

# Regional Circulating and Ecological Sphere (R-CES) to Enhance Urban-Rural Connectivity: A Systematic Review

Ajeng Nugrahaning Dewanti

Department of Urban and Regional Planning, Institut Teknologi Kalimantan

Ariyaningsih

Department of Urban and Regional Planning, Institut Teknologi Kalimantan

Rahmat Aris Pratomo

Department of Urban and Regional Planning, Institut Teknologi Kalimantan

<https://doi.org/10.5109/7183395>

---

出版情報 : Evergreen. 11 (2), pp.1040-1049, 2024-06. 九州大学グリーンテクノロジー研究教育センター

バージョン :

権利関係 : Creative Commons Attribution 4.0 International

# Regional Circulating and Ecological Sphere (R-CES) to Enhance Urban-Rural Connectivity: A Systematic Review

Ajeng Nugrahaning Dewanti<sup>1</sup>, Ariyaningsih<sup>1,2\*</sup>, Rahmat Aris Pratomo<sup>1,3</sup>

<sup>1</sup>Department of Urban and Regional Planning, Institut Teknologi Kalimantan, Indonesia

<sup>2</sup>Graduate School of Media and Governance, Keio University, Japan

<sup>3</sup>Department of Geography, Planning and Environment, Radboud University, the Netherlands

\*Author to whom correspondence should be addressed:

E-mail: ariyaningsih@lecturer.itk.ac.id

(Received November 7, 2023; Revised April 23, 2024; Accepted May 8, 2024).

**Abstract:** In recent years, there has been a growing awareness in discussions on the international development of the significance of establishing linkages between rural and urban areas. It is mentioned that providing sustainable solutions to urban-rural challenges requires understanding their connectivity in spatial and temporal scales. Furthermore, sustainable urban and rural development demands a new hint at the urban-rural linkage, which can be achieved by the Regional Circular and Ecological Sphere (R-CES). The Regional-CES is based on establishing a self-sufficient and environmentally sustainable society. This study explores and understands the R-CES concept. The methodology used is a systematic literature review technique using PRISMA Framework. This literature review includes 56 articles from databases and registers. The literature review evidence indicates that most studies have focused on the connection or linkage between rural and urban areas. However, there is limited academic literature on the R-CES concept. The findings show that assessment of urban-rural resource interdependencies is required to ensure optimal resource circulation and achieve Regional-CES.

Keywords: urban-rural linkages, R-CES, sustainable city, resilient

## 1. Introduction

Rural communities worldwide have several characteristics, including local livelihoods that rely on natural resources<sup>1)</sup> (most of them become farmers or fisherman), low population density, and limited access as well as connectivity<sup>2)</sup> unlike urban communities. The concept of rural-urban connectivity occurred in the early 1980s in the field of regional planning<sup>3)</sup>. It was initially used as a theoretical strategy to address regional growth imbalances during the oil boom era, particularly in emerging nations, through the coordinated and simultaneous management of critical socio-economic systems<sup>4)</sup> including livelihoods, trades, and labor<sup>5)</sup>. As the divide between urban and rural communities deepens, developing relationships between the two is more necessary than ever<sup>6)</sup>. In addition, in the coming decades, more urbanization of previously rural areas is expected to cause pollution of natural resources and health risks<sup>7)</sup>. According to Douglass (1998)<sup>8)</sup>, people, production, commodity<sup>9)</sup>, money, and information transfers for rural-urban areas are critical to the success of rural-urban connectivity. This flow is exceedingly unlikely to occur in the absence of rural structures, urban duties and

responsibilities, and government actions<sup>10)</sup>.

The significance of connecting rural-urban areas has been widely acknowledged in the discussion of international development in recent years<sup>11)</sup>. As an example of Global Policy Frameworks, the Sustainable Development Goals and the Habitat Agenda have recognized it as a crucial component of sustainable development<sup>12)</sup>. Cities worldwide struggle with urban-rural conflicts<sup>13)</sup>, so encouraging development policies for urban-rural areas is essential. Furthermore, there are many connections between urban and rural areas, for instance, the mobility of persons<sup>5)</sup>. Because of their interdependence with urban regions, rural areas are experiencing economic, demographic, environmental, and governance changes<sup>14)</sup>. Many essential services, including those related to education, health, employment, the market, administration, information, credit, and emergency services, are concentrated in urban regions, making them inaccessible to rural communities<sup>15)</sup>. However, the rapid transformations involving special planning for rural and urban areas have heightened concerns<sup>16)</sup> about achieving regionally coordinated development. Mobility patterns, household access to goods and services, and knowledge and financial resources are only some examples of how

rural-urban connections can shift<sup>17</sup>). The IPCC (The Intergovernmental Panel on Climate Change) on their fifth assessment report stressed the importance of better understanding rural-urban links and how to manage them in light of climate change and its effect.<sup>14</sup>). To fully execute the New Urban Agenda, UN-HABITAT has also stressed the importance of fortifying rural-urban connections, especially in the face of risks.

Though the urban area approach is becoming increasingly popular, it has not yet gained as much popularity as conventional sectoral approaches.<sup>18</sup>). Urban and rural development strategies are more complicated<sup>19</sup>). In addition, it calls for more in-depth study than those for rural areas because they necessitate unique policies and governance structures that permit vertical and also horizontal coordination among many institutional public and private actors<sup>20</sup>). As a result, it is important to develop a sustainable approach to significant challenges through spatial and temporal analysis of urban-rural linkages<sup>21</sup>). Correspondingly, sustainable urban and rural development demands a new hint at the urban-rural linkage, which can be achieved by the Regional Circular and Ecological Sphere (Regional CES)<sup>12</sup>). The Japanese government announced the idea of a "circulating and ecological sphere" (CES) in 2018 to help reduce regional development gaps and disparity as well as promote sustainable growth<sup>12</sup>). One of the most important strategies for actualizing the revolving and ecological sphere was the promotion of interdependence connecting urban and rural areas<sup>22</sup>). To the point that it is implemented through concrete policies, such as a strategic partnership with neighboring areas or municipalities allowing all stakeholders to benefit from each other's assets, R-CES can be a valuable idea for decision policy making<sup>23</sup>).

The urban population of Indonesia has grown rapidly over the past decade<sup>24</sup>), and this tendency is projected to stay over the next two decades<sup>25</sup>). Most of the Indonesia's population will reside in cities during the next two decades. Recent estimates suggest that by 2035, 66.6% of the world's population will live in urban areas<sup>26</sup>). Cities grow, and megacities arise, because of urbanization. This variable may affect urban-rural connections across a wide swath of Indonesia. There is a growing literature on urban-rural linkages, especially R-CES<sup>3,12,27,28</sup>); however, few studies have addressed this topic in an Indonesian context.

