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# Sustainable Development Goals In Rural Areas With Environmental And Social Implications: A Meta-Regression Analysis

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## Abstract

***Purpose:*** *The purpose of this study is to analyze the sustainability of village development by examining village development standards, goals, and methodologies.*

***Methodology/approach:*** *This research employs a regression meta-analysis to explore the relationship between village development norms, objectives, and strategies. The investigation focuses on countries where agriculture plays a significant role in the economy. Specifically, it examines programs aimed at increasing agrarian productivity to reduce poverty, improve food security, and stimulate agricultural growth. Additionally, the study considers the potential of non-agricultural villages to contribute to poverty alleviation and the creation of social capital through enhanced agrarian productivity.*

***Results/findings:*** *The results of the meta-analysis, which were performed utilizing OpenMEE as well as JASP, display the observed outcome and are stated as a percentage. According to the analysis, the Provide Quality Education and Establish Good Health and Well-Being model has a value of -0.13. The studies 9, 20, and 24 had the largest forest plots, measuring 47%, 71%, and 25%, respectively, while the studies 2, 4, 5, 7, 10, 11, 14, 15, 16, 17, 19, 21, and 25 had the smallest forest plots.*

***Limitations:*** *Areas of village development objectives from previous research and analysis using meta analysis.*

***Contribution:*** *In the area of use determinations, both the public and private sectors are necessary. Additionally, businesses are obliged to make wise judgments.*

***Novelty:*** *Systematic Reviews and Meta-Analyses*

***Keywords:*** *meta analysis, observed outcome, sustainaibility development goal, forest plot, good health*

## 1. Introduction

### 1.1 Sustainability Development Goals (SDGs)

Village Sustainable Development Goals (SDGs) are development programs prepared with the right targets by the government. These goals were initiated by the United Nations (UN) on September 25, 2015, [1]as part of a global effort to create a sustainable living system. The

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global SDGs consist of 17 main points that provide a framework for sustainable development on a global scale. Recognizing the need for local adaptation, village SDGs were proposed, consisting of 18 specific points that address the unique challenges and opportunities faced by villages (LPPM, 2022). Village SDGs are important because in implementation requires collaboration from various parties, including universities. Higher education is also an educational institution that has the greatest intellectual capital to actively participate in various SDG programs.

The Sustainable Development Goals (SDGs) are global actions that have been agreed upon by world leaders. This is because of the urgency to end poverty, reduce inequality, as well as protect the environment. The government then stipulated the regulations in Presidential Regulation (Perpres) Number 59 of 2017 related to the SDGs' implementation. The data obtained from the 2016–2020 Sustainable Development Report is presented in the graph below.


a. Achievement b. World Ranking

Figure 1. Sustanaible Development Report 2016-2020

The requirement of sanitation, water, health waste management, hygiene, as well as environmental cleaning infrastructure and services in health care facilities (HCFs) is collectively known as Water, Sanitation, and Hygiene (WASH). Universal health coverage (UHC) relies on the effective implementation of WASH services in all health care facilities, as they are essential for delivering qualified care and maintaining compliance with infection prevention as well as control standards. Numerous examinations demonstrated an association between adherence to WASH requirements as well as a decrease in healthcare-associated infection rates (Meshi et al., 2022)(Balsalobre-Lorente et al., 2023)(Sulistiowati, Adisa, & Caturiani, 2021; Zakaria, 2021).

Access to adequate sanitation services as well as domestic wastewater treatment in developing countries is a crucial issue. The conventional sanitation-based domestic wastewater treatment is the most popular approach, neither ecologically nor economically healthy to recognize sustainable sanitation solutions. Hence, reducing the sanitation-related concerns as well as conventional system limitations are needed through alternative sustainable sanitation system development (Balsalobre-Lorente et al., 2023)(Werkneh & Gebru, 2023). With the increasing request to increase available sanitation systems for environmental protection as well as resource (energy, nutrition, as well as water) conservation, ecological sanitation approaches are directing the scientific community's interest. Subsequent research is to present a comprehensive study of the characteristics of conventional sanitation systems, domestic wastewater, as well as their sustainability challenges; ecological sanitation technologies, process conditions, and their performance in terms of resource recovery efficiency (such as biogas, clean water, and struvite-based nutrients). (Chand et al., 2021). The results of this approach are resource-oriented as well as closed-loop systems that promote sustainable sanitation by overcoming the conventional system limitations. Furthermore, the implementation of this technology to treat domestic wastewater also increase public health by decreasing the entry of disease-causing pathogens into the water cycle, as well as minimizing destructive environmental effects. Then the application of ecological sanitation technology to treat domestic wastewater will be a

feasible choice to solve the sanitation issues as well as synchronously promote the energy-food-water-health link, particularly in developing countries. (Tiimub et al., 2023)(Werkneh & Gebru, 2023).

### 1.2 Clean Water and Sanitation

Domestic wastewater, consisting of black water (a source of pathogens), gray water (from shower drains and washing facilities), as well as yellow water (from urine and rich in nutrients), constitutes the bulk of all wastewater flows. More than 90% of domestic wastewater in developing countries is discharged or accumulated without any treatment into rivers, surrounding areas, lakes, as well as coastal areas, creating severe ecological situations, including water quality deterioration. Domestic wastewater, consisting of black water (a source of pathogens), yellow water (from urine and nutrient riches), and gray water (from drain showers and washing facilities), makes up the bulk of the overall wastewater stream. More than 90% of domestic wastewater in developing countries is accumulated or discharged into and surrounding rivers, lakes, as well as coastal areas without any treatment, thereby serious ecological trouble occurred such as worsening of water quality as well as biodiversity loss (Werkneh & Gebru, 2023). It is crucial to prioritize the implementation of treatment and prevention strategies at both the national and individual levels. This entails presenting awareness about the significance of using clean water and ensuring that effective water management policies are applied (Qamar et al., 2022). Knowledge of water hygiene is necessary for cooking, drinking, washing, personal hygiene, cleaning, sanitation, and even agriculture. Access to adequate water and sanitation is identified as a fundamental human right under international law.(Ostadtaghizadeh et al., 2022). All of the above constitute access to affordable, sufficient and safe water supply for proper sanitation facilities. In addition, the need for sufficient water can increase human survival and prevent death. The ability to supply water means processing raw water and being able to distribute it to customers or communities in need. Sanitation means that it can collect and treat wastewater into a safe product that can then be channeled and discharged into the environment for other purposes. Clean water is also security in terms of water supply, domestic hygiene, and environmental hygiene (Meshi et al., 2022)(Biyanto, Fadlan, & Prasetiasari, 2023; Svongoro, Chigora, & Katsande, 2023).

