

Strengthening applied rural innovation in rural-urban linkages

Dahri Tanjung^{1,4*}, *Agit Kriswantriyono*¹, *Yeti Lis Purnamadewi*², *Didik Suhardjito*³ and *Yulia Puspawati Wulandari*¹

¹CARE-Bogor Agricultural University 16151, Indonesia

²Faculty of Economics and Management, Bogor Agricultural University 16680, Indonesia

³Faculty of Forestry and Environment, Bogor Agricultural University 16680, Indonesia

⁴School of Vocational Studies, Bogor Agricultural University 16128, Indonesia

Abstract. Efforts to reduce the rural-urban gap are expected to be able to erode the poverty gap, grow job opportunities, and increase rural economic growth. This research aims to analyze strategies for strengthening rural innovation and reducing the rural-urban development gap. This research itself was conducted in 2022-2023 in 4 provinces: West Java, Central Java, Yogyakarta, and Jakarta. The analytical methods used are the Location Quotient, Sustainable Livelihood Approach (SLA), and Quintuple Helix Innovation (QHI). Based on the LQ analysis, the study villages are centers of superior agricultural commodities. Agribusiness activities are related to the socio-economic areas of the surrounding cities, such as upstream (production facilities) to downstream (marketing) activities. The results of the SLA analysis show several innovations supporting the development of superior commodities, starting from the cultivation subsystem to digital-based marketing infrastructure. Furthermore, QHI's analysis shows that these more developed villages are supported by the synergistic strength of the five pillars driving innovation, where village government figures and reformers have an important role and are key to accelerating the village economy. Strengthening cooperation on these five pillars also strengthens applied rural innovation so that accelerating rural economy and rural-urban economic linkages are sustainable.

1 Introduction

Efforts to reduce the urban-rural disparity are expected to bridge the poverty gap in rural areas, create job opportunities, and enhance rural economic growth. Several challenges in rural development [1] include (1) the suboptimal utilization of rural economic potential oriented towards geographic advantages and local resources as the economic base in rural development and (2) the insufficient active involvement of the community in supporting rural development. To optimize the utilization of these village potentials, a rural development strategy that integrates rural-urban linkages is needed to realize self-sufficient villages [2].

* Corresponding author: ir.da@apps.ipb.ac.id

The urgency of village development has become increasingly felt, especially after the COVID-19 pandemic and its significantly negative impacts on local communities. The emergence of increasingly serious socio-economic disparities has led to a rise in the number of poor people and the unemployed. The downturn of the Indonesian economy since 2020 has resulted in many people being laid off, forcing them to return to their respective villages. This phenomenon has sparked empathy to contribute solutions to the impacts of the COVID-19 pandemic, whose end is still uncertain. Developing innovation in villages has become imperative.

Village Development Index (IDM) data from the Ministry of Villages, Development of Disadvantaged Regions and Transmigration (KDPDTT) in 2023 shows that 5.9% or 4,382 villages in Indonesia are categorized as very underdeveloped areas and as many as 9.14% or 6,802 villages are included in the underdeveloped. This is homework for many parties, especially the government, to encourage these areas to become developed and independent villages.

Rural development cannot be separated from increasing the intensity of rural-urban linkages through the development of economic activities based on village potential. To understand the context of rural-urban linkage in a region, it is necessary to understand the existing conditions of the region and the interactions that occur between regions. Village-city linkages can be grown through a superior commodity approach. Rural development cannot be separated from increasing the intensity of rural-urban linkages through the development of economic activities based on village potential.

The enhancing competitiveness of flagship products from villages, disadvantaged areas, and transmigration regions can be achieved through a "resources-based approach," which is followed by improving competitive advantages by various collaborating parties in supporting development activities [3]. This includes the development of creative innovations and technology advancements. This development focuses on products, product processing, and financing.

Regarding innovation, practical innovations are increasingly emerging in rural areas, such as the Innovative Village Program, which is expected to empower villages to independently address arising issues, particularly related to literacy problems and the ability to invigorate the village economy. Villages, which are fundamentally the frontline and primary level of Indonesia's development, should now become the driving nodes of development supported by their diverse, specific, and prospective cultural values and local potentials.