Furthermore, there has been published some research related to urban and rural linkages<sup>5,20,29-31</sup>). However, the significance of urban-rural partnerships in Indonesia has yet to be discussed even for the literature review. This research contributes to the current or existing understanding of urban-rural connectivity, particularly the R-CES concept, and tries to integrate it with urban-rural characteristics in Indonesia, which have never been discussed before. Principally from a literature review, this research has three aims, which are: (1) To review the current literature on urban-rural linkages and their concept application (R-CES); (2) To explore and

understand the significance of urban-rural linkages in the context of sustainability; (3) To review the concept of R-CES for Resilient City.

## 2. Methodology

The methodological approach for this research on the current literature aims to identify, organize, and inspect the most reliable original articles on urban-rural connectivity and the implementation of sustainability and R-CES. Furthermore, to give an objective overview of the current state of study and potential future avenues for R-CES for urban rural connection, we conducted a systematic literature review (SLR). A literature review was used for the analysis by applying the PRISMA Framework. The PRISMA statement establishes a framework for expressing the rationale for a review and the authors' methodologies and findings<sup>32</sup>). The PRISMA framework's goal is to assist researchers in writing high-quality publications for systematic reviews and meta-analyses by recommending how these studies should be published.

The PRISMA framework focuses on ways researchers can use to ensure the steps in a literature review are transparent. The databases used in this study "Scopus", "ScienceDirect", "Google Scholar", "WOS", "JSTOR" and "ResearchGate". While the keywords used are "urban-rural linkages", "R-CES", "resilience", and "sustainable". However, the results are quite limited, so authors removed "R-CES" and "resilience". Finally, total articles included in this study is 56 articles. The flow chart is presented in Fig. 1 below.

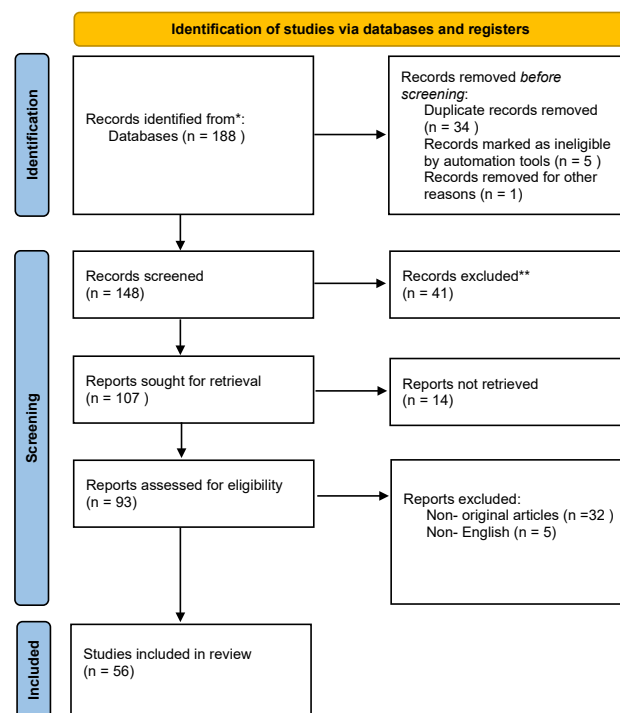


Fig1 : Step on PRISMA Framework

Based on figure above (Fig. 1), the literature review procedure includes the following steps:

1) Step 1

The study of this systematic review was constructed through queries entered the most popular research tools utilized by academics worldwide for bibliographic searches. In this case, authors used "Scopus", "ScienceDirect", "Google Scholar", "WOS", "JSTOR" and "ResearchGate" as a database. From the database, there were 188 articles found by authors.

2) Step 2

The article is chosen by scanning the articles' abstracts and keywords; while the keywords used are "urban-rural linkages", "R-CES", "resilience", and "sustainable". Authors primarily selected original papers published between 2002 and 2022 related to urban-rural research.

3) Step 3

In this step, authors omitted non-English written article; only original articles were selected. Furthermore, the classification of studies is based on the evaluation methodology and tools used in the corresponding case studies.

### 3. Results: Data Acquisition

Using a keyword search technique, academic publications, journals, and conference papers relating to construction project complexity were extracted from the Scopus, ScienceDirect, and ResearchGate databases. Figure 2 shows statistics from the Scopus database, which allows users to explore and categorize required documents by subject area.

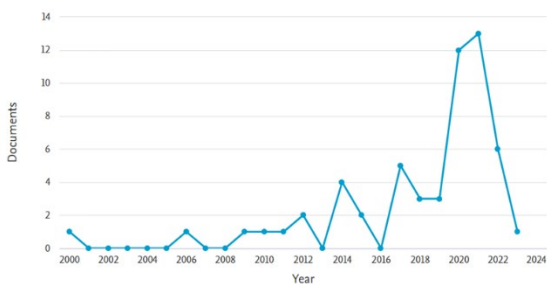


Fig 2 : Growing significance of urban-rural linkage research

According to the graph above (Fig. 2), research on urban-rural links was limited in the 2000s. This demonstrates a lack of interest in this research. Much research was undertaken exclusively for urban or rural areas during this period. The issue of urban-rural links was inadequately depicted throughout this timeframe. Unsurprisingly, spatial planning policy-making methods generally depend on terms of 'urban' and 'rural' classification. These policies often aim to separate urban and rural areas and disregard the characteristics of the areas in between. The simplicity of regional categorization leads to a lack of clarity in the discussion

on the connections between urban and rural areas<sup>33</sup>. Then, in 2014, research on urban-rural connectivity became a significant issue, growing fast after 2020. COVID-19 had an impact on urban-rural connectivity research from 2020 to 2023. According to research undertaken in Japan, such as Mitra, etc., COVID-19 threatens the Japanese state and significantly impacts the transportation of energy and commodities from rural to urban areas. COVID-19 has a massive effect on the robustness of urban-rural linkages.

The urban-rural dichotomy has emerged as a significant challenge for public policy, particularly in Indonesia<sup>34</sup>. A policy aimed at enhancing living standards and fostering economic growth has led to the implementation of discriminatory legislation, the emergence of unequal geographical patterns, and the occurrence of inequalities in growth. The disparities in growth trajectory have led to significant disparities between rural and urban areas, especially in Indonesia. Urban-rural linkages have been acknowledged in Indonesia since Mulyana's publication in 2014<sup>35</sup>.