When the incident occurred, the spread of the COVID-19 virus had already infected all levels of society. This spread includes spreading from human to human through close contact with infected people or surfaces and through inhalation. In order to safeguard public health in the COVID-19 pandemic, it is very necessary to have clean water, and the sanitation provided must be maintained. There are several countries with low wastewater treatment capacity, as well as directly discharged into water bodies. Vietnam, Pakistan, Philippines, and India carried out wastewater treatment at 38%, 10%, 8%, 4%, and 1%, respectively, while 85%, 80%, and 50% of households in sub-Saharan Africa, Asia, and Latin America lack access to a wastewater treatment network. (Ishiwu, Nnanwube, Nkem, & Ezegbe, 2020)(Ostadtaghizadeh et al., 2022)(Chaitkin et al., 2022).

This research aims to take existing approaches to the management as well as accessibility of clean water and sustainable sanitation for evereone, inclusive growth, as well as sustainable economic growth. This goal can be continued with the existence of productive and comprehensive employment opportunities, building resilient infrastructure, decent work for all, and enhancing inclusive as well as sustainable industries. Furthermore, other goals were carried out such as encouraging innovation, safe, inclusive, sustainable, and resilient cities as well as settlements, sustainable patterns of production and consumption, rapid measure to solve climate change with its impacts, as well as sustainable use of marine and oceanic resources for sustainable development and protection.

## 2. Literature review and hypothesis/es development

One of the cities that can be used as a pilot is Dhaka, Bangladesh. The city faces urban planning challenges for residents to access to clean water as well as sanitation (Brouwer et

al., 2023). The planning is related to slums and non-slums. Other experiences include water pollution, urban water supply, flood risk, as well as disease-related costs. This was then analyzed by making comparisons between people's ability to pay for better water services and improving public health. The lesson that can be learned from this experience is that there are some people who want to contribute from their income. The community's contribution is to assist large-scale investments in infrastructure as well as better sanitation and their recovery costs.

**2.1 Availability and sustainable management of clean water and sanitation**

Sanitation has a very broad scope as a basic human right and need. Despite the aspirations of Goal 6 of the Sustainable Development Goals (SDGs) to acquire universal access to clean water, sanitation, and hygiene by 2030, specifically emphasizing the importance of addressing the needs of women, girls, and marginalized populations, the realization of this goal remains unlikely. This is evidenced by the fact that nearly two billion individuals had low access to primary sanitation, while over 673 million individuals continue to use open defecation on a regular basis (Carbonell et al., 2023). If a direct measure is not taken to implement sustainable improvements, the global water crisis is expected to worsen. This situation particularly affects Pakistan, where inadequate water sanitation poses significant challenges. The prevalence of waterborne diseases is increasing exponentially due to increasing microbial contamination, trace elements, as well as drug toxicity in unsanitary areas across the country. To address these issues, it is crucial to implement treatment and use prevention methods both nationally and individually. Emphasizing awareness about the importance of using clean water and implementing effective water management policies are essential steps. By actively promoting the sustainability of water resources, a safer future for Pakistan can be ensured.(Mohamed, Alakhras, Khalil, & Mohamed, 2021)(Qamar et al., 2022).

In health facilities (HCFs), Water, Sanitation, and Hygiene (WASH) encompass the requirement of infrastructure and services related to water, sanitation, health waste management (HCWM), hygiene, and environmental cleaning. Effective WASH implementation in all healthcare facilities is crucial for the achievement of universal health coverage (UHC) with a vital role in delivering quality care and ensuring compliance with infection prevention as well as control norms and standards. Some examinations showed an as- sociation between adherence to WASH requirements as well as reductions in health care-associated infection rates (Meshi et al., 2022). The research has found a significant concern during the COVID-19 pandemic, namely the disregard for environmental issues that have led to a global crisis characterized by expanded pollution of micro-plastic. The World Health Organization (WHO) has affirmed that standard personal protective equipment (PPE) is planned for single-use which turns hazardous medical waste once utilized. The pandemic has created a substantial volume of hazardous waste globally. There have been suggestions that China, Japan, South Korea, and other countries have issued instructions to conceal this issue from the public (Chand et al., 2021).

**2.2 Inclusive and sustainable economic growth, full and productive employment opportunities and decent work**

The problem that is often found in rural communities is that improving environmental conditions in rural areas will require the community's ability to purchase power. Of course, the community will not be able to fix environmental problems without the ability of households to fulfill their daily needs. The relationship between environmental problems and society becomes a social, economic, as well as environmental analysis. Through economic analysis, the interplay of finances among stakeholders is examined, encompassing the entire value chain and evaluating the economic growth inclusiveness through considerations such as income distribution and employment generation. Utilizing financial analysis and estimations of each actor's contribution, the total value added, which includes salaries, taxes, finance costs, depreciation, and net operating surplus, is calculated across the value chain. This analysis also takes into account the operations' net surplus and

wages. By scrutinizing micro and macro data, insights regarding the economic viability and inclusivity of active value chains are derived (Avadí et al., 2022)(Schoneveld, 2020)(Chow & Singh, 2022). It is essential to consider the structural characteristics specific to each region, including their unique patterns of productivity, the dynamics of cooperation and competition among economic activities, local customs and traditions, and the presence of trusted relationships and productive interdependence between external and local actors. These factors are deemed significant in establishing a competitive advantage for companies operating within an industrial area (Assiri et al., 2021)(Flores-tapia et al., 2023)(Cheng et al., 2022). The failure to acknowledge social reproductive work and its repercussions on individuals, households, and society can be better understood by considering the concept of "depletion through social reproduction" (DSR) (Rai et al., 2019).

The research showed that social (0.796) and environmental (0.196) SDGs positively influence economic SDGs. Additionally, economic SDGs positively influence entrepreneurial viability (0.590) as well as competitiveness (0.918). The model explains 34.8% of entrepreneurial continuation as well as 84.3% of competitiveness. The significance of the path coefficients was evaluated using bootstrap test results (Del-Aguila-Arcentales et al., 2022). Rural transformation is considered a comprehensive process of societal change wherein individuals vary their activities as well as decrease their dependence on agribusiness and different primary extractive industries for the sake of income from services. This transition signifies a shift from independence to dependency, or from subsistence to market exchange. Notably, its success lies in providing diversity in consumption, asset ownership, and urban living, which in turn create favorable conditions for improved social as well as economic organization (Mallawaarachchi & Rahut, 2023)(Darko, Bans-Akutey, Ugoh, Ankomah, & Afriyie, 2022; Medlimo, Septania, Hapsari, Zuleika, & Agustin, 2022; Saadon, Suharto, & Dacholfany, 2021; Setiaji, Suharto, & Mazni, 2021).