The diversity of progress among villages in Indonesia essentially requires different treatments. There are some villages that can be categorized as advanced, but most are in the middle category, and a large number are still not advanced. So far, each village has been striving to make significant breakthroughs, such as the development of tourist villages, billionaire villages, innovative villages, and other initiatives aimed at bringing progress to the village. The purpose of this research is to analyze strategies for strengthening applied rural innovations to reduce the urban-rural development gap.

2 Methodology

2.1 Conceptual framework

Several factors determine the success of innovation diffusion. The first factor is the characteristics of the innovation product [4]. A new product can be easily accepted by consumers if it has a relative advantage. This means that a new product will attract consumers if it has benefits compared to existing products on the market. For example, mobile phones quickly became widely used because they had relative advantages over previous

communication tools. The second factor is compatibility, which also affects the outcome of innovation. A compatible product is one that can consistently meet the needs, values, and desires of consumers. The third factor is complexity. The more complex a product is, the harder it is to operate and the less attractive it becomes to consumers. Consumers will prefer simple and easy-to-use products. They are more interested in products that are straightforward compared to those that are difficult to operate. The fourth factor is trialability. A new product that is easy to try and experience will attract consumers. Another important factor is observability. Observability refers to the product's ability to be communicated to other consumers. The easier it is to see and communicate to other consumers that the product is new, the more attractive it becomes, as it signals to other consumers that they are keeping up with developments.

Second, the innovation communication channels will spread to consumers in the community through existing communication channels. A new product can quickly and widely spread to the community if the company utilizes numerous and broad-reaching communication channels such as mass media and interpersonal networks.

Third, the efforts of the company's change agents must be able to accurately identify the opinion leaders to be used and involve them as company agents to influence consumers to accept and use new products (innovation).

Fourth, the social system where modern social systems are generally more receptive to innovation compared to traditional social systems because modern societies tend to have a positive attitude towards change, generally value education and science, have a better outward perspective, and easily interact with people outside their groups, thus facilitating the acceptance of new ideas.

In this study, the research framework used starts from analyzing local flagship commodities (Figure 1). Then, it maps out which commodities are superior at the district level and where the production centers are located. Next, it determines the various innovations carried out in the villages to develop these flagship commodities, as well as the presence of various pillars in developing these innovations.

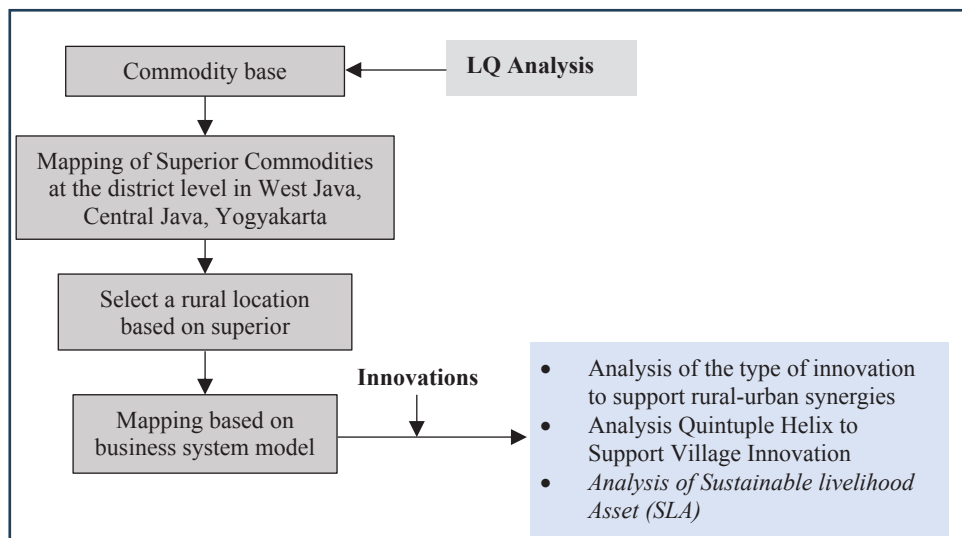


Fig. 1. Research analysis framework.

2.2 Method of collecting data

This research includes both primary and secondary data. Primary data was obtained through interviews with structured questionnaires, focus group discussions (FGD), and observation. Interviews with various informants (120 respondents) consisting of village governments, farmers, supporting business actors, and City/Regency governments are used to obtain. Secondary data is collected both offline and online from documents from various relevant agencies at the provincial, district, and village levels.

