



Understanding rural context in the social innovation knowledge structure and its sector implementations

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Abstract

The concept of social innovation is increasingly being discussed to pursue sustainable development. New terms and keywords are created to cope with new ideas in various contexts. How these terms are developed in the current structure of knowledge and how we can reinterpret the semantic networks with the empirical context are the primary motivation of this paper. The rural social innovation knowledge structure is constructed to understand the phenomena better and cope with future needs. A multi-methods methodology is applied to construct the knowledge structure with the primary method being topic modeling. The results from topic modeling, co-word analysis, and co-citation are combined to co-construct the knowledge structure. The narratives for the built knowledge structure are then developed in the context of rural social innovation to enhance our understanding. This study found three findings. First, the trend of keywords “community”, “governance”, and “rural” have increased significantly in the field of social innovation. Second, an investigation of the intensity of the topics found six dominant groups of topics, namely actor, business model, natural resources, food security, governance, and urban. Third, the co-word analysis shows that the word innovation is closely related to the terms: sustainable development, social entrepreneurship, social enterprise, rural community, electronic commerce, co-design, and social behavior. The mapping of key terms shows that the structure of the global social innovation research landscape is quite complex. However, it can be broken down into five main parts: objectives, inputs, transformations, outputs, and outcomes.

Keywords Rural social innovation; knowledge structure · Topic modeling · Co-word analysis · Co-citation analysis

1 Introduction

Having left 2021 behind us, COVID-19 still stays in front and threatens us for longer than we think, leaving questions about how we should integrate the environmental, social, and governance issues into, e.g., the social capital market. According to the Climate Bonds Initiative (CBI) of the \$400 billion in sustainable debt issuance in 2019, social bonds made up approximately \$20 billion, whereby corporates and financial institutions are becoming more active in the social bond market (S&P Global 2020). This composition and the total amount of money changed drastically in 2020 due to COVID-19. Thus, social innovation (SI) will have an essential role in the development process by opening various solutions to developmental problems. Social innovation will change or transform the structure of costs and benefits, and it can increase the value of products or services through social changes. Furthermore, social innovation provides freedom for the necessary changes and adaptations according to socio-cultural, geography, and demographic characteristics. In the context of rural SI, efforts to encourage rural development in more sustainable ways will be influenced by how social innovation grows and develops in rural communities (Castro-Arce and Vanclay 2020). Therefore, it is essential to understand how the structure and scope of this concept evolved.

Research on social innovation aims to understand the complex dynamics of its mechanism and social innovation processes in different contexts. The concept of social innovation is recognized in theory, and its implementations are pervasive. However, the structures, processes, and mechanisms underlying social innovation have not yet been clearly defined, and it remains an elusive concept (Borzaga and Bodini 2014; Marques et al. 2018; Grimm et al. 2013) are concerned that the concept has been stretched in so many directions that it is at a breaking point and argue the need for more theoretical work.

This paper presents the construction of knowledge related to social innovation or, more specifically, rural social innovation while at the same time identifying related sectors as the context for its implementation. To this end, a method is used to analyze the content of the text in world scientific publications on rural social innovation. The knowledge structure is argued will reflect the definitions of social innovation found in the literature. The primary method used to construct the knowledge structure is topic modeling. We assume that the knowledge hidden in a corpus of large documents can be structured with different methods and by triangulation with peers' interpretation through a qualitative synthesis of previous literature. The selected peers have previous experiences in doing research related to innovations in rural development. Focusing on finding the same structure as from the empirical evidence on the cases of social innovation in rural areas, we strive to gain co-existence or similarity to validate the constructed knowledge structure. Attention to the process of social innovation in rural areas is a major concern in this study. An understanding of social innovation in the rural context is important because social innovation is seen as an innovative way to solve various social problems through community-based regional development. Regional development is important, especially to balance the disparities that occur between rural and urban areas so that they can reduce rural-urban flows which always

occur continuously if development gaps are not addressed such as problems of socio-economic balance, availability of education, and health, and so on.