Documents by subject area

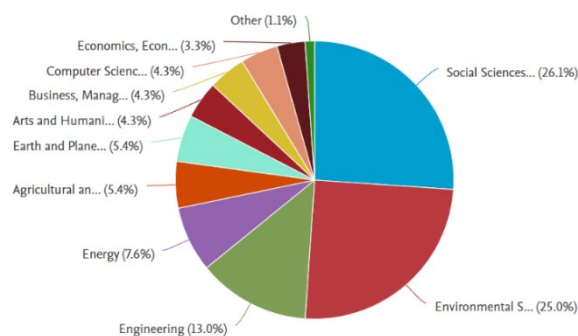


Fig 3.: Documents by the Subject Area

Grounded in the results of the systematic literature review, it can be said that the field of study that most discusses this is the field of social science as much as 26.1%, followed by environmental science (25%). Wjitbusaba et al.<sup>27</sup> conducted study in Thailand, and their findings highlight the importance of having a comprehensive territorial development strategy for the province, given the interrelated nature of the city, suburbs, and countryside. It is critical to strengthen urban-rural connectivity to become more resilient, particularly in the face of possible challenges such as urban sprawl<sup>36</sup> and climate change, which can reduce water supply and food security.

In the Fig. 4, it has been noted that the most research on urban-rural linkages has been conducted in the USA, then Japan case study is the second-most country which has been researched regarding urban-rural linkages. Surprisingly, urban-rural linkages also be conducted in Indonesia but in few numbers. It means that there is limited concern to know deeper about urban-rural linkages.

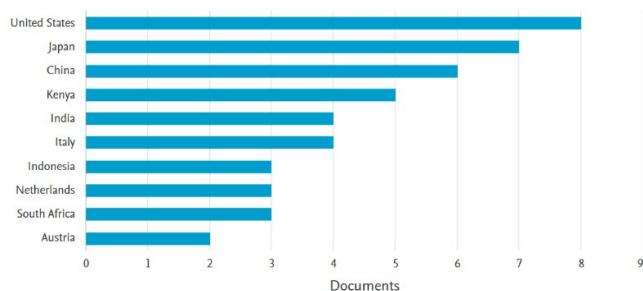


Fig 4.: Documents by Country

## 4. Findings

### 4.1 Definition of “Urban-Rural Linkages” and “Regional-CES”

Extensive scholarly research exists on theories and definitions of urban and rural areas<sup>37</sup>). Based on Tacoli (2003)<sup>38</sup>), urban-rural linkages refer to the various connections and interactions between communities located in urban and rural areas, encompassing economic, cultural, social, environmental, and political components. Furthermore, other scholars (Braun, 2007) mentioned that the term "urban-rural linkages" is used to describe the flow of communities, commodities, services, capital, and information linking rural and urban areas<sup>4</sup>). In addition, other publications define the movement of people, goods, resources, and information between labor markets and the establishment of partnerships at different levels that promote this linkage<sup>3</sup>).

Urban and rural areas have a mutually dependent relationship. Urban centers serve as markets for agricultural and rural products, which are distributed regionally, nationally, and internationally<sup>39</sup>). On the other hand, rural areas produce agricultural surpluses. Thus, the expansion of agriculture necessitates the acquisition of agricultural supplies and access to repair facilities for agricultural production from firms located in metropolitan areas. Conversely, the long-term viability of urban areas' expansion relies on the economic success of rural areas, which necessitates increasing the incomes of most rural households<sup>40</sup>).

The urbanization in Indonesia can be observed by the ambiguous boundary between areas classified as 'rural' and 'urban'. Agricultural and non-agricultural activities coexist in the surrounding areas of urban centers, while urban physical expansion is higher than the administrative boundaries of the city<sup>35</sup>). In Indonesia, two terminologies refer to rural areas (kawasan, perdesaan) and villages (Desa), as stated in Law No. 6/2014 on Village (Desa) and Law No. 26/2007 on Spatial Planning. An area is categorized as rural if its primary economic activity is agriculture, and it also includes resource management and serves as a functional area for social services, government, and rural settlement. On contrary, a village is defined as a legal administrative region under the authority of the

Indonesian government that has the autonomy to manage and control its own government administrative and community interests based on local community initiative, voice rights, and/or traditional rights. As a result, bridging the gap between urban and rural areas across the country will be critical in enhancing development and growth potential<sup>41</sup>). Urban and rural areas have a dependence on the same resources of nature<sup>42</sup>). Nevertheless, development planning in Indonesia has predominantly concentrated on well-delineated regional boundaries.

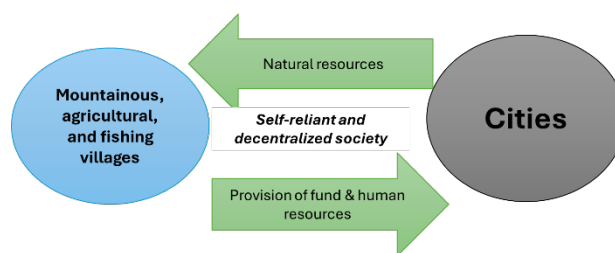


Fig 5.: Urban-Rural Dependencies (Source : authors)

The Ministry of the Environment, Japan (MOEJ) is actively encouraging the establishment of the Regional Circular and Ecological Sphere (Regional-CES). The Regional-CES is based on establishing a self-sufficient and environmentally sustainable society, as outlined in the 5th Basic Environmental Plan, endorsed by the Cabinet in 2018<sup>43</sup>). The Regional-CES concept is integrated into every aspect of the social framework. For instance, cities and rural areas will establish extensive networks that mutually benefit from their different resources, successfully optimizing the unique characteristics of each area. In other words, the concept of "Regional Circular and Ecological Sphere (Regional-CES)" aims to implement SDG practices in a specific local area, referred to as "local SDGs." This concept involves creating an integrated circulation of the environment, economy, and society, and showcasing the local vitality by effectively utilizing local resources. It also involves establishing a decentralized autonomous society that complements and supports each other's resources based on the unique characteristics of the local area.

### 4.2 Significance of Urban-Rural Linkages in the Context of Sustainability

Increased urban demands for land, water, and air have contributed to the growth of rural-urban linkages among environmental flow<sup>5</sup>). Significant urban sprawl into peri-urban and rural areas, in some countries developing rapidly<sup>44</sup>) in an unplanned and uncoordinated manner<sup>45</sup>), is one aspect of the increasing interconnectedness between rural and urban areas<sup>5,46</sup>). In addition, rural populations are increasingly urbanizing or adopting urban behaviors, such as consumption and also a daily habit. For example, famers in Japan use ICT and modern technology for their agriculture land. The process of rural urbanization occurs due to the increased flow of information from urban to

rural areas through media and other communications<sup>60</sup>). A study have also demonstrated that environmental services like recycling are becoming more accessible in rural areas<sup>47</sup>). As a result, there is a decreasing disparity in environmental attitudes and behaviors between rural and urban regions<sup>48</sup>).