The data collected includes: 1) Demographic data: population size, occupations, religions, education levels, land ownership patterns, etc.; 2) Geographic data: topography, location from a geographic perspective, location accessibility; 3) MSME data: profiles of MSMEs with business networks across cities and provinces, how their trade channels operate, etc.; 4) IDM data: variables of economic, social, and environmental resilience of villages; and 5) Potential support for sustainable livelihoods in the form of natural resources, human resources, infrastructure resources, economic resources, and social resources.

Secondary data was obtained through the Central Bureau of Statistics (BPS), City/Regency Government, Provincial Government, Village Government, Ministry of Villages, Development of Disadvantaged Regions and Transmigration (KDPDPTT) for village development index data Research period and activity location. The data period used is the last five years (2019-2023).

This research was conducted from 2022 to 2023. The first screening to determine the study locations and flagship commodities in West Java, Central Java, and Yogyakarta Province was conducted through LQ analysis. The second screening phase adjusted the LQ values with the flagship commodities data according to regional development clusters. The third screening was coordinated with the Local Governments in these three regions. Based on the three screening stages, survey areas were determined, consisting of 6 (six) villages and two cities in West Java and Jakarta, 2 (two) villages in Central Java, and two (two) villages in Yogyakarta.

2.3 Data analysis techniques

2.3.1 LQ analysis

Secondary data collected was analyzed using Location Quotient (LQ) Analysis. This analysis is utilized to determine the extent of specialization in the economic sectors of a region by leveraging basic sectors or flagship sectors. LQ analysis is obtained from secondary data processing in the form of BPS data. Specifically, the LQ technique is widely used to discuss economic conditions that lead to economic activities and determine the flagship sector as a main sector in industrial economic activities. This LQ technique compares the share of each sector output in a city or regency with the share of output at the provincial level. The mathematical formula used to compare the capabilities of sectors in a region is as follows:

$$LQ = (L_{ij}/L_t)/(N_i/N_t) \quad (1)$$

Where:

L_{ij} represents the amount of commodity i at district level j ,

L_t represents the total amount of commodities,

N_i = amount of commodities i at the provincial level,

N_t represents the total number of commodities at the provincial level.

Criteria:

$LQ > 1$ indicates that the commodity is basic.

$LQ \leq 1$ indicates non-basic necessities commodities.

$LQ > 1$ indicates that the commodity is a basic or key sector.

$LQ \leq 1$ indicates that the commodity is non-basic or non-essential.

2.3.2 SLA analysis

The Pentagon Analysis is a tool used to assess the potential for sustainable livelihoods. It is named Pentagon Analysis because its pentagon shape illustrates differences in community access to assets or resources. In this study, the assets referred to are (1) natural resources (NR), (2) human resources (HR), (3) financial resources (FR), (4) physical infrastructure (PR), and (5) social resources (SR). SLA analysis was obtained from primary data processing through direct interviews with village government respondents.

2.3.3 Quintuple Helix Innovation Analysis

Quintuple Helix Innovation refers to a model of innovation involving five key stakeholders: academia, industry, government, civil society, and media/press. Integrating these five stakeholders is expected to enhance the quality of innovation and its impact on society. Quintuple Helix Innovation analysis was obtained from interviews with several respondents.

To reduce the urban-rural gap using the Quintuple Helix Innovation model, here are several steps that can be taken:

1. Collaboration among Stakeholders: Assessing the strength of collaboration among academia, industry, government, civil society, and media/press in identifying local issues and designing innovative solutions.
2. Education and Research: Involvement of academic institutions in conducting research focused on challenges faced by both rural and urban areas and developing relevant solutions.
3. Development of Local Economy: Engagement of industries in developing local economic projects that empower communities in rural and urban areas, such as sustainable agriculture, local crafts, and tourism.
4. Community Participation: Active participation of rural and urban communities in the innovation process, both as consumers and producers of innovation. This can be facilitated through training programs, workshops, and discussion forums.
5. Empowerment of Media: The role of media in raising awareness about issues faced by rural and urban areas and advocating for innovative solutions that have been identified.
6. Government Support: Evaluation of government support in terms of policies and regulations that facilitate collaboration among the five stakeholders and provide incentives for innovations contributing to narrowing the urban-rural gap.