The advantages of co-word analysis over qualitative analysis were recognized through the aggregation of the co-occurrences of signal words across a population of texts and the depiction of significant levels of such co-occurrences by graphical methods (Callon et al. 1986; Janik et al. 2021) did a bibliometric analysis aiming to identify research patterns and trends in the scientific literature on social innovation using bibliometrics. The study by Janik et al. (2021) describes the productivity of the author's publications, the number of publications that are most cited, the author's country of origin, topic grouping, and also the types of scientific collaboration that exist in social innovation. The difference between this paper and Janik et al. (2021) is that this study explores deeply social innovation in a rural context. This is based on the argument that the phenomenon of social innovation in many developing countries has a rural context as an effort to solve existing social problems. Lack of provision of public services, under-competence resources, inadequate education systems, and funding in rural areas has led to the emergence of various initiatives rooted in the community to jointly empower the community and even develop the area. Rural communities generally take advantage of their local wisdom to overcome their social problems.

Meanwhile, Phan Tan (2021) carried out a bibliometric analysis of research related to social entrepreneurship to explore the scientific structures and relationships using a combined bibliographic coupling, co-citation, and co-word analyses. He aimed to rigorously and holistically explore the constantly changed social entrepreneurship subject so that academia can acknowledge current contributions, locate research resources in potential areas, and explore subsequent future research. Nonetheless, the presented knowledge structure is far from comprehensive. Both Janik et al. (2021) and Phan Tan (2021) failed to construct a comprehensive knowledge structure of social innovation because lack the use of rigorous content analysis. This study approaches the exploration differently by elaborating Scientometrics with enhanced rigor using content analysis (topic modeling, co-word analysis, and co-citation) to better understand the knowledge structure with special attention to rural social innovation literature. The main strength of this study is the combination of topic modeling, co-word analysis, and co-citation to co-construct the knowledge structure. The rest of the article focuses on key concepts in rural social innovation. In the discussion, the key elements of social innovation in rural development are highlighted with balanced views from Europe and developing countries to distinguish its various aspects and better understand the structures and mechanisms. This article contributes to the social innovation literature by building the knowledge structure in rural social innovation research which is valuable for future research.

2 Social Innovation

This study uses the definition of social innovation, according to the European Commission (2013), as developing and implementing new ideas (products, services, and models) to meet social needs and create new social relationships or collaborations.

Social innovation refers to the actions, participatory processes, and outcomes that provoke changes in social relations, collective empowerment, political arrangements, governance processes, and improve the social system (Moulaert et al. 2013). Social innovations consisted of the new or novel products, services, models, markets, or processes utilized by the entrepreneurs in the communities to improve entrepreneurship growth and solve social problems such as poverty (Westley and Antadze 2010). Similarly, Neumann (2021) investigated the impact of entrepreneurship on economic, social, and environmental welfare, and he also conducted a systematic review to explore its determinants. He pointed out that instead of focusing on firm performance and socio-cultural background and motivation, it is better to focus on survival, internationalization, and entrepreneurship qualification.

Social innovation needs collaborative actions from several agencies to solve the problems and obtain better outcomes. In addition, to achieve a more equitable, fair, efficient, effective, and sustainable society, social innovation initiatives must have the ability to scale up to become part of a multi-level governance system (Avelino et al. 2019). Therefore, Van der Have and Rubalcaba (2016) suggest that the social innovation field is grounded in four distinct intellectual communities arising through a somewhat organized diffusion process: (1) community psychology; (2) creativity research; (3) social and societal challenges; (4) local development. Eichler and Schwarz (2019) showed that most social innovation case studies deal with improved health and well-being. The study illustrates a pronounced difference in the focus of social innovations between developing and developed countries. The study indicates that five types of innovators are fundamentally involved in developing and implementing social innovations: social entrepreneurs, NGOs and non-profits, public institutions, civil society, firms, and social enterprises. Neumeier (2012) said, “social innovation happens when there is a change in attitude, behavior, or perception within a group who enters a network in which people work around common interests, setting up new paths to collaborative action within, or beyond, the borders of the group.” Thus, social innovations happen as social practices, not technical or technological artifacts.