The next analysis is regarding infrastructure development in rural areas and in accordance with the sustainability development goals for villages. In the past ten years, land governance has achieved significant attention from policymakers and academics. Initially sparked by media discussions on "global land grabbing," it has evolved into a well-established research field and a crucial area for policy interventions. The focus is on addressing mounting pressures on land and managing diverse competing claims. While land has traditionally been viewed as a local resource of immense significance for people's needs, it is now recognized as an international asset essential for addressing global challenges such as energy needs, food security, as well as climate change (Zoomers et al., 2017)(Juliyani, Noor, & Suharto, 2021).

### 2.3 Resilient Infrastructure Development, Inclusive Cities and Settlements, Sustainable Production and Consumption Patterns

In recent years, land governance has gained significant prominence among academics and policymakers. The initial term of media attention around "global land grabbing" has now evolved into a well-established field of early research and a crucial area for policy intervention. The focus is on addressing the growing pressures on land and managing diverse competing claims (Zakari et al., 2022)(Razzaq et al., 2022). Traditionally, land has been considered a local asset of immense importance to people's lives. However, it is increasingly recognized as a global resource required to tackle global challenges such as energy demands, food security, as well as climate crises (Paglialunga et al., 2022)(Bojago & Abrham, 2023). Additionally, there are competing claims for land, including related to mining, urban expansion, and nature conservation. Extensive academic publications as well as media reports investigated this global land issue, highlighting both the limitations and opportunities for achieving sustainable and inclusive development (Zoomers et al., 2017). The evaluations become possible to assess the quantity and accessibility of green urban areas (GUAs) at the sub-neighborhood level. The findings regarding SDG 11 indicated that only 9.23% of the population lacks access to desired GUAs, while 2.73% live in areas without easy walking access to GUAs. Conversely, SDG 15 evaluation result indicates that

each resident possesses an average of 10 $m^2$ of green areas, below the average for cities with over 250,000 citizens in Spain (Lorenzo-Sáez et al., 2021)(Castelblanco & Guevara, 2022).

**2.4 Climate Change, Marine Resources and Sustainable Use of Land Ecosystems**

The impact of climate change on food systems is already evident, with agriculture being identified as one of the sectors anticipated to face significant consequences (Bruce M et al., 2018)(Akter et al., 2023).

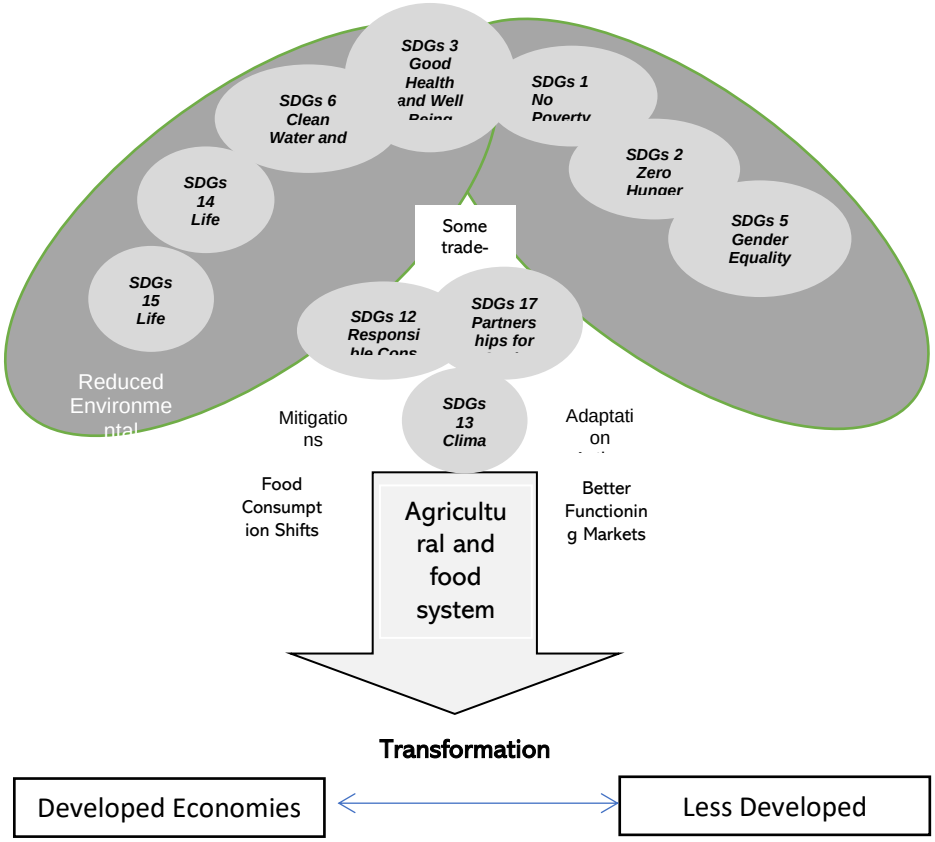


Figure 2. The relationship between climate change actions in the food system and the goals of sustainable development (Bruce M et al., 2018)

The main challenge lies in the interconnectedness of food systems with multiple SDGs, leading to potential trade-offs between these goals when implementing actions within the food system. Several interactions have both positive and negative effects. For instance, livestock production accounts for approximately 14% of global emissions, and aligning dietary choices with World Health Organization (WHO) guidelines to lower livestock consumption can potentially decrease emissions by up to 1.37 metric tons of CO2 per year by 2030. However, it is important to recognize that livestock has a crucial role in supporting the adaptive capacity of millions of smallholder farmers through milk and meat production, as well as providing manure for crop production, traction, and transportation.