Furthermore, the physical growth of urban areas has been the most noticeable change because it directly links to urbanization<sup>49</sup>) and the need to accommodate rising populations and economic activity in urban areas<sup>50</sup>). Land within and around cities has been increased to build residences, industries, and transport corridors<sup>4</sup>) including transportation infrastructure like roads and highways and waste management systems (both industrial and household)<sup>4</sup>). It is known that this demand for land has been projected to grow year by year<sup>16,50</sup>).

Several issues in urban areas affect rural areas<sup>47</sup>) and vice versa. For example, the problem of urban waste may affect not only urban areas but also rural areas<sup>51,52</sup>). Because it is well understood that the waste problem can potentially cause a major disaster<sup>53</sup>). Another example is related to wastewater in urban areas, it can also affect rural areas<sup>54</sup>). Heavy metal-containing industrial wastewater occasionally spills into the environment, either unintentionally or illegally, contaminating soil, rivers, and ground water<sup>55</sup>). In addition, some issues like waste collection systems have not been properly developed<sup>56</sup>). This waste problem in urban areas also can impact rural areas due to the pollution and the air quality.<sup>20,57</sup>)

Social connections, economic processes, and environmental synergies support continuities in linkage for urban-rural areas<sup>58</sup>). Promoting local partnerships for rural-urban areas is crucial to achieve sustainable development<sup>18,20</sup>). Therefore, urban-rural linkages and collaboration are receiving more attention in development agendas in European countries locally and globally and in development programs worldwide. For instance, the Regional Circulating and Ecological Sphere (CES) concept was included in Japan's 5th Basic Environment Plan due to the plan's recognition of the need for urban-rural connectivity to regenerate economy aspect, low carbon, and resilient society<sup>12,23</sup>).

One of good example is Vietnam. The effective strategies employed to address the urban-rural gaps in Vietnam included decentralisation, increased investment in essential and economic infrastructures, and the implementation of sustainable agriculture systems. These systems encompassed tourism, the establishment of value-added chain networks, and the implementation of more targeted and efficient regulations. This study also suggests the need to enhance the harmonious interaction and minimise conflicts between the proposed strategy and the Sustainable Development Goals<sup>59</sup>).

The research specifically examines the interconnections between urban and rural areas and their impact on the region<sup>60</sup>). Another rationale for prioritising urban-rural interdependencies is linked to the economic attributes<sup>61</sup>).

Although these situations exhibit contrasts, urban-rural interdependencies often possess numerous common characteristics<sup>62</sup>).

After Covid-19, encouraging urban-rural partnerships is important to develop strategies for sustainable development, including implementing R-CES<sup>63</sup>). For instance, the impact of COVID-19 on urban-rural linkages includes food, water, energy, etc., for disruption to both demand and supply<sup>64</sup>). However, in the current literature review, the geographical context is critical to establishing win-win solutions for realizing R-CES<sup>27</sup>). In addition, several researchers mentioned that collaboration between stakeholders from urban and rural areas should be done to enhance urban-rural partnership<sup>65</sup>), which can benefit its sustainability<sup>4,66</sup>). Finally, for an area to achieve sustainability, it must be economically self-sufficient, meaning it relies on local resources for production.

### 4.3 Review of Concept of R-CES for Resilient City

Following its 5th Basic Environmental Plan, the Japanese government officially created the R-CES, or "regional and circular ecological sphere."<sup>12</sup>) The goal of implementing R-CES is Decentralized and self-resilient society. The R-CES is a theoretical framework for organizing cities and regions to ensure that, depending on the sector or resource in question, both material and carbon are circulated at a scale that minimizes waste<sup>27</sup>). The framework for the idea is an approach to policymaking that takes into account all three of the following ideas at once: (a) a low-carbon society; (b) resource circulation; and (c) living in harmony with nature<sup>23,67,68</sup>). It seeks to integrate the economies of rural mountain communities, agricultural towns, and urban fishing enclaves in order to maximize regional vitality<sup>27</sup>). The SDGs cover economic, social, and environmental dimensions; Regional-CES give a concrete vision of an incorporated approach covering all three<sup>28</sup>). The idea can help rural areas generate income and jumpstart their economies by directing attention to the efficient use of solar, wind, and other forms of abundant natural capital. It is vital to the R-CES framework to comprehend the interdependencies and resource flows between urban and rural areas. The detailed description related to three principles in R-CES can be found as follows:

#### A. *Low Carbon Society*

There is a significant ongoing discussion in the context of R-CES related to sustainable development on the achievement of carbon neutrality, which ultimately reduces all greenhouse gas (GHG) emissions. Achieving carbon reduction on a global scale necessitates more than just economic incentives. It comprehensively restores technological and infrastructural elements and social and cultural behaviors within a spatial framework. The transition to a low-carbon energy grid extends beyond the gradual elimination of the existing energy infrastructure that relies heavily on carbon emissions. The R-CES encourages local regions to research their undeveloped



capacity for renewable energy sources, resulting in a more adaptive and decentralized power system based on innovative interactions within and between regions that revolve around energy. Rural communities can use their relatively unexplored renewable energy resources, such as hydro, wind, or solar panels, for specific uses while at the same time exchanging excess energy with nearby areas or cities in return for other goods and services<sup>69</sup>).

**B. Resource Circulation**

The R-CES emphasizes the significance of promoting self-sustaining ecological processes at a regional level. It advocates for circular systems that incorporate the concepts of the circular economy<sup>70</sup>. While complete localization of all resources may appear unattainable within the existing global capitalist system, increasing the localization of a greater portion of these resources is feasible. R-CES advocates for reconsidering the spatial limits that dictate the distribution of resources, urging communities to contemplate which of their requirements may be fulfilled at the local and regional levels. Additionally, it emphasizes implementing mechanisms to enhance the practice of reusing and recycling—methods to enhance garbage reuse and recycling systems.

**C. Living in Harmony with nature**

Embracing a lifestyle that harmonizes with nature is comprehensive and economically efficient, resulting in several benefits for the regions that adopt it in terms of sustainable development. The environmental advantages include carbon sequestration, decreased land degradation and erosion, enhanced air quality, habitat and ecosystem restoration, biodiversity protection, and reduced negative impacts from micro-climatic changes. An example in Japan is Satoyama, which denotes natural areas in the suburbs, towns, or villages formed by human activities, such as agriculture, that are rich in biodiversity. human activities, such as agriculture, that are rich in biodiversity, while Satoumi area refers explicitly to marine and coastal ecosystems. Satoyama and Satoumi help conserve ecosystems and their services while providing welfare to the community. ecosystems and their services, while delivering well-being for humans<sup>71</sup>).