Through the implementation of the Quintuple Helix Innovation model, it is expected that the urban-rural gap can be reduced through sustainable and inclusive development involving all relevant stakeholders.

3 Results

3.1 Regional economic potential based on LQ analysis

Commodity LQ analysis is carried out in each provincial region. The types of commodities calculated focus on agricultural commodities in general (agriculture, fisheries, and livestock). For agricultural commodities, it is divided into horticultural agriculture (vegetables and fruits); for fisheries commodities, it is divided into marine capture fisheries, land capture fisheries, and aquaculture. Meanwhile, the LQ value calculation for livestock commodities includes cattle, broilers, layers, goats, sheep, and ducks (Table 1).

Table 1. Results of LQ commodities analysis and trade value for each province

Commodity	Highest LQ	City/Regency
West Java Province		
A. Agriculture		
A.1. Fruits		
Manggo	6,39	Indramayu, Cirebon, Majalengka
A.2. Vegetables		
Potatoes	59,06	Garut
A.3. Food Crops		
Rice	1,20	Indramayu, Subang, Karawang
Corn	4,50	Garut
B. Fishery		
B.1. Marine Capture Fisheries	1,07	Indramayu, Cirebon
B.2. Aquaculture		Kuningan, Tasikmalaya, Indramayu
C. Livestock		
Cattle	18,23	Bandung, Sukabumi, Pangandaran
Dairy Cattle	12,27	Bandung, Cimahi, Sukabumi
Central Java Province		
A. Fishery		
Land Capture Fisheries	3,91	Klaten, Sragen, Jepara, pati
B. Livestock		
Cattle	58,79	Pekalongan, Magelang, Surakarta, Jepara
DI. Yogyakarta		
A. Agriculture		
Chili	1,72	Gn. Kidul, Kulonprogo
Snake fruit	2,90	Sleman

The second screening stage is carried out by adjusting the LQ value results with superior commodity data according to regional development clusters in each province. Based on the results of LQ Analysis and regional development cluster leading up to the location determination, several flagship commodities were identified in several villages. These commodities' performance is a key factor in driving village development forward (Tabel 2).

Table 2. Maps of superior commodities in survey location based on LQ analysis

Business system	Area typology	
	Lowland	Upland
Agriculture	Indramayu District:	Garut District:
-Food	-Rice (Pawidean Village)	-Corn (Dangdeur Village)
-Horticulture	-Manggoe (Pawidean Village)	-Potatoes (Padaawas Village)
	Kulonprogo District:	Sleman District:
	-Chili (Bugel Village)	-Snake fruit (Wonokerto Village)
Fishery	Indramayu District	-
	- Aquaculture (Losarang Village)	
	- Marine Fisheries (Karangsong Village)	
	Pati District:	
	-Milkfish (Dukutalit & Bakaran Village)	
Livestock	Bandung District:	Bandung District:
	-Beef cattle (Cikancung Village)	-Dairy cattle (Margamukti Village)
	Jepara District:	
	-Beef cattle (Blingoh Village)	

3.2 Sustainable livelihood approach in area study

The potential for the Sustainable Development Index (infrastructure) to be the biggest supporting factor in supporting the livelihoods of the people in the study area. Ease of accessibility due to the location being close to the Regency capital, as well as favorable road and transportation conditions, are the main reasons. The availability of economic development infrastructure. Markets, TPI, etc., also help stimulate the community's economy. The HR (human resources) score is also quite good, proving that human resources are sufficient to support innovation development in the study area. Figures 2, 3 and 4

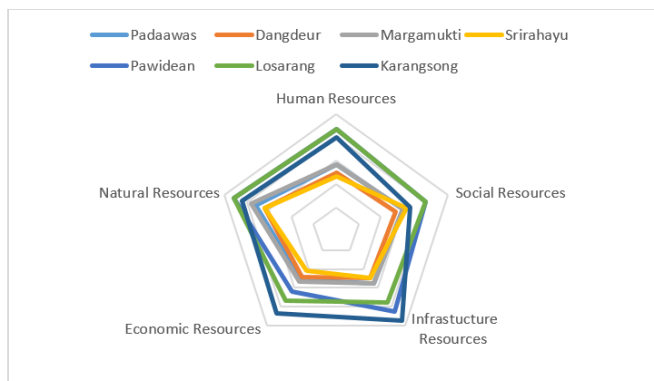


Fig. 2. Sustainable livelihood approach in West Java province area study.