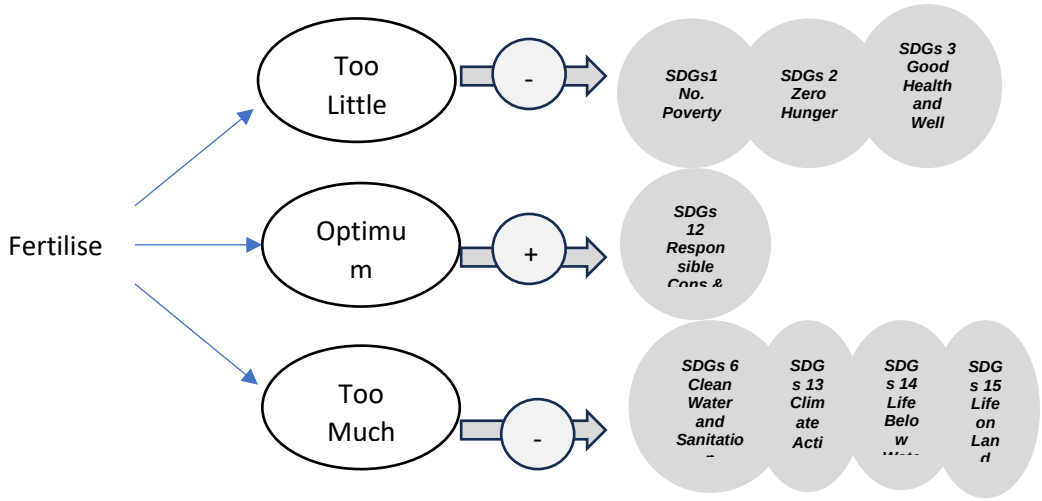


Figure 3. Opinion on environmental sustainability (Bruce M et al., 2018)

The oceans and marine environment are widely recognized for their priceless contribution to ecosystem stability, as well as their significant role in driving global trade, cultural activities, and recreational pursuits. (Fasoulis, 2021).

Climate change serves as a vital example highlighting the significance of understanding the perspectives of various stakeholders concerning the SDGs. In the midst of a climate emergency, completing the SDGs becomes even more crucial, as emphasized by the Intergovernmental Panel on Climate Change (Fasoulis, 2021). Concerningly, the SDG Agenda introduction did not have an explicit effect on the scientific output of the aerospace engineering community. This observation raises concerns about shifting societal attention away from pressing and urgent challenges like climate change, despite the variations among countries. Additionally, experts have determined seven SDGs that are highly relevant to the field of aerospace engineering (Sánchez-Roncero et al., 2023).

### 2.5 Selection Process of Study

This review used 26 independent articles based on the criteria including sustainable water and sanitation management, inclusive as well as sustainable economic growth, employment opportunities, resilient infrastructure development, inclusive cities and settlements, patterns of production and consumption of economic growth, as well as population. Likewise, qualitative case studies, and analysis based on quality education and establishing good health and well-being models, qualitatively report the data needed for meta-analysis. Figure 4 shows the selection flow chart along with the systematic scoping assessment as well as meta-analysis (Fasoulis, 2021)(Recuero Virto, 2018).

In studies cocerning to the quality of clean water management, sustainable sanitation, inclusive as well as sustainable economic growth, employment opportunities, infrastructure development, inclusive settlement cities, production and consumption patterns of economic and population growth, as well as the data analysis results, evaluation metrics are used to obtain educational quality standards and models of good health and well-being. This study investigates some of the potential driving forces in quality of life modeled in quality education and good health and well-being (Fasoulis, 2021).

### 2.6 Data Extraction

The data extraction process involves the identification and classification of various variables, such as climate change, economic growth, sustainable management of clean water and sanitation, employment opportunities, infrastructure development, production, as well as consumer patterns, and urbanization. These variables are categorized as either dependent or independent. Subsequently, the remaining 48 articles were carefully analyzed and organized in an Excel spreadsheet to assess the applicability of key concepts related to

climate change. These concepts include health consequences, public knowledge or attitudes towards climate change, the role of MDGs (Millennium Development Goals), the significance of SDGs (Sustainable Development Goals), mitigation strategies, adaptation strategies, the urgency reflected in documents, plans to address climate change effects, and measures to promote climate change management. After reviewing the 17 articles, the climate maintenance theme was then analyzed in addition to the list of criteria (Lilienfeld et al., 2018).

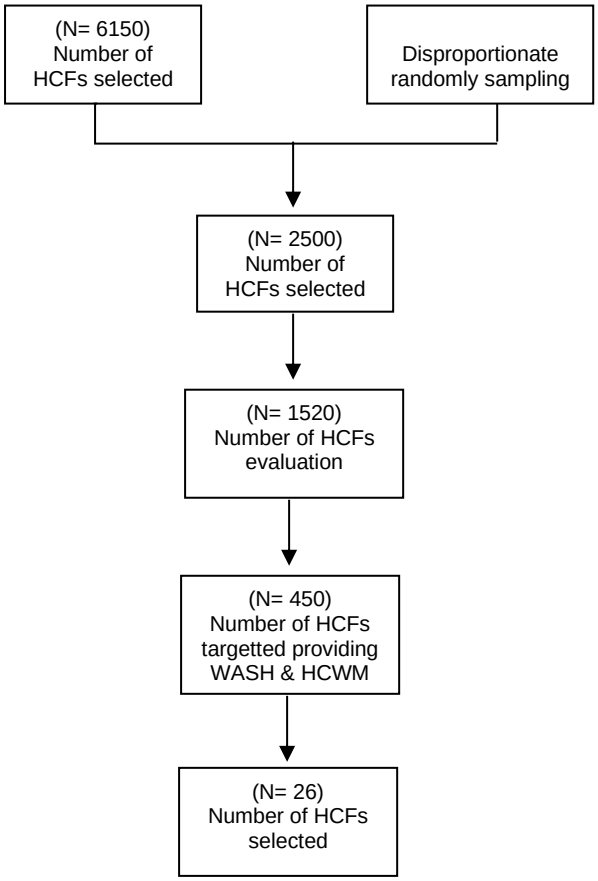


Figure 4. Selection of HCF healthcare facilities data and reliability of water, sanitation, hygiene (WASH)(Meshi et al., 2022)

Table 1 describes several articles utilized in this review. Some findings examined the relationship between the dependent as well as independent variables; for example, study 2 used the variables GDP, urbanization rate (URB), material footprint (MF), infrastructure development index (IDI), environmental innovation (EI), and a sample size of 160. Meanwhile, other studies analyze the dependent variable as the value of the level of education and the health and welfare of the community. (Zhou & Jamaani, 2023) explained that nowadays, global warming and climate change are two of the most influential dangers, which definitely increase the government's consideration for human health problems in addition to attracting attention to sustainable policy levels. Public health is critical to improving the quality of health and disease prevention through effective government guideline implementation as well as education and innovation promotion.