Recognizing that humans are a part of the environment and are living creatures themselves<sup>66</sup>, it also ensures a symbiotic relationship between humans, the environment, and other organisms<sup>72</sup>). Because of its focus on enabling concrete strategies due to its principles, for instance, strategic cooperation with neighboring authorities that accepts all partners to gain from each other's assets<sup>68</sup>), R-CES is an approach that could be predominantly beneficial for decisionmakers<sup>28</sup>). Because of their interdependence, there are prospects for cooperation between urban and rural areas<sup>6</sup>); such as urban residents may provide financial assistance to rural farmers in exchange for actions that improve the quality of a pool that is physically located in the countryside but is heavily used by city dwellers<sup>57</sup>). According to Regional-CES (R-CES), the research also suggests ways the various regions

might increase their independence. Farmers, for instance, may gain from the presence of distribution hubs or fruit and vegetable processing businesses in the countryside, as this would cut down the need for mediators in the city<sup>73</sup>). In summary, Table 1 provides variables which can be considered to measure interdependencies of urban-rural linkages.

Table 1. Variables For Measuring Interdependencies of Implementing R-CES

Area	Dimension	Variables/Parameters
Urban	Physical	<ul style="list-style-type: none"> <li>• infrastructure location (hospital and health care center)</li> <li>• Location of tourist attraction</li> <li>• Distance from peri-urban.</li> <li>• Location of market of goods</li> <li>• Number of urban settlements</li> </ul>
	Socio-Economical	<ul style="list-style-type: none"> <li>• Number of education places</li> <li>• Number of workplaces</li> <li>• Number of tourists</li> <li>• Number of water supply investment</li> <li>• Population rate</li> </ul>
	Environmental	<ul style="list-style-type: none"> <li>• Total of water resources</li> <li>• Total of energy resources</li> </ul>
	Governance	Number of collaborative programs with rural area
Rural	Physical	<ul style="list-style-type: none"> <li>• Food market location</li> <li>• Location of agricultural products</li> <li>• Location of hospitals and healthcare centers</li> <li>• Distance from peri-urban.</li> <li>• Number of rural settlements</li> </ul>
	Socio-Economical	<ul style="list-style-type: none"> <li>• Number of education places</li> <li>• Number of workplaces</li> <li>• Number of tourists</li> <li>• Number of water supply investment</li> <li>• Population rate</li> </ul>
	Environmental	<ul style="list-style-type: none"> <li>• Total of water resources</li> <li>• Total of energy resources</li> </ul>
	Governance	Number of collaborative programs with urban area

Source : (compilation from literature review<sup>5,12,18,23,28,31,64,74</sup>)

The R-CES promotes the development of elaborate and enduring connections between rural and urban areas by rethinking the present flow of food, goods, people, capital, waste, natural resources, and energy from renewable sources. These emerging connections can reconfigure the spatial arrangement of ecological production<sup>75)</sup> and consumption chains to optimize efficiency. This involves towns and cities meeting their most basic needs by mainly depending on their surrounding rural areas for food and energy, while also aiming for self-sufficiency<sup>67)</sup>. Additionally, this approach aims to reduce waste and enhance resilience.

## 5. Conclusions and Limitations

In conclusion, this study is the first systematic review to identify the urban-rural linkages and sustainable concepts. Studying urban-rural connectivity in local contexts is critical to realize the transition to sustainable development or SGDs because the relevance of urban-rural collaborations has been recognized in European countries' global and regional development goals and in global development programs. Moreover, as urban communities always depend on rural areas for their daily needs, the significance of urban-rural research should be prioritized. From the current literature review, we can say that the significance of urban-rural linkages has progressively been recognized in development and policy after 2002 due to the World Summit on Sustainable Development (Rio+10). In the literature review, decision-makers must consider the importance of upstream areas for downstream areas in water resource planning to ensure resource circulation at optimal scales and to realize Regional CES. In addition, we looked at the most-cited systematic reviews/meta-analyses that could have a greater impact on future clinical practice and research because they synthesize and analyze a larger number of similar and most recent original studies. Using this systematic review study, we can better comprehend how earlier studies were evaluated in the past. The analysis of previous research led to discovering three primary findings in this investigation.:

- 1) Understanding the nature and trajectory of R-CES reviewing research on the urban-rural interface
- 2) improvement of sustainability and urban-rural connection studies by reviewing previous research
- 3) According to the results, most of the studies undergo systematic reviews. In addition, the data showed that most review studies have concentrated on the linkage or connectivity between urban and rural areas.

Furthermore, changing the 'urban' and 'rural' lens is necessary based on gaps and issue. Urban and rural cannot be separated into concepts concerning development. Finally, this literature review identified a gap that requires improvements in development planning through studies of

land use and projected natural resource demands and supplies, as well as the implementation Regional-CES (R-CES) as a guide for encouraging local resources and enhance the tourism sectors to improve livelihood. In addition, this research can be used as a foundation or preliminary study for stakeholders to develop strategies on how to balance urban and rural assets and reduce urban-rural disparity.

The implication has been identified. This paper offers tangible cognitive benefits. Hence, the implication is to formulate appropriate policies. This provides ways to enhance and establish integration between rural and urban areas through the utilization of the R-CES principle, which remains relatively unfamiliar in Indonesia. However, the authors acknowledge that their study has limitations because it is mostly based on a review of previously published articles. While the research's findings are expected to be applicable for the future, the urban-rural situation is constantly changing, and an increasing number of research are highlighting successful cases of urban-rural area from around the world. As a result, future research in this field would focus on case-specific studies at the regional level to carry out the proposed R-CES for translating urban-rural connectivity.

## Acknowledgements

Authors thanks to LPPM – Institut Teknologi Kalimantan, Indonesia for providing funding to this research.