Figures 2, 3, and 4 show the results of the SLA analysis in villages per province. In general, these results show that villages in Central Java have the lowest development and on the other hand, villages in Yogyakarta have the best development.

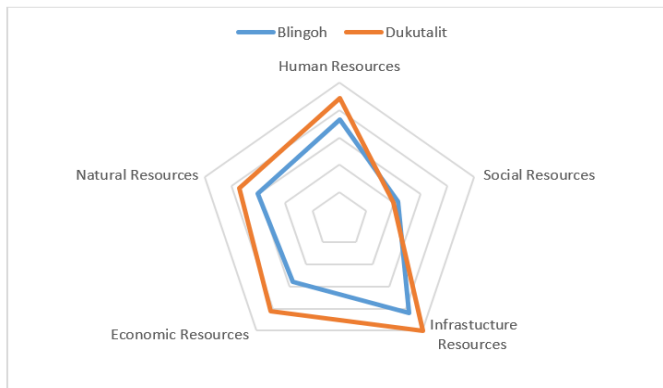


Fig. 3. Sustainable livelihood approach in Central Java province area study.

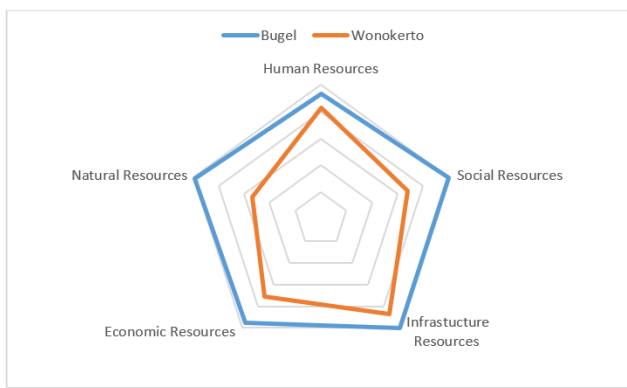


Fig. 4. Sustainable livelihood approach in DI Yogyakarta province area study.

Based on the results analysis of the fifth indicator, livelihood sustainability, there are several differences between upland and lowland areas including a description of its strengths and weaknesses as well as opportunities and threats. The following description provides a general fifth source power for both regional typologies (Table 3).

3.3 Innovation in the study area

Development commodity superior in the villages studies No free from exists developed innovations both by society and government area nor partner other such as company and of course just universities. Innovation that develops in society Villages are very varied and adaptable to existing potential and location-specific. A number of innovations found in the study area and relatively related to an agribusiness system, among others:

Upstream subsystem: 1) Make MoU in capital and marketing with industry and 2) Chile auction application from Bank Indonesia. **On-farm & Off-farm subsystem:** 1) SME mango products in Pawidean, Indramayu; 2) Integrated Fish Auction Place in Karangsong, Indramayu; 3) Security innovations (Jumat Curhat) in Losarang, Indramayu; 4) Plasma nucleus Cattle Business in Cikancung, Bandung, 5) Village Knowledge in Padaawas, Garut, 6) Export Snake fruit in Wonokerto, Sleman, 7) Snake fruit Ecotourism in Sleman, 9) Drip irrigation in chili cultivation on the Kulonprogo Coast, 10) Chile auction in Kulonprogo chili farmer, 11) Digital Marketing on soft bone milkfish SME Pati, and 12) Cow breeding center in Donorejo, Jepara.

Table 3. Rural Typology Analysis in Research Area

Indicator	Upland	Lowland
Natural Resources	Land is still relatively available to support commodity development	Threat of land conversion into industrial and residential areas
Human Resources	Availability power work supporters still relatively available	Potency urbanization and migration large enough, lack of supporting human resources agriculture start felt
Infrastructure Resources	Accessibility and affordability limited infrastructure _ more limited intervention partis outside of procurement mean infrastructure is limited.	Accessibility and affordability are easier and wider. Infrastructure facilities are relatively available. There is quite a lot of external intervention in the development of infrastructure facilities.
Economic Resources	Limited market access, depending on 1-2 partners/traders collector level village	with wider market access, farmers can reach traders/collectors outside the village/district
Social Resources	Still dominated public genuine, mutual cooperation characteristics and values social still tall enough	ready start lots of immigrants, acculturation culture, and values like mutual cooperation begin to reduce