Tabel 1.Analysis of Study Data

| Employee Engagement | Authors | Article | Year | Country | Industry | N | Influenced Factors (IF) |
|---|---|---|---|---|---|---|---|
| Studi 1 | Andrea L. Magnano, Pablo A. Meglioli, Eugenia Vazquez Novoa, Ver´onica Chillo, Juan A. Alvarez, Leandro M. Alvarez, Carmen E. Sartor, Diego P. V´azquez, Cecilia C. Vega Riveros, Pablo E. Villagra | Relationships between land-use intensity, woody species diversity, and carbon storage in an arid woodland ecosystem | 2023 | Argentina | Carbon Storage | 150 | 1) Bio Mass<br>2) Soil Organic Carbon<br>3) Necro Mass<br>4) Woody Debris<br>5) Good Health<br>6) Dead Plant trees |
| Studi 2 | Asif Razzaq, Arshian Sharif, Ilhan Ozturk, Marinko Skare | Inclusive infrastructure development, green innovation, and sustainable resource management: Evidence from China's trade-adjusted material footprints | 2022 | China | Infrastructure Development | 116 | 1) GDP<br>2) Urbanization Rate (URB)<br>3) Material Footprint (MF)<br>4) Infrastructure Development Indeks (IDI)<br>5) Environmental Innovation (EI) |
| Studi 3 | Abdulrasheed Zakari Vincent Tawiah, Irfan Khan, Rafael Alvarado, Guo Li | Ensuring sustainable consumption and production pattern in Africa: Evidence from green energy perspectives | 2022 | Afrika | Green Energi | 170 | 1) Renewable Energy<br>2) Sustainable Consumption<br>3) Personal Income<br>4) Production<br>5) Economic Growth<br>6) Labor Force |

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|---|---|---|---|---|---|---|---|
| Studi 4 | Asma Akter, Gershom Endelani Mwalupaso, Shangao Wang, Mohammad Shah Jahan, Xianhui Geng | Towards climate action at farm-level: Distinguishing complements and substitutes among climate-smart agricultural practices (CSAPs) in flood prone areas | 2023 | Bangladesh | Climate Change | 600 | 1) Age<br>2) Education<br>3) Soil Fertility<br>4) Land Slope<br>5) Government<br>6) Climate Change |
| Studi 5 | Britta Augsburg a, Antonella Bancalari, Zara Durrani, Madhav Vaidyanathan, Zach White | When nature calls back: Sustaining behavioral change in rural Pakistan | 2022 | Pakistan | Household Sanitation | 551 | 1) Household<br>2) Sanitation<br>3) Latrine Technology<br>4) Public Infrastructure |
| Studi 6 | Daniel Balsalobre-Lorente, Jaffar Abbas, Chang He, Ladislav Pilaˇ, Syed Ale Raza Shah | Tourism, urbanization and natural resources rents matter for environmental sustainability: The leading role of AI and ICT on sustainable development goals in the digital era | 2023 | OECD | Information and Communication Technology | 36 | 1) GDP<br>2) Urbanization<br>3) Information & Computer Techn.<br>4) Natural Resources<br>5) Tourism |
| Studi 8 | Dušan Ristića, Danijela Vukoičić, Miroljub Milinčić | Tourism and sustainable development of rural settlements in protected areas-Example | 2019 | Serbia | Rural Settlements | 337 | 1) Nature Conservation2) Real Income3) Education |

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| | | NP Kopaonik (Serbia) | | | | | |
| Studi 9 | Elias Bojago a, Yitbarek Abrham | Small-scale irrigation (SSI) farming as a climate-smart agriculture (CSA) practice and its influence on livelihood improvement in Offa District, Southern Ethiopia | 2019 | Southern Ethiopia | Climate Smart Agriculture | 134 | 1) Age Category<br>2) Family Size<br>3) Education level<br>4) Land Size<br>5) Farm Experience |
| Studi 12 | Mansooreh Feisali, Mehrdad Niknami | Towards sustainable rural employment in agricultural cooperatives: Evidence from Iran's desert area | 2021 | Iran | Rural Employment | 356 | 1) Economic<br>2) Production<br>3) Employment<br>4) Educational |
| Studi 13 | Noorhaslinda Kulub Abd Rashid, Nor Fatimah Che Sulaiman, Zuraini Anang, Bayu Taufiq Possumah, Suriyani Muhamad, Nor Hayati Sa'at, Fauziah Abu Hasan, Hairunnizam Wahid | Survey dataset on the level of sustainable consumption of Malaysian households from the perspective of income and consumption expenditure | 2021 | Malaysia | Income & Consumption Expenditure | 635 | 1) Age<br>2) Employment<br>3) Education<br>4) Health<br>5) Marital Status<br>6) Income |

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|---|---|---|---|---|---|---|---|
| Studi 14 | Peter Asare-Nuamah | Climate variability, subsistence agriculture and household food security in rural Ghana | 2021 | Ghana | Household Food Security | 378 | 1) Age<br>2) Education<br>3) Farming System<br>4) Income |
| Studi 15 | Pingyang Liu, Shengxin Qi, Dongxuan Li, Neil Ravenscroft | Promoting agricultural innovation as a means of improving China's rural environment | 2021 | China | Agricultural Innovation | 264 | 1) Age<br>2) Education<br>3) Farming Scale<br>4) Agricultural Experiences |
| Studi 17 | Samuel Kojo Abanyie, Ebenezer Ebo Yahans Amuah, Nang Biyogue Douti ,Michael Noah Antwi , Bernard Fei-Baffoe , Charles Casmed Amadu | Sanitation and waste management practices and possible implications ongroundwater quality in peri-urban areas, Doba and Nayagenia, northeastern Ghana | 2021 | Ghana | Sanitation and Waste Management | 240 | 1) Age2) Gender3) Education |
| Studi 20 | Shama Nazneen, Xu Hong, Nizam Ud Din, Barkat Jamil | Infrastructure-driven development and sustainable development goals: Subjective analysis of residents' perception | 2021 | China | Infrastructure Development | 1.000 | 1) Family Income<br>2) Ecological awareness |
| Studi 23 | Siwei Hu, Yanying Yang, Hua Zheng, Changhong Mi, Tiantian Ma, Rongguang Shi | A framework for assessing sustainable agriculture and rural | 2022 | China | Rural Development | 193 | 1) Construction<br>2) Urban Population<br>3) GDP |

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| | | developme nt: A case study of the Beijing-Tianjin-Hebei region, China | | | | | |
| Studi 24 | Thi Phuoc Lai Nguyen, Salvatore G.P. Virdis, Thanh Bien Vu | "Matter of climate change" or "Matter of rapid urbanizatio n"? Young people's concerns for the present and future urban water resources in Ho Chi Minh City metropolita n area, Vietnam | 2023 | Vietnam | Climate Change | 725 | 1) Water use resources<br>2) Climate Change<br>3) Urbanization |
| Studi 25 | Umrbek Allakulov, Serena Cocciolo, Binayak Das, Md. Ahasan Habib, Lovisa Rambjer, Anna Tompsett | Transparen cy, governance , and water and sanitation: Experiment al evidence from schools in rural Bangladesh | 2023 | Bangladesh | Water Sanitati on | 226 | 1) Institutional Quality<br>2) Exam Result<br>3) Male Teacher Knowledge<br>4) Female Teacher Knowledge |
| Studi 26 | Wenhui He , Liqing Zhang , Chao Yuan | Future air temperature projection in high-density tropical cities based on global climate change and urbanizatio n – a study | 2022 | Singapore | Global Climate Change | 19 | Urbanization |