## References

- 1) A. Nugraha, G. Prayitno, R. Rahmawati, and A. Auliah, "Farmers' social capital in supporting sustainable agriculture: the case of pujon kidul tourism village, indonesia," *Civ. Environ. Sci.*, 005 (02) 235–249 (2022). doi:10.21776/ub.civense.2022.00502.12.
- 2) A.T. Nugraha, G. Prayitno, A.W. Hasyim, and F. Roziqin, "Social capital, collective action, and the development of agritourism for sustainable agriculture in rural indonesia," *Evergreen*, 8 (1) 1–12 (2021). doi:10.5109/4372255.
- 3) G. Baffoe, X. Zhou, M. Moinuddin, A.N. Somanje, A. Kuriyama, G. Mohan, O. Saito, and K. Takeuchi, "Urban-rural linkages: effective solutions for achieving sustainable development in ghana from an sdg interlinkage perspective," *Sustain. Sci.*, 16 (4) 1341–1362 (2021). doi:10.1007/s11625-021-00929-8.
- 4) J. Von Braun, "Rural-urban linkages for growth, employment, and poverty reduction," *Ethiop. Econ. Assoc. Fifth Int. Conf. Ethiop. Econ. June 7-9, 2007 United Nations Conf. Center, Addis Ababa Keynote, Plenary Sess. I*, 22 (2007).
- 5) J.A. Berdegué, F. Carriazo, B. Jara, F. Modrego, and



- I. Soloaga, "Cities, territories, and inclusive growth: unraveling urban-rural linkages in chile, colombia, and mexico," *World Dev.*, 73 56–71 (2015). doi:10.1016/j.worlddev.2014.12.013.
- 6) T. Gebre, and B. Gebremedhin, "The mutual benefits of promoting rural-urban interdependence through linked ecosystem services," *Glob. Ecol. Conserv.*, 20 e00707 (2019). doi:10.1016/j.gecco.2019.e00707.
  - 7) T. Sato, "How is a sustainable society established? a case study of cities in japan and germany," *Evergreen*, 3 (2) 25–35 (2016). doi:10.5109/1800869.
  - 8) D. Gollin, "The lewis model: a 60-year retrospective," 28 (3) 71–88 (2014).
  - 9) S. Minsun Kim, "An empirical analysis on urban-rural linkage in mumbai metropolitan area asian mega-cities and peri-urbanization," *J. Dev. Pract.*, 2 (November) 20–25 (2015).
  - 10) C. Adam, D. Bevan, and D. Gollin, "Rural–urban linkages, public investment and transport costs: the case of tanzania," *World Dev.*, 109 497–510 (2018). doi:10.1016/j.worlddev.2016.08.013.
  - 11) P. Mitra, R. Shaw, V. Sukhwani, B.K. Mitra, M.A. Rahman, S. Deshkar, and D. Sharma, "Urban–rural partnership framework to enhance food–energy–water security in the post-covid-19 era," *Int. J. Environ. Res. Public Health*, 18 (23) (2021). doi:10.3390/ijerph182312493.
  - 12) K. Thapa, V. Sukhwani, S. Deshkar, R. Shaw, and B.K. Mitra, "Strengthening urban-rural resource flow through regional circular and ecological sphere (r-ces) approach in nagpur, india," *Sustain.*, 12 (20) 1–19 (2020). doi:10.3390/su12208663.
  - 13) M. Anbari, "The effects of rural-urban linkages on social development indicators : comparison of iran and china," 15 (2023) 293–317 (2024).
  - 14) P. Dasgupta, J. Morton, D. Dodman, B. Karapinar, F. Meza, M.G. Rivera-Ferre, A.T. Sarr, and K.E. Vincent, "Climate change 2014: impacts, adaptation, and vulnerability. working group ii ipcc fifth assessment report," *Clim. Chang. 2014 Impacts, Adapt. Vulnerability. Work. Gr. II IPCC Fifth Assess. Rep.*, 613–657 (2014).
  - 15) P.N. Lal, T. Mitchell, P. Aldunce, H. Auld, R. Mechler, A. Miyan, L.E. Romano, S. Zakaria, A. Dlugolecki, T. Masumoto, N. Ash, S. Hochrainer, R. Hodgson, T.U. Islam, S. Mc Cormick, C. Neri, R. Pulwarty, A. Rahman, B. Ramalingam, K. Sudmeier-Reiux, E. Tompkins, J. Twigg, and R. Wilby, "National systems for managing the risks from climate extremes and disasters," 2012. doi:10.1017/CBO9781139177245.009.
  - 16) M. Antrop, "Landscape change and the urbanization process in europe," *Landsc. Urban Plan.*, 67 (1) 9–26 (2004). doi:https://doi.org/10.1016/S0169-2046(03)00026-4.
  - 17) L. Camarero, and J. Oliva, "Thinking in rural gap: mobility and social inequalities," *Palgrave Commun.*, 5 (1) 1–7 (2019). doi:10.1057/s41599-019-0306-x.
  - 18) S. Zhong, M. Wang, Y. Zhu, Z. Chen, and X. Huang, "Urban expansion and the urban–rural income gap: empirical evidence from china," *Cities*, 129 (April 2021) 103831 (2022). doi:10.1016/j.cities.2022.103831.
  - 19) P. Hongsrabhas, "Toward urban-rural linkage development: contribution of climate-adaptive agroecology in the lower chao phraya river basin, thailand," *Front. Sustain. Cities*, 5 (2023). doi:10.3389/frsc.2023.1146087.
  - 20) J.G. Gimpel, and K.A. Karnes, "The rural side of the urban-rural gap," *PS - Polit. Sci. Polit.*, 39 (3) 467–472 (2006). doi:10.1017/S1049096506060859.
  - 21) D. Guzal-Dec, M. Zwolińska-Ligaj, and Ł. Zbucki, "The potential of smart development of urban-rural communes in peripheral region (a case study of the lublin region, poland)," *Misc. Geogr.*, 23 (2) 85–91 (2019). doi:10.2478/mgrsd-2019-0017.
  - 22) T. Rahmoun, and W. Zhao, "A new model of a spatial structural map for re-building urban-rural links," *Int. Rev. Spat. Plan. Sustain. Dev.*, 12 (1) 21–43 (2024). doi:10.14246/irspds.12.1\_21.
  - 23) W. Marome, P. Rodkul, B.K. Mitra, R. Dasgupta, and Y. Kataoka, "Towards a more sustainable and resilient future: applying the regional circulating and ecological sphere (r-ces) concept to udon thani city region, thailand," *Prog. Disaster Sci.*, 14 (March) 100225 (2022). doi:10.1016/j.pdisas.2022.100225.
  - 24) A. Nugroho, A. Hasyim, and F. Usman, "Urban growth modelling of malang city using artificial neural network based on multi-temporal remote sensing," *Civ. Environ. Sci.*, 001 (02) 052–061 (2018). doi:10.21776/ub.civense.2018.00102.2.
  - 25) KLHK, "Indonesia third biennial update report," *Indones. Gov. Rep.*, 1 (2) 1–136 (2021).
  - 26) T.A. Prajnawrdhi, A. Sivam, and S. Karuppanan, "Is urbanised city sustainable ? a case study of denpasar," *6th Int. Conf. Work. Built Environ. Dev. Ctries.*, (December) 4–5 (2012).
  - 27) W. Marome, P. Rodkul, B.K. Mitra, R. Dasgupta, and Y. Kataoka, "Towards a more sustainable and resilient future: applying the regional circulating and ecological sphere (r-ces) concept to udon thani city region, thailand," *Prog. Disaster Sci.*, 14 (January) 100225 (2022). doi:10.1016/j.pdisas.2022.100225.
  - 28) S. Joshi, B. Morey, S. Deshkar, and B.K. Mitra, "Applying circulating and ecological sphere (ces) concept for post-pandemic development: a case of hingna tahsil, nagpur (india)," *Sustain.*, 14 (15) (2022). doi:10.3390/su14159386.
  - 29) G. Ewing, and I. Demir, "An ethical decision-making framework with serious gaming: a smart water case study on flooding," *J. Hydroinformatics*, 23 (3) 466–482 (2021). doi:10.2166/HYDRO.2021.097.
  - 30) W. Handayani, U.E. Chigbu, I. Rudiarto, and I.H. Surya Putri, "Urbanization and increasing flood risk