3.4 Analysis of the quintuple helix innovation model in the study area

The urgent application of the quintuple helix model to the domain innovation village is an embodiment of the development of village-based knowledge [5]. In the current era, knowledge-based development is a must-have practiced at all levels of government, including villages. Quintuple helix makes it possible to progress in a village through integration sector education, economics, politics, and empowerment society [6]. This model is also possible for management industry-level villages like cooperatives/BUMDes for their own power competitiveness, creativity, and capability [7]. Implementation of the innovation model quintuple helix based on some studied village experience There are lots of adjustments, and little varies. There are not longer any clear boundaries about the distribution function/role of each helix. For example, in practice innovation in Bugel-Kulonprogo Village, first helix, government village play function facilitator. Viewed from the perspective of political and leadership capacity, as well as process and bureaucratic capacity, the first helix can use political capital well. Next, college plays a role exclusively college as a producer of knowledge and innovation. College in management and research works the same with the second helix, industry.

This practice implies that the quintuple helix formula experiences adjustment with context locus. The creation of knowledge and technology by academics can done in two ways [8]. The First refers to the system production knowledge through a study base, and refers to a knowledge production system based on scientific principles, namely applied and if technology is transferred [9].

Looking at the dominance of the role of the government helix in the production process, knowledge, and innovation in Bugel Village, for example, regarding variations in knowledge development become very relevant [8]. Knowledge, technology, and innovation in the chili auction market in Bugel Village were born from the collaboration between the Bugel Village Government, Industry, Bank Indonesia, and Universities.

The second helix, college in villages study, is demonstrated by its implementation of several collaborations between government villages with an institution of education. One of the universities in Yogyakarta has synergized with village studies to develop appropriate

technology. In 2017, the same was inaugurated through the signing of the MoU by both split parties. The university also does its villages study as laboratory fields for students, especially major agriculture. These two helixes also agreed to carry out higher education tasks in the field of education through public lectures, research, and community service through the development of appropriate technology.

Collaborative relationships with academic helix are also established with other universities. As a producer's knowledge, universities take a role in the empowerment of health and economy in villages research, one of them with send student practice field, do synergy research and implementation devotion to people in villages study. Furthermore, strengthening the role of college in empowerment BUMDes showed openness to universities, commitment, and accompanying action plan BUMDes.

In the third helix, industries represented by several companies operate as partner businesses. In fact, business partners are still limited, for example only in a few villages, but because they have collaborated frequently, partners in marketing are running well.

The fourth helix is the last organic helix. In general, this helix is known with civil society, which also becomes an actor key in good governance. The definition of the fourth helix here is interpreted as a media-based and culture-based society, integrating and combining two forms of capital, namely social capital and information capital [9].

The fifth helix in the quintuple helix model is a medium that is a means for realizing sustainable development, even catalyst innovation. In the village research, their managed village website is very kind, informative, and always up-to-date, resulting in innovation based on information capital produced by the government helix. Society doesn't have a role as a producer of information capital; in other words, society only has a role as a user, no producer of knowledge and innovation-based technology, and knowledge. Uniquely, user innovation is not only a public village; the public, in a general way, can also feel the benefit of the website as a medium of information and accountability management budget village.

With the minimum synergy of the five helixes above, innovation at the level of the village develops. Furthermore, innovation Pushes villages to become more proceed approach cities as an objective beginning to reduce the development gap between cities and villages. Existence leader and an agile person pursuing various existing village opportunities (like house renovation, village internet/government programs, and corporate/CSR banking, etc.), including an open-wide opportunity college that will introduce the village to new technology. Furthermore, innovation was welcomed by the resident public, specifically farmers, and finally produced a market-oriented base.

This matter is in line with [10], who mentions factor pusher development in a village No regardless of the work process. The same collaborations are built through involvement roles in government (central and regional), academics/universities level, civil society organizations, society, the business/private world, and the media. Working together and collaborating becomes important for speeding up and pushing the empowerment of the public in building village innovation. The use of digital and media reporting is increasing; it gives Spirit to farmers because it is easier, cheaper, and feels more valued. The three helixes in the quintuple helix are pushing innovation. This is the one that originates from the city, that is college, industry, and media. So it can be said that the progress of innovation in rural areas has shown the occurrence of harmonious rural-urban linkages. This harmony is demonstrated by the integrated synergy of the five helixes, as can be seen in Figure 5 below.