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| | | in Singapore | | | | | |

**2.7 Theoretical framework**

This research analyzes the effect of renewable energy production and consumption patterns on sustainable consumption as well as production patterns according to expert estimates based on arguments following the IPAT model (environmental impact (Impact) as a function of population (Population), affluence (Affluence), as well as technological progress (Technology)) expressed as I = (P A T) (Zakari et al., 2022). This is important because it focuses on consumption and production patterns to indicate the Cobb-Douglas production function as well as the Keynesian consumption function:

$$Y = AL. K,$$

where Y is total production, K denotes capital input, L is labor input, as well as A is the entire factor productivity.

$$C = Y$$

where C is consumption as well as Y is personal income. Hence, the authors calculate the IPAT model by combining the Cobb-Douglas production as well as Keynesian consumption functions.

Considering the meta-analysis approach utilized in this study, certain models derived from individual studies are deemed potential generalized models, encompassing both dependent and independent variables. It can also make the value of the observed result expressed in percent (%), which is how the OpenMee as well as JASP software help in achieving the value of Var(Z). The limitations consist of insufficient input data from all types and categories of industries. This experience is potentially due to the inability of industry types to provide a full range of relevant information for analysis. Furthermore, other weaknesses are the limited available data taken from articles that focus on energy consumption analysis, generally in the agricultural innovation industry, climate change, green energy, infrastructure development, and rural employment.

**3. Methodology**

This methodology utilizes data analysis techniques to assess empirical studies that specifically examine the consumption of renewable energy and provide greater insights related to its impact on the quality of education and good health and well-being. In general, meta-analysis aims to resume the effect size by evaluating as well as calculating some factors, for example, consumer trends in consumption behavior. Furthermore, the effect size is ascertained from the standard error coefficient of estimation utilizing a significance value of p 0.001, thereby any p value > 0.001 is to be considered insignificant. This serves as a valuable tool for identifying interventions that have the potential to decrease or improve energy consumption (Tampubolon et al., 2022).

**3.1 Effect Size**

To estimate the necessary statistical parameters and effect sizes, it is crucial to have access to the correlation coefficients (r) as well as the p-values, both methodologically and conceptually. However, a majority of research fail to provide such statistical information and merely categorizes their outcomes as significant or not significant. Incorporating statistical data becomes imperative as it highlights the importance of generating forest plots,

that offer a graphical representation showing the implications of standard statistics of a study's examination. The obtained values align with the findings represented in the forest plots, showcasing the progressively substantial impact of renewable energy sources on global warming. Forest plots positioned farther to the right indicate a more pronounced effect, while those located towards the left signify a more negligible effect. This study incorporates several factors such as economic development, urbanization, industry, government intervention, and energy consumption.

### 3.2 Variables

In this study, the dependent variable is ecosystem health (EH), which is evaluated using the VORS model. The independent variable is land urbanization (LU), typically measured by either the built-up area or the proportion of built-up area to urban land area. The latter method is commonly used as it aligns better with the urbanization rate. Therefore, this research adopts the ratio of urban built-up area to total urban area as a proxy variable for LU (Qiao & Huang, 2022). Based on the scale agglomeration effect, an addition in PD directs to higher housing demand, energy consumption, and traffic, resulting in ecosystem degradation. Therefore, this paper includes PD as a controlling factor. Additionally, the economic development level, estimated by GDP per capita (PGDP), is under control. Higher levels of urban economic development correlate with increased awareness as well as emphasis on ecosystem protection, thereby contributing to higher ecosystem health levels. Furthermore, the research considers the urban sprawl form, calculated by urban compactness (UC), and uses the ratio of the area to the perimeter of each urban land patch as a proxy variable for UC.

The regional ecosystem health level is jointly determined by the physical ecosystem health and the capacity to provide ecosystem services. The former shows the spatial entity health status using the VOR model, whereas the latter provides the integration of humans as well as natural ecosystems. The formula for assessing ecosystem health can be expressed as follows:

$$\mathrm{EH_{it}} = \sqrt{\mathrm{PH_{it}} \mathrm{x} \mathrm{ESV_{it}}}$$
$$\mathrm{PH_{it}} = \sqrt[3]{\mathrm{O_{it}} \mathrm{x} \mathrm{V_{it}} \mathrm{x} \mathrm{R_{it}}}$$

where EHit is the ecosystem health of unit I in year T. PHit as well as ESVit each contribute to the physical health of the ecosystem itself as well as provide ecosystem service capabilities. Oit, Vit, and Rit reflect organization, passion, and resilience, respectively. Oit, Vit, Rit, and ESVit should be normalized to 0–1 range before measuring ecosystem health. (Qiao & Huang, 2022). Ecosystem resilience (R) contains two essential aspects: resistance to external disturbances as well as the ability to recover and repair its original state following disturbances. These components, referred to as resistance and recovery, respectively, measure the ecosystem's capacity to sustain its structure and patterns over time.

$$= 0.35\mathrm{xLH} + 0.35\mathrm{xLC} + 0.3\mathrm{xIC}$$
$$= 0.25\mathrm{xSHDI} + 0.1\mathrm{xSHEI} + 0.15\mathrm{xDivision} + 0.1\mathrm{xIJI} + 0.1\mathrm{xFN}$$
$$+0.1\mathrm{x}\ \mathrm{Division}_{\mathrm{forest-wetland}} + 0.1\mathrm{xIJI}_{\mathrm{forest-wetland}} + 0.1\mathrm{xFN}_{\mathrm{forest-wetland}}$$

### 3.3 Charting Data

Specifically, for each year as well as country in the data set, it uses monthly CRU (Climatic Research Unit) data to construct temperature-following indicators and aims to capture both the presence of warming trends and cases where a country attacks by more extreme events. The initial indicator is temperature, represented by the average monthly temperature documented within a specific year (Paglialunga et al., 2022).

## 4. Results and discussion

### 4.1 The impact of independent variables on the quality of education and health and well-being

Tables 2 and 3, as well as Figures 5 and 6, describe the JASP software analysis results. Subsequently, specified studies were conducted and processed to derive z as well as var (z) values. Increased CO2 emissions are likely to create perceptions of a lack of regulation for pollution. However, these conditions show an attractive environmental image for foreign investment which eventually can improve FDI (Tampubolon et al., 2022)(Kaya et al., 2017). The independent variables in the model provide an overview of the model, as presented in the table below. For the coefficient of the Omnibus Test, it gives a Q value of 8,048 with a degree of freedom of 12. Similarly, the probability result is given a p value of 0,781. while the test value of residual heterogeneity gives a value of p 0.001.