Some of the above definitions indicate that social innovation generates new ideas in visible and invisible forms and then applies the idea to the community. Social innovation aims to create better value that can improve the quality of life. To succeed, social innovators must find ways to bring an idea into action. This action may need collaboration with other agencies and, in most cases, a government’s support to improve economies of scale and develop more innovations for optimizing economies of scope.

2.1 Rural Social Innovation

In many developing countries, social innovation at the rural level has been challenging and is regarded as an agent of change. With the right role model, it can accelerate the process of innovation and development in rural areas (Abbasiachavari and Moritz 2021). The authors’ experiences in understanding village progress find two general characteristics. First, those with local wisdom and experiences can mobilize community participation. Second, those with technical capabilities can develop the right technology to increase productivity sustainably. Both groups of social entrepre-

neers are needed to promote village progress. They are facilitators who actively work together with the village community.

On the other hand, the central government is interested in encouraging rural social innovation; however, there are two significant problems. First, Neumeier (2017) said that social innovation in rural development could not be quickly initiated or steered from the top down. Second, limited funding and assistants have made many efforts that cannot be completed, are not sustainable, or even fail. Oftentimes, rural administration is forced to implement innovations from the central government. Innovation is not a priority for the community, and they do not have the resource and capability to implement it. Although the rural government can implement the innovation, the results are not aligned with the expected targets and fail to sustain. This background has triggered a new concern about the importance of investment integrated with the environmental, social, and governance (ESG) factors to create a sustainable world (Porter et al. 2019).

The literature on social innovation has not specifically paid attention to rural social innovation. Banerjee et al. (2021) argue that strategies and innovations grounded on local communities' knowledge and rhythm within complex rural contexts are still underrepresented in the social innovation literature. Therefore, some definitions of rural social innovation are developed to better understand and guide further development in rural social innovation. Moulaert et al. (2005, 2013) and Castro-Arce et al. (2019) argue that an initiative must foster satisfaction of needs, changes in socio-political arrangements, and empowerment to be defined as a rural social innovation. Rural social innovation is said to be successful if it can bring rural communities to better conditions of welfare and resilience. It seems that rural social innovation can succeed if it solves basic problems, brings social changes, and opens a bigger space for cooperation from various parties. Thus, rural social innovation needs to be transformative with the ability to scale up and provoke changes in the governance system.

Therefore, many studies are conducted on rural social innovation and related to the concept of governance. The concept of governance of social innovation in a broad sense refers to collaborative governance, which is a practice between civil society organizations and public actors to develop alternative solutions to meet social needs. A study on social innovation and governance of sustainable places by Baker and Mehmod (2015) analyzed the role of social innovation in rural areas in building community resilience. Harmonious governance between the community and the environment in which they live will provide sustainable futures. The governance referred to in the study is to view social innovation in the context of the coupled relationship between social processes and ecological systems. A study by Saviera et al. (2022) indicates that social innovation represents in the form of indigenous tourism initiatives. This research shows the competitive advantage of empowering social entrepreneurship while creating consensus for each actor toward sustainable village tourism. It shows the emergence of governance in the systems during the interaction and relation of the actors involved in social innovation activities. Meanwhile, a study conducted by Galedo et al. (2021) is a recent study that is similar to this study. The difference is that Galedo et al. (2021) conducted a scoping review of two major concepts, namely social innovation and governance, which resulted in the finding that governance of social innovation involves many actors in its implementation.