- in the northern coast of central java-indonesia: an assessment towards better land use policy and flood management,” *Land*, 9 (10) (2020). doi:10.3390/LAND9100343.
- 31) T. Sicular, Y. Ximing, B. Gustafsson, and L. Shi, “The urban-rural income gap and inequality in china,” *Rev. Income Wealth*, 53 (1) 93–126 (2007). doi:10.1111/j.1475-4991.2007.00219.x.
  - 32) A. Liberati, D.G. Altman, J. Tetzlaff, C. Mulrow, P.C. Gøtzsche, J.P.A. Ioannidis, M. Clarke, P.J. Devereaux, J. Kleijnen, and D. Moher, “The prisma statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration,” *PLoS Med.*, 6 (7) e1000100 (2009). doi:10.1371/journal.pmed.1000100.
  - 33) D.I. Alexander Wandl, V. Nadin, W. Zonneveld, and R. Rooij, “Beyond urban-rural classifications: characterising and mapping territories-in-between across europe,” *Landsc. Urban Plan.*, 130 (1) 50–63 (2014). doi:10.1016/j.landurbplan.2014.06.010.
  - 34) A. Herdiyanti, P.S. Hapsari, and T.D. Susanto, “Modelling the smart governance performance to support smart city program in indonesia,” *Procedia Comput. Sci.*, 161 367–377 (2019). doi:10.1016/j.procs.2019.11.135.
  - 35) W. Mulyana, “Rural-urban linkages : indonesia case study,” *Dev. with Territ. Cohes.*, (126) 1–34 (2014). www.rimisp.org.
  - 36) M.R. Pahlevi, D. Dinanti, A. Subagiyo, Y. Qomariyah, and J. Varo, “The relationship between community characteristics and urban sprawl in driyorejo sub-district, gresik regency, indonesia,” *Reg. Rural Stud.*, 1 (1) 22–31 (2023). doi:10.21776/rrs.v1i1.6.
  - 37) A. Caffyn, and M. Dahlström, “Urban-rural interdependencies: joining up policy in practice,” *Reg. Stud.*, 39 (3) 283–296 (2005). doi:10.1080/0034340050086580.
  - 38) C. Tacoli, “The links between urban and rural development,” *Environ. Urban.*, 15 (1) 3–12 (2003). doi:10.1177/095624780301500111.
  - 39) T. Forster, G. Santini, D. Edwards, K. Flanagan, and M. Taguchi, “Strengthening urban-rural linkages through city-region food systems,” *Reg. Dev. Dialogue*, 35 (November) 121–137 (2014).
  - 40) S. Akkoyunlu, “The potential of rural–urban linkages for sustainable development and trade,” *Int. J. Sustain. Dev. World Policy*, 4 (2) 20–40 (2015). doi:10.18488/journal.26/2015.4.2/26.2.20.40.
  - 41) W.P. Wijayanti, S.K. Machmud, and A. Subagiyo, “Linkage among two satellite cities: what makes people move? (case study: bogor regency and depok city),” *Reg. Rural Stud.*, 1 (1) 1–5 (2023). doi:10.21776/rrs.v1i1.2.
  - 42) D. Keeble, and P. Tyler, “Enterprising behaviour and the urban-rural shift,” *Urban Stud.*, 32 (6) 975–997 (1995). doi:10.1080/00420989550012753.
  - 43) Takayuki Matsuda, “松,” 3 (3) 181–188 (2021).
  - 44) “Journal of regional science - 2015 - veneri - urban-to-rural population growth linkages evidence from oecd tl3 regions.pdf,” (n.d.).
  - 45) K. Barełkowska, and L. Chlasta, “Suburban buffers as key areas in a sustainable city,” *WIT Trans. Ecol. Environ.*, 191 (July) 681–689 (2014). doi:10.2495/SC140571.
  - 46) U. Eppler, U.R. Fritsche, and S. Laaks, “Urban-rural linkages and global sustainable land use,” *Glob. Issue Pap.*, (May) 1–64 (2015). [http://www.iinas.org/tl\\_files/iinas/downloads/land/II\\_NAS\\_2015\\_Urban-Rural\\_Linkages\\_Issue\\_Paper.pdf](http://www.iinas.org/tl_files/iinas/downloads/land/II_NAS_2015_Urban-Rural_Linkages_Issue_Paper.pdf).
  - 47) Huddart-Kennedy, “Rural sociology - 2009 - huddart-kennedy - rural-urban differences in environmental concern in canada.pdf,” (n.d.).
  - 48) K.S. Imai, and B. Malaeb, “Asia’ s rural-urban disparity in the context of growing inequality,” 2016.
  - 49) H. Soma, V. Sukhwani, and R. Shaw, “An approach to determining the linkage between livelihood assets and the housing conditions in urban slums of dhaka,” *J. Urban Manag.*, 11 (1) 23–36 (2022). doi:10.1016/j.jum.2021.08.006.
  - 50) W. Pradoto, B. Setiyono, and H. Wahyono, “Peri-urbanization and the dynamics of urban-rural linkage: the case of sukoharjo regency, central java,” *IOP Conf. Ser. Earth Environ. Sci.*, 202 (1) (2018). doi:10.1088/1755-1315/202/1/012039.
  - 51) D.C. Funnell, “Urban-rural linkages: research themes and directions,” *Geogr. Ann. Ser. B, Hum. Geogr.*, 70 (2) 267–274 (1988). doi:10.1080/04353684.1988.11879571.
  - 52) L. Xiao, Z. He, Y. Wang, and Q. Guo, “Understanding urban–rural linkages from an ecological perspective,” *Int. J. Sustain. Dev. World Ecol.*, 24 (1) 37–43 (2017). doi:10.1080/13504509.2016.1157105.
  - 53) Syafrudin, M.A. Budihardjo, N. Yuliasuti, and B.S. Ramadan, “Assessment of greenhouse gases emission from integrated solid waste management in semarang city, central java, indonesia,” *Evergreen*, 8 (1) 23–35 (2021). doi:10.5109/4372257.
  - 54) H. Susanne, and X. Zou, “Municipal solid waste management in china with focus on waste separation,” (December) p.69 (2011).
  - 55) Y. Masaki, “Characteristics of industrial wastewater discharged from industrialized provinces and specific industrial sectors in china based on the official statistical reports,” *Evergreen*, 3 (2) 59–67 (2016). doi:10.5109/1800873.
  - 56) A. Aitimbetova, A. Batyrkhanova, A. Nurtayeva, R. Isayeva, and G. Bekturyeva, “Environmental assessment of solid waste pollution of urban areas (on the example of shymkent, republic of kazakhstan),” *Evergreen*, 10 (3) 1209–1217 (2023). doi:10.5109/7148441.