Tabel 2. The fix dan random effects

**Fixed and Random Effects**

| | Q | df | p |
|---|---|---|---|
| Omnibus test of Model Coefficients | 8.048 | 12 | 0.781 |
| Test of Residual Heterogeneity | 267338.789 | 13 | < .001 |

Note. p -values are approximate.

Note. The model was estimated using Restricted ML method.

Estimated values for lower and upper, respectively, are 0.022 and 0.125. The results of the calculation of residual heterogeneity have a confidence interval value of 95%, as shown in Table 3.

Table 3. Estimated Residual Heterogeneity

**Residual Heterogeneity Estimates**

| | | 95% Confidence Interval | |
|---|---|---|---|
| | Estimate | Lower | Upper |
| $\tau^2$ | 0.043 | 0.022 | 0.125 |
| $\tau$ | 0.207 | 0.150 | 0.354 |
| $I^2$ (%) | 99.984 | 99.970 | 99.995 |
| $H^2$ | 6364.186 | 3326.080 | 18625.878 |

Meanwhile, table 4, as presented below, explains the estimate standard. The standard estimate value is negative for the categories of agricultural innovation, climate change, green energy, income and consumption expenditure, infrastructure development, infrastructure innovation, and rural employment.

Table 4. Analysis of the study data

**Coefficients**

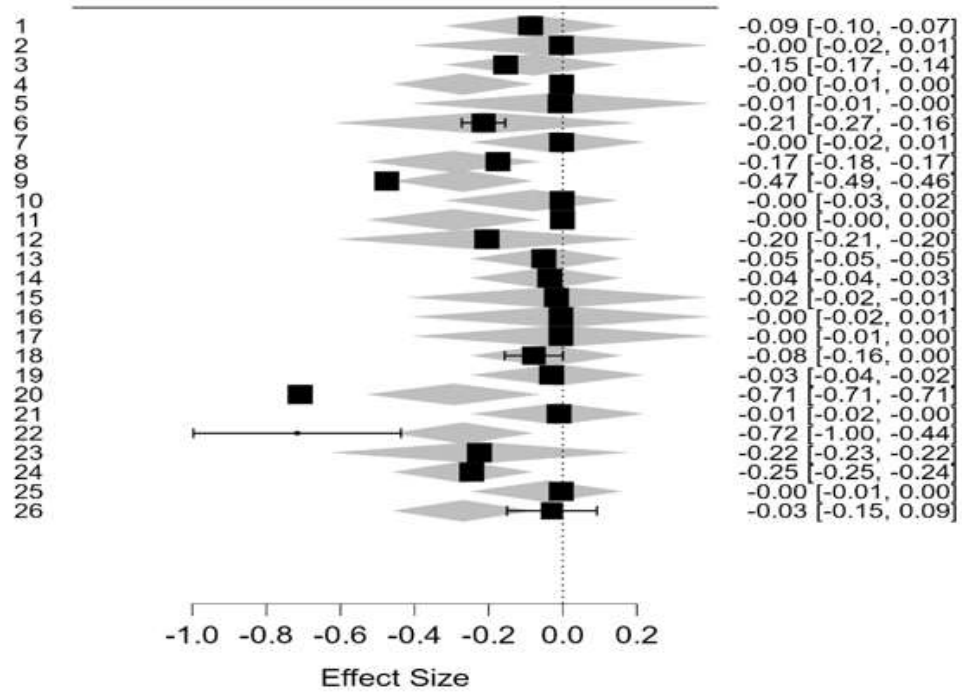
| | Estimate | Standard Error | z | p | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| intercept | -0.014 | 0.120 | -0.120 | 0.905 | -0.249 | 0.220 |
| Category (AgricuturalInnvovation) | -0.003 | 0.239 | -0.011 | 0.991 | -0.471 | 0.466 |
| Category (ClimateChange) | -0.255 | 0.154 | -1.657 | 0.098 | -0.556 | 0.047 |
| Category (GreenEnergy) | -0.067 | 0.169 | -0.395 | 0.693 | -0.398 | 0.265 |
| Category (Income&ConsumptionExpenditure) | -0.027 | 0.158 | -0.173 | 0.863 | -0.338 | 0.283 |
| Category (IncomeDevelopment) | 0.007 | 0.239 | 0.031 | 0.976 | -0.461 | 0.476 |
| Category (InfractructureDevelopment) | 0.009 | 0.239 | 0.039 | 0.969 | -0.459 | 0.478 |
| Category (InfrastructureDevelopment) | -0.281 | 0.169 | -1.660 | 0.097 | -0.612 | 0.051 |
| Category (InfrastructureInnovation) | -0.200 | 0.241 | -0.829 | 0.407 | -0.672 | 0.273 |
| Category (InfrastrukturDevelopment) | 0.010 | 0.239 | 0.043 | 0.966 | -0.459 | 0.479 |
| Category (RuralEMployment) | 0.009 | 0.239 | 0.039 | 0.969 | -0.459 | 0.478 |
| Category (RuralEmployement) | -0.211 | 0.239 | -0.881 | 0.378 | -0.679 | 0.258 |
| Category (RuralEmployment) | -0.191 | 0.239 | -0.798 | 0.425 | -0.659 | 0.278 |

Note. Wald test.

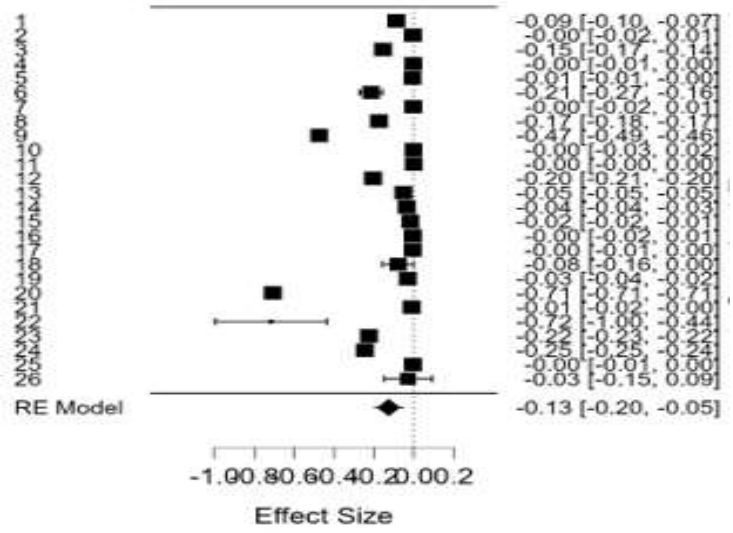
**4.2 Effect size dan RE Model**

The tables presented in Table 5 and Table 6 below explain the value of the effect size with the RE model, which gives a value of -0.13. This illustrates that the effect size values obtained have different values. The more to the left the effect size value, the more this illustrates that the variable levels of education, health, and welfare of the people in that country are still not very good. Conversely, for the effect size value that is to the right of the RE Model value, it illustrates that the variable levels of education, health, and welfare of the people in that country are getting better.