Castro-Arce and Vanclay (2020) argue transformative social innovation can be developed through a bottom-linked governance framework involving: a network enabler, knowledge broker, resource broker, transparency and conflict resolution agent, and shared vision champion. This statement is in line with the long-standing arguments that said civil society actors need to take part in enhancing better services and infrastructure and developing local assets through co-production with the third sector (Pestoff 2012). Rural social innovation is understood as a concerted effort to solve social needs mutually beneficial to strengthen civil society in rural areas. The public, private, academic, civil actors, and community need to share the responsibilities for creating a better enabling ecosystem of rural social innovation. Current development by Audretsch et al. (2021) highlights the needs of both social innovators and entrepreneurs that extend the ecosystem to foster social innovation in rural areas. Thus, it can be summarized that rural social innovation relates to the keyword such as resource, community, empowerment, actor/agent/institution, role, network, governance, and ecosystem. With a better social innovation ecosystem, rural communities will be better prepared to transform in technological developments, such as deploying digital technology as one of the critical pillars of social innovation.

Similar to the innovation stages in general, in the context of rural areas, social innovation typically goes through stages. The first stage is the ideas generation stage, which may then be piloted or prototyped. The next stage is the implementation stage and then the scaling-up stage. The main challenge for the government or policymakers is the ability to identify which ideas are the most promising to take to the pilot stage and which pilots can improve on existing models of practice (Europe Commission 2013). There have been many studies that have presented how rural social innovation can be implemented properly. Still, no one has mapped and reconstructed this related knowledge at the implementation and scale-up level. The final stage of this innovation is important because it is at this stage that rural social innovation begins to benefit society and become the new norm in social practice (Europe Commission 2013). The novelty of this study seeks to fill the gap by reconstructing how rural social innovation in various countries can impact the communities by using a process perspective accompanied by its sector implementations.

3 Methods

This study is conducted using a multi-methods methodology following the post-positivist paradigm by pursuing a proper understanding of the directions and perspectives of any research study in multi-dimensions and multi-methods (Guba 1990). Initially, sensitizing concepts are identified to provide guidance and suggest directions. To this end, bibliometric analysis is conducted using indexed keywords of the Scopus dataset from the year 2000 to the year 2021. Then the text is filtered with keyword 'social innovation' and various filtering using keywords such as 'rural', 'governance', 'community', 'network', 'ecosystem', 'policy', 'institution', and 'tourism', 'poverty', 'woman', 'food', 'agriculture', and 'environment'. The selection of these keywords is based on two approaches. First, through a retrospective approach based on the experience of the authors in conducting research in rural areas. Second, some key-

words are taken from the study of Purwanto et al. (2021) and others. For example, related to the role of women, Mollet (2011) concluded that Papuan women who live in the mountains have high entrepreneurial talent. Then, a report from Europe discovered that a larger percentage (26%) of female-led social enterprises were located in human health and social work activities (WeStart 2015). Due to traditional gender roles that place women much closer to social issues such as poverty, food security, and degraded environment, both in their private and professional life, women are usually more concerned with social goals than men (Atina 2022). Then, a report from a developing country identified that high trusting relationships of rural women in a community enable members to initiate social innovation (Ghorbani et al. 2022). In many countries across the world, women are much more involved in businesses with a social impact than in traditional companies (Atina 2022). A social innovation by empowering women's communities of traditional woven fabric craftsmen in the East Nusa Tenggara (Sikka Regency) in Indonesia is successful through the support and intervention from the government to encourage good governance involving relevant actors in terms of scaling up, access to marketing, increasing competence, and capital (Indriati et al. 2018). Meanwhile, many studies have also linked social innovation practice with governance such as has been carried out by Galedo et al. (2021) to provide a deep understanding of social innovation and governance. The analysis of the selected keywords related to social innovation is carried out using the analytics tool in the Scopus application.

