental degradation, and climate change. To address these human behavior issues, the scholars suggest a social innovation model and use a mechanistic model for sustainability research [18]. Human behavior theories and models are more relevant to the system approach to Sustainable development in the Anthropocene. Our literature reviews found that there are big gaps in sustainability research in systems' concepts and human behavior models.

The study aims to examine the interconnectedness of human, earth, and sustainable development systems in the Anthropocene and develop a human behavior change model for Sustainability in the Anthropocene. Methods of system analysis, such as problem and decision tree analyses are used for the study, followed by scenario analysis and model development for sustainability. The study was focused on nature, root causes, and impacts of the Anthropocene rather than natural causes. Research problems were interconnectedness and relationships of sustainability systems in the Anthropocene, and how human behavior change models promote sustainability.

Study Results

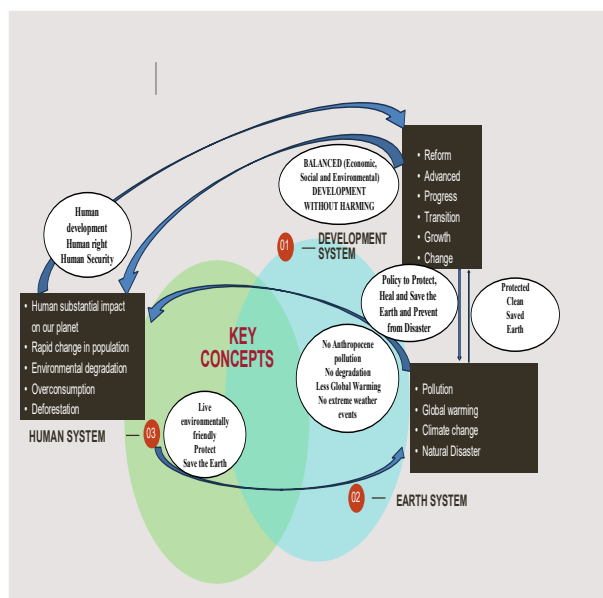


Figure 1: Relationships of Development, Earth, and Human Systems In The Anthropocene

A balanced development system provides a policy on the one hand to protect, heal, and save the Earth and prevent disaster that leads to a protected, clean, and safe Earth System, on the other hand, a policy on promoting human development, protecting

human rights, and ensuring human security that makes human system valued and enables live environmentally friendly, protect and save the Eart system.

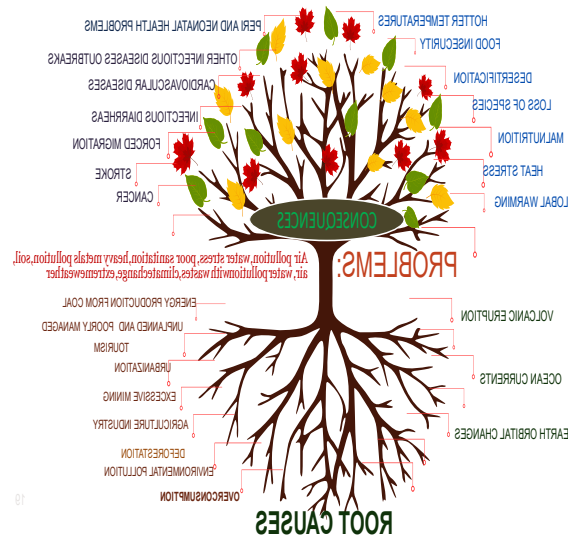


Figure 2: System or Problem Analysis of Environmental Sustainability In The Anthropocene

Problem analysis of environmental sustainability in the Anthropocene, shown in Figure 1, describes the root causes of natural and human-made problems of sustainability, coal mining and consumption, poorly planned and managed tourism, rapid urbanization, excessive mining, poorly managed agriculture industry, deforestation, environmental pollution, and

overconsumption are included in human-made causes. These causes create problems with air, water, soil, and heavy metal pollution, climate change, and extreme weather events. As a result, we face the consequences of hotter temperatures, food insecurity, malnutrition, loss of species, desertification, heat stress, global warming, and serious health challenges.

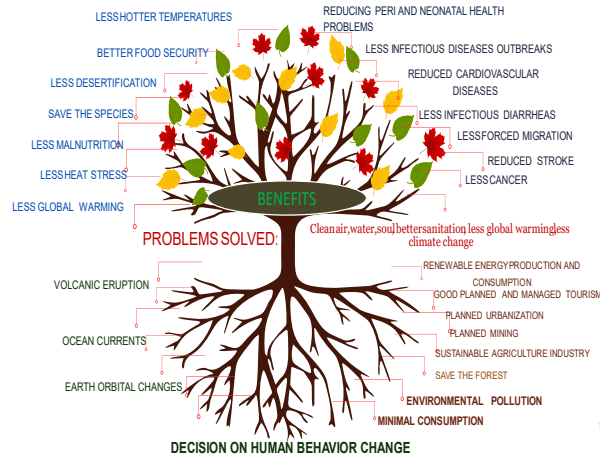


Figure 3: Decision Tree Analysis of Environmental Sustainability In The Anthropocene

Decision tree analysis, shown in Figure 2, shows that when the decision on the human behavior change strategy is taken, interventions addressing human-made root causes result in positive change, the problems identified by problem analysis of environmental sustainability will be solved, and the consequences described by problem tree analysis will be turned into benefits.

According to the human behavior change strategy for sustainability in the Anthropocene, at least four possible scenarios could be developed in the future: (i) the current scenario, (ii) the worst scenario, (iii) the best scenario, and (iv) the feasible scenario.

Options for the scenarios	Characteristics of the scenario
The Current Scenario	Not yet considered a behavior change strategy for Sustainability Human-made causes are untouched and remain at the same level, could even be increased All problems of environmental sustainability are not solved and remain at the same level
The Worst Scenario	Not yet considered about behavior change for sustainability, may have some resistance to this strategy Human-made causes are expanded and increased All problems of environmental sustainability are not solved, and worsen.

The Best Scenario	The behavior change policy has been implemented Policy process and outcome changes are evident Human-made causes are solved Environmental sustainability
The Feasible scenario	Human behavior change strategy for Sustainability has been introduced A policy process change has occurred Human-made causes are partially solved due to a behavior change strategy

Table 1: Possible Scenarios for Sustainability In The Anthropocene

Each scenario has its characteristics and needs different resources and timing. The scenarios are concerned with how human behavior change strategy is introduced and leads to process and outcome policy changes. The Feasible scenario was chosen for the next stage of modelling the Pro-Sustainability Human Behavior Complex Model. The current and the worst scenarios are avoided and undesirable in uncertain and risky situations. The best scenario is impossible to develop; the development,

human, and earth systems are not willing to be changed in that way.

Pro-Sustainability Human Behavior Complex Model is a kind of theoretical framework that includes human behavior change policy at the international, national, regional, and local levels, and its human behavior change interventions resulted in changes in knowledge, attitude, and practices of human behavior.

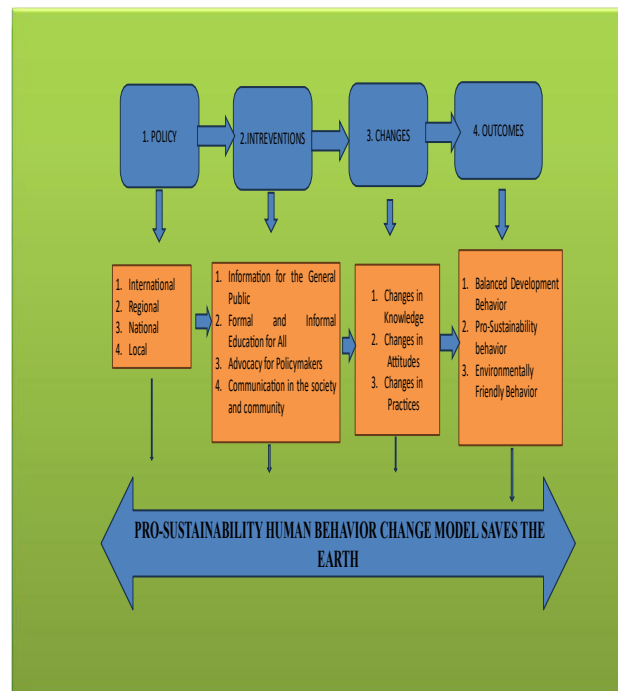


Figure 3: Pro-Sustainability Human Behavior Complex Model

We expect that the Pro-Sustainability Human Behavior Complex Model includes policy, interventions, changes, and outcomes components, could save the Earth, Development, and the Human System. The model would lead to the development of balanced development behavior, pro-sustainability behavior, and environmentally friendly behavior.

Limitations of The Study

The study itself was challenging because a complex nature of development, human, and Earth systems relations, and interconnectedness. Relational study, scenario analysis, and human behavior model development methodologies are not popular in sustainability studies. The study needs to validate the results of the problem, Decision Tree Analysis, and the Pro-Sustainability Human Behavior Complex Model.

Discussion of The Study

The study explores relationships between development, earth and human systems and the interconnectedness of these

systems. The main source of these relationships is balanced development system without hurting any of economic, social and environmental system in the Anthropocene. Environmentally friendly and human centered policy is enabled the earth to be safe and human to be valued. Human activities cause the problems of environmental sustainability, human behavior change policy could benefit to development, earth and human systems. The study needs to compare with previous studies in sustainability, but most studies were not addressed to changing healthy behaviors. The study has theoretical and practical significance in environmental sustainability.

Conclusion

Literature reviews on the subject found gaps in the systems' concepts and the human behavior model. Problem and decision three analysis of the study explores human-made root causes of environmental degradation, global warming, and climate change. These causes are coal mining and consumption, poorly planned and managed tourism, rapid urbanization, excessive

mining, poorly managed agriculture industry, deforestation, environmental pollution, and overconsumption. Human-made causes were used as a driving force for scenario development, and a feasible scenario was chosen from the four possible scenarios. A Pro-Sustainability Human Behavior Change Complex Model was developed. The model would be piloted in certain regions. As mentioned in the model, the development of balanced development behavior, pro-sustainability behavior, and environmentally friendly behavior at the international, regional, national, and local levels save the earth, development, and humans.

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