Table 5 Effect size




Tabel 6 RE Model




The countries shown in Table 5 are as follows: study no. 3, 6, 8, 20, 9, 12, 23, 24. Then for studies that are in the RE Model value area, see studies no. 2, 4, 5, 7, 10, 11, 14, 15, 16, 17, 19, 21, and 25. Figure 5 displays the comparison between theoretical quantiles as well as sample quantiles, whereas Figure 6 displays plots that differ from the sample. Nevertheless, the plot points commonly exhibit proximity to the line represented by theoretical quantiles. This discrepancy could potentially arise from variations in the industrial sectors of different companies, such as the distinctions between the coal and the oil or gas mining industries.

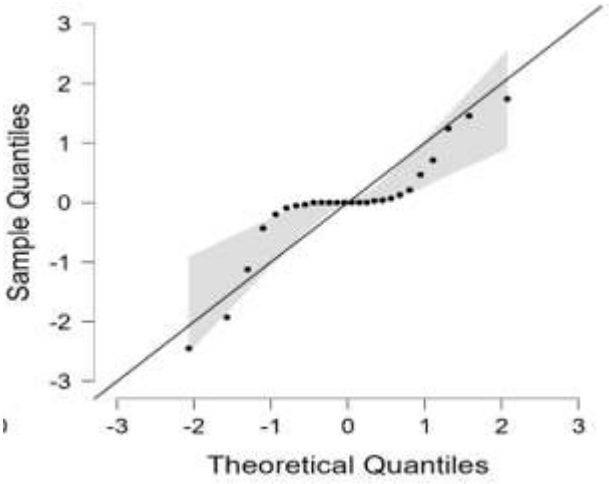



Figure 5. Normal Q-Q Plot

Figure 6 displays the profile plot overview, which the restricted log-likelihood rises from $\tau 2$=0.02 to $\tau 2$= 0.04 and become stationary at $\tau 2$ of 0.048, before reducing to $\tau 2$= 0.10.

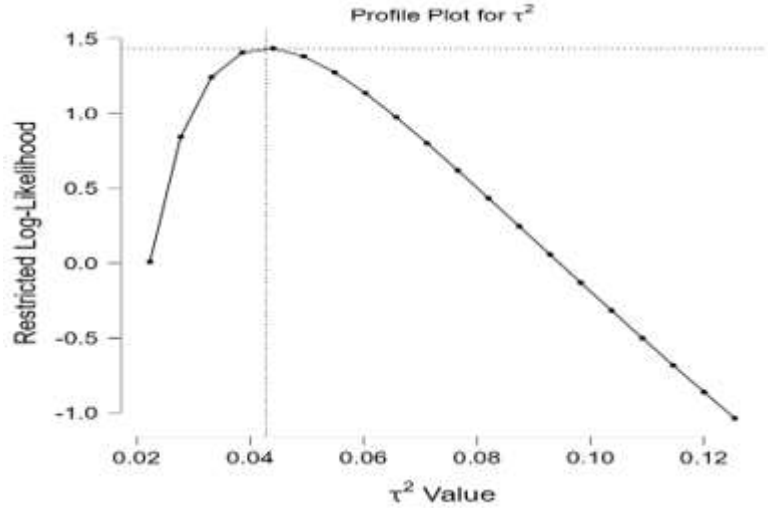



Figure 6. The Log-likelihood for τ^2

## 5. Conclusion

### 5.1. Conclusion

The findings in this study highlight village development goals with independent variables such as SDG No. 6 (clean water as well as sanitation), SDG No. 8 (decent work as well as economic growth), SDG No. 9 (industry, innovation, as well as infrastructure), SDG No. 11 (sustainable cities as well as communications), SDG No. 12 (responsible consumption as well as production), SDG No. 13 (climate action), and SDG No. 14 (life below water). Then for the dependent variable, there are SDGs No. 4 (quality education) and No. 3 (good health as well as well-being). Based on these results, research studies 3, 6, 8, 20, 9, 12, 23, 24 produced the highest percentage of forest plot yield values, namely 15%, 21%, 17%, 71%, 47%, 20%, 22%, and 25%, while the lowest yield values were obtained for studies 2, 4, 5, 7, 10, 11, 14, 15, 16, 17, 19, 21 and 25.

The outcome values vary based on the value of quality education and good health and well-being; for example, in studies 8, 20, and 24 are primarily from the rural settlement industry (Serbia), infrastructure development (China), and climate change (Vietnam). In addition, the quality education and good health and well-being models were found to have a value of -0.13. Consequently, tit is recommended that the government adopts policies

aimed at fostering inclusivity, safety, resilience, and sustainability in cities and human settlements. This is in specific the result obtained from this study using the meta-analysis method, which was carried out with a population sample in Serbia and gave a value of 71%. This improvement needs to be done because, in order to get good quality education and good health and well-being, good city conditions that are healthy, safe, and sustainable are needed. For research results using meta-analysis obtained with a sample population in China, 17% This value is actually not too high, but it is quite far from the model value of good health and well-being. This is due to infrastructure development in the country.The last result is from taking a sample in Vietnam, which has a model value of quality education and good health and well-being of 47%. This illustrates that it is necessary to control air and environmental conditions in the country. The impact of the climate itself has been felt by most people in Vietnam associated with floods and drought incidents, which have a direct effect on the degradation of natural resources, infrastructure, reduced crop yields, and disease while the results of the meta-analysis for a population sample in Indonesia's closest neighboring country are Malaysia, which gives a result of 5% of the model value of quality education and good health and well being. This is related to income and consumption expenditures.

### 5.2. Limitation

Areas of village development objectives from previous research and analysis using meta analysis.

### 5.3. Suggestion

It is necessary to improve and increase people's income and consumption. The government, the private sector, and other stakeholders can do this. Government collaboration with other stakeholders can increase people's income and consumption. This will have a direct influence on the quality of education as well as good health and well-being.

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