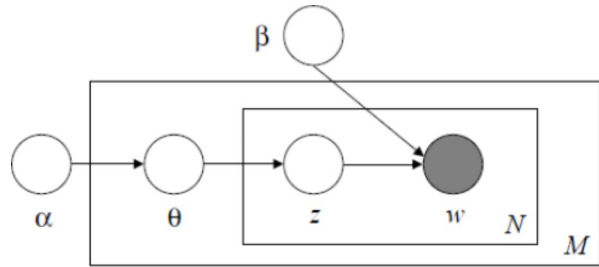
3.1 Co-word analysis

Co-word analysis is a technique that uses patterns of co-occurrence of pairs of keywords to determine the relationship between the topics in the documents (Leung et al. 2017). The more keywords appear together, the greater the strength between them to cluster and form a topic. Co-word analysis explores the interaction between keywords in the research topic. Researchers recognized the advantages of co-word analysis over qualitative analysis through the aggregation of the co-occurrences of signal words across a population of texts and the depiction of significant levels of such co-occurrences by graphical methods (Callon et al. 1986). Using the quantitative co-word analysis will allow highlighting features of scientific fields that have not always been recognized. The co-word analysis is conducted using the software VosViewer which aims to extract new knowledge from mapping the keywords in the selected dataset and looking for the trend. The dataset is searched using the script: TITLE-ABS-KEY ("rural" AND "social innovation"), which resulted in 329 records. The analysis was carried out with the minimum number of occurrences of a keyword. The size of the bubble expresses the frequency of keywords and the intensity of the occurrence of the two keywords is expressed by the thickness of the line connecting the two keywords.

3.2 Co-citation analysis

One of the most successful and efficient methods of knowledge mapping is co-citation analysis. The co-citation analysis determines how often a third document cites

Fig. 1 Graphical representation model of the LDA



two documents. Research clusters begin to form when numerous authors mention the same pair of papers. These clusters of co-cited papers tend to have a shared theme. Therefore, it is assumed that the articles cited together in other articles will have content in common (Benckendorff and Zehrer 2013) or share a theoretical basis. Thus, co-citation can be used to show the intellectual structure of a collection of research publications. Beyond its normal usage, co-citation was even used by Small (2003) to challenge Thomas Kuhn's seminal work, the structural view of scientific development (Kuhn 1970).

We use the co-citation analysis to make the clustering of the co-cited papers, which are then interpreted into topics. Then, the interpreted topics are used to look for similarity or co-existence of results from the topic modeling and co-word analysis. The co-citation analysis is conducted using a Scopus dataset resulting from the searching with the keyword 'social innovation', whereby there are 3,920 records. Topics expressed from the co-citation analysis will tend to be subjective. Thus, they were peer-reviewed to derive connected keywords, and a common thread can be drawn, and a logical explanation can be given.

3.3 Topic modeling

Topic modeling is a kind of a probabilistic generative model in the text analysis for unsupervised topic discovery in a corpus of documents. Latent Dirichlet Allocation (LDA) is the most widely used topic modeling algorithm initially developed by Blei et al. (2003). LDA introduces the Dirichlet distribution to the topic-and-word distribution in documents, encoding the intuition that a document covers a number of topics and that a topic uses a set of words. This model can reveal the main topic of a corpus which can potentially be used to build a knowledge structure in a corpus. However, this quantitative method does not offer the depth of contextual understanding that qualitative methods do. Figure 1 shows a graphical representation model of the LDA using plate notation, which illustrates the dependencies between model parameters. The plate box represents the text. The outer plate represents the document, while the inner plate represents the topic choices and repetitive words in the document.

The LDA model is represented as a probabilistic graphical model in the diagram above. There are three levels to the LDA representation. M represents the total documents in the corpus, while N represents the number of words in a document. Parameters α and β are corpus level parameters; α is the parameter of the initial Dirichlet on the per-document topic distribution, and β is the parameter of the initial Dirichlet

on the word-by-topic distribution. The variable θ_d is a document-level variable that represents the topic distribution for document d . The variables z_{dn} (the topic for the n th word in document d) and w_{dn} (the specific word) are word-level variables.