- 57) C. Chen, R. LeGates, M. Zhao, and C. Fang, "The changing rural-urban divide in china's megacities," *Cities*, 81 (April) 81–90 (2018). doi:10.1016/j.cities.2018.03.017.
- 58) D. Satterthwaite, and C. Tacoli, "The role of small and intermediate urban centres in regional and rural development: Assumptions and evidence," in: *Earthscan Read. Rural. Linkages*, Routledge, 2018: pp. 155–183.
- 59) C. Le Dinh, B.K. Mitra, R. Dasgupta, N.-B. Pham, and S.T.P. Phu, "Exploring the gaps and potential for strengthening urban–rural linkages in hoi an city, vietnam," *Environ. Urban. ASIA*, 14 (2) 170–187 (2023). doi:10.1177/09754253231194724.
- 60) C. Delgado-Viñas, and M.L. Gómez-Moreno, "The interaction between urban and rural areas: an updated paradigmatic, methodological and bibliographic review," *Land*, 11 (8) 1–21 (2022). doi:10.3390/land11081298.
- 61) R. Bürgin, H. Mayer, A. Kashev, and S. Haug, "Far away and yet so close: urban–rural linkages in the context of multilocal work arrangements," *Reg. Stud. Reg. Sci.*, 9 (1) 110–131 (2022). doi:10.1080/21681376.2022.2042370.
- 62) D. Luca, J. Terrero-Davila, J. Stein, and N. Lee, "Progressive cities: urban–rural polarisation of social values and economic development around the world," *Urban Stud.*, 60 (12) 2329–2350 (2023). doi:10.1177/00420980221148388.
- 63) V. Sukhwani, R. Shaw, S. Deshkar, B.K. Mitra, and W. Yan, "Role of smart cities in optimizing water-energy-food nexus: opportunities in nagpur, india," *Smart Cities*, 3 (4) 1266–1292 (2020). doi:10.3390/smartcities3040062.
- 64) V. Sukhwani, and R. Shaw, "A water-energy-food nexus based conceptual approach for developing smart urban-rural linkages in nagpur metropolitan area, india," *IDRiM J.*, 10 1–22 (2020). doi:10.5595/001c.16635.
- 65) J.D. Dávila, "ISSN : 1516-9375 rural-urban linkages : problems and opportunities this article examines recent evidence from a wide range of countries in latin," 5 35–64 (2002).
- 66) L.A. Camarero Rioja, and J.O. Serrano, "Hidden disparities in rural transition: cosmopolitanism, socioeconomic decline and accessibilities," *Ager*, 2021 (32) 65–92 (2021). doi:10.4422/ager.2021.10.
- 67) K. Nilsson, T.S. Nielsen, C. Aalbers, S. Bell, B. Boitier, J.P. Chery, M. Groschowski, D. Haase, W. Loibl, K. Nilsson, T.S. Nielsen, C. Aalbers, S. Bell, and B. Boitier, "Strategies for sustainable urban development and urban-rural linkages to cite this version: hal id: hal-01528698 strategies for sustainable urban development and urban-rural linkages," (2017).
- 68) A.N. Somanje, G. Mohan, J. Lopes, A. Mensah, C. Gordon, X. Zhou, M. Moinuddin, O. Saito, and K. Takeuchi, "Challenges and potential solutions for sustainable urban-rural linkages in a ghanaian context," *Sustain.*, 12 (2) 1–19 (2020). doi:10.3390/su12020507.
- 69) "IGES proposal 2019," 2–6 (n.d.).
- 70) Rena, S. Yadav, S. Patel, D.J. Killedar, S. Kumar, and R. Kumar, "Eco-innovations and sustainability in solid waste management: an indian upfront in technological, organizational, start-ups and financial framework," *J. Environ. Manage.*, 302 (PA) 113953 (2022). doi:10.1016/j.jenvman.2021.113953.
- 71) K. Takeuchi, K. Ichikawa, and T. Elmqvist, "Satoyama landscape as social-ecological system: historical changes and future perspective," *Curr. Opin. Environ. Sustain.*, 19 30–39 (2016). doi:10.1016/j.cosust.2015.11.001.
- 72) J.D. Nelson, and B. Caulfield, "Implications of covid-19 for future travel behaviour in the rural periphery," *Eur. Transp. Res. Rev.*, 14 (1) (2022). doi:10.1186/s12544-022-00547-0.
- 73) P. Antwi-Agyei, and L.C. Stringer, "Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: insights from northeastern ghana," *Clim. Risk Manag.*, 32 (May 2020) 100304 (2021). doi:10.1016/j.crm.2021.100304.
- 74) D. Lagakos, "Urban-rural gaps in the developing world: does internal migration offer opportunities?," *J. Econ. Perspect.*, 34 (3) 174–192 (2020). doi:10.1257/jep.34.3.174.
- 75) S. Kameswaran, B. Ramesh, and M. Bangeppagari, "Environmental Conservation for Rural and Urban Development BT - Prospects for Soil Regeneration and Its Impact on Environmental Protection," in: S.A. Aransiola, B.R. Babaniyi, A.B. Aransiola, N.R. Maddela (Eds.), Springer Nature Switzerland, Cham, 2024: pp. 47–71. doi:10.1007/978-3-031-53270-2\_3.