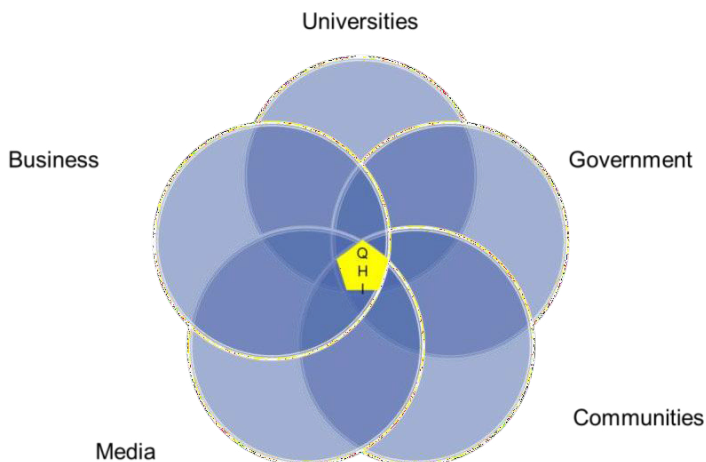


Fig. 5. Quintuple Helix Innovation (QHI) model in area study.

Furthermore, what strategy should be carried out for cooperation between the five helixes above walk with lasting and sustainability? This matter at a time has to mean what strategy is necessary done in strengthen innovation rural applied development, keep going. Based on various discussions previously show that the main thing in the village is that it has political power regional rulers and the masses as well as a network of districts and provinces, economic power (owners budget development region), and socio-cultural power (respected and appreciated) are Village Government, then the key is on the government village. If The Village Head is someone who has the vision to build a village, then he will move the other four helixes; otherwise, the other helix will easily cooperate with the government village.

4. Discussion

The analysis results show that although the selected villages have superior commodities, their development is not uniform. One ideal condition for a village to develop in line with urban development is the possession of the five assets mentioned previously. These five assets are supported by five pillars integrated within the quintuple helix, which synergize to generate innovation, including sustainable innovations that can enhance the quality of life for the community and maintain environmental sustainability. This synergy creates a mutually supportive and reinforcing innovation ecosystem.

Innovation at the village level can be understood as various agricultural cultivation technologies, processing, marketing, as well as information and communication, and even the existing institutions within the village. By utilizing advanced technology or new methods to address problems and enhance the economy using available technologies in their environment, it is hoped that villages will develop and progress, thereby reducing the gap between rural and urban areas. An innovative village must be capable of developing institutional-based innovations, networks, and interactions. The villages involved in the research show that they have met these elements, albeit at different levels. The potential conditions possessed by the village serve as a foundation, while the creativity of various pillars acts as a facilitator [11].

Ideas for innovation in village development, whether as products, policies, systems, institutions, processes, or methods, can originate from both internal and external sources of the village. For example, the utilization of coastal land that was previously just bushes transformed into chili and fruit cultivation in Bugel Village began with initiatives from a provincial university. Another example is the strategic location development combined with

snake fruit orchards in Wonokerto Village, which became the eco-agro-tourism site of Pulesari-Wonokerto Village. Subsequently, this external innovation successfully developed internal innovations through further initiatives from the village head. These innovations include ideas for establishing Village-Owned Enterprises (BUMDes) and the digitalization of public service innovations. The benefits felt by the community include increased job opportunities in rural areas, reducing their interest in migrating to cities and experiencing a better life in the village.

Institutional innovation is defined as the main strength of innovation. Therefore, ideal innovation must be supported by several factors, such as the establishment of a legal basis for innovation, an innovation management structure, a clear division of roles and authority, and clarity in the flow of responsibilities. Strengthening institutional innovation aims to maintain the sustainability and usefulness of an innovation. The institutional framework for innovation in Bugel Village was established through careful planning, including the formation of BUMDes, the Social Safety Net Implementation Agency (Bapel JPS), the Village Community Institution (LMD), and several other village institutions.