The total probability of the corpus can be calculated using the formula:

$$p(D|\alpha, \beta) = \prod_{d=1}^M \int p(\theta_d|\alpha) \left(\prod_{n=1}^{N_d} \sum_{Z_{dn}} p(Z_{dn}|\theta_d) p(W_{dn}|Z_{dn}, \beta) \right) d\theta_d \quad (1)$$

Topic model selection is carried out based on the minimum perplexity value, which is defined as:

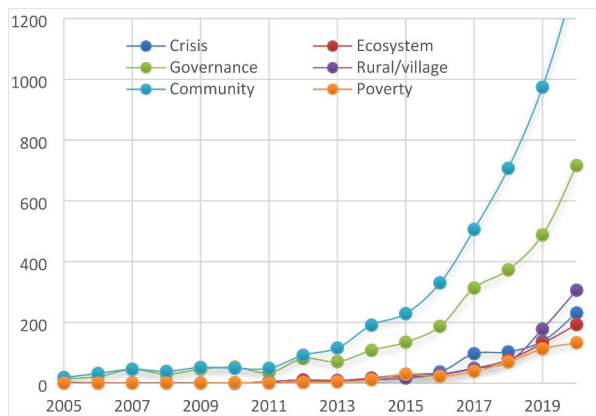
$$Perplexity(w) = \exp \left\{ - \frac{\log(p(\varphi))}{\sum_{d=1}^D \sum_{j=1}^V n^{(jd)}} \right\} \quad (2)$$

In information theory, perplexity measures how well a probability model predicts a sample to determine the statistical goodness of fit of a topic model (Blei et al. 2003). It can be used to compare probability models. A low perplexity value indicates a good probability distribution in predicting the sample, which would make it easier to interpret. However, it is worth knowing that Chang et al. (2009) also showed models that achieve better predictive perplexity while having less interpretable latent spaces.

The pursuit of a better method to tackle the interpretability issues of a topic model and the topic size determination was also directed to evaluating the semantic coherence of the topic models. Semantic coherence is a measure of the co-occurrence of highly probable words in a topic. Mimno et al. (2011) have shown that the coherence value correlates with expert judgments of topic quality. The analysis of the perplexity from the topic modeling results in a validated topic model following Mimno et al. (2011). The method is used for optimal topic number (topic size= k) selection of the LDA model whereby the topics are also qualitatively evaluated on having high explanatory power. The topic model is evaluated using a grid search method by looking at the perplexity's minimum value (Zhao et al. 2015). The selected individual topics are evaluated and compared on their interpretability and the theoretical concept (Bonilla and Grimmer 2013; Maier et al. 2018).

The topic modeling is conducted using the Stanford Topic Modeling Toolbox (TMT), which is widely used by social scientists in text analysis. The dataset for topic modeling is collected from the global research publications related to rural social innovation searched in the Scopus database and Science Direct. The two sources are used to develop a more comprehensive dataset. The Scopus indexed publications are filtered using the script: "TITLE-ABS-KEY (rural OR village OR forest* OR farm* OR agri*)". The source from ScienceDirect is collected using the search script (rural AND 'social innovation'). The two sources are merged and then screening is carried out for the duplicated title. Titles and abstracts of all publications were carefully

Fig. 2 The trends of research in social innovation with selected filtering keyword in the Scopus database



considered for relevance to rural social innovation. The search resulted in a total of 1727 records.

In LDA, the corpus is represented as a matrix of terms in a document, generally a sparse matrix. Reducing the dimensions of the matrix necessitates text preprocessing which can improve the topic modeling results. For this purpose, preprocessing is necessary to include syntactically close words in just one basic term. The text's common preprocessing before analysis consists of three steps: tokenization, stopwords removal, and stemming. Tokenization is