Innovation networks refer to the interactions among stakeholders within an innovation environment. Innovation networks depend on the relationships (institutional) of innovation managers and the relationships of stakeholders outside the innovation environment, including users of the innovation. The Bugel and Wonokerto Village governments are able to create and manage innovation networks through cross-sector and actor cooperation, involving both government and non-government entities as part of the quintuple helix.

Strengthening the culture of innovation involves fostering innovative thinking and actions in daily life, as a lifestyle for the government, BUMDes, and the village community. Continuous improvement of innovative products, diversification of Village Information System services, development of BUMDes businesses, and village festivals are examples of efforts to strengthen the culture of innovation in Bugel and Wonokerto Villages. The advancement of science and technology and absorption of global issues are realized through the development of the Village Information System, support for achieving sustainable development goals through the management of BUMDes, and the preservation of local wisdom through cultural tourism and community empowerment.

Further discussion related to media, such as internet readiness in rural areas, shows that almost all villages are now accessible and have easy internet access. However, individual needs and institutional levels vary. Additionally, although the supporting information and communication technology devices are available, human resources have not yet supported their optimal utilization.

In this concluding section, strategies to strengthen applied village innovation to reduce the rural-urban gap can be carried out through several alternatives, including: (1) building multistakeholder collaboration; followed by (2) training and mentoring for communities in the application of technology and innovation, entrepreneurship, and management; for (3) developing superior local products to add value at the village level; as well as (4) utilizing information and communication technology to expand market access and promotion.

5 Conclusion

Agribusiness activities related to superior rural commodities are interconnected with the socio-economic conditions of nearby urban areas, from upstream (production means) to downstream (marketing). The SLA analysis results show several innovations supporting the development of superior commodities, including those related to cultivation, marketing, and institutional partnerships between farmers, universities, and industries. The development of these applied innovations is inseparable from the synergy of various pillars in the quintuple

helix innovation. The village government's and reformist figures' creativity in strengthening village innovation through multistakeholder collaboration is the key driver of the five helixes aimed at accelerating the village economy.

The research was financially supported by the Friedrich Eberth Stiftung and The Coordinating Ministry for Human Development and Culture of the Republic of Indonesia.

References

1. M. Purwaning Diah. Rural development to reduce the gap between villages and cities in Indonesia: opportunities and challenges. *Pub. Adm. J. of Res.* **2**, 166 (2020).
2. A. Suherman, Integration of rural-urban development towards food independence and prosperous communities, in *Proceedings of the National Seminar on Urban Village Inclusive Development Planning*, UNAND, July (2017).
3. A. Purbantara, Mujianto, E. Rahmawati. Development of competitiveness of primary products in villages and disadvantaged areas and transmigration. *Sci. J. of Biz Econ.* **26**, 290 (2021).
4. S. Sumanjaya Hutagalung, D. Hermawan. *Building Government innovation area.* (Deepublish, Yogyakarta, 2018)
5. J. Kolehmainen, J. Irvine, L. Stewart, Z. Karacsonyi, T. Szabó, J. Alarinta, A. Norberg. Quadruple helix, innovation and the knowledge-based development: lessons from remote, rural and less-favored regions. *J. of the Knwl. Econ.* **7**, 23 (2018).
6. E. Carayannis, E. Grigoroudis. Quadruple innovation helix and smart specialization: knowledge production and national competitiveness. *Foresight and STI Gov.* **10**, 37 (2016).
7. G. Sukarno. Strengthening industrial competitiveness creativity through the quintuple helix, creativity industry and capabilities industry. *UNEJ E-Proceedings*, Jember, Indonesia, June (2018), B1
8. M. Gibbons, C. Limoges, H. Nowotny, S. Schwartzman, M. Trow, P. Scott. *The new production of knowledge - the dynamics of science and research in contemporary Societies.* (SAGE Publications, London, UK, 1994).
9. A.N. Praswati. Development of the helix model in enhancement innovation. in *Proceedings of the National Seminar on Management & Business Research Development E-Business "Concepts and Research in Indonesia,"* (2017), B691
10. R.S. Zuhro. *Book Guidelines - Building an innovation village for an advanced and prosperous Indonesia.* (BRIN, Jakarta 2022).
11. P.D. Darmoko. Village Innovation Potential in Pemalang Regency. *Madaniyah*, 2(9), 198–211 (2015). <https://media.neliti.com/media/publications/195105-ID-laporan-penelitian-potensi-desa-inovasi.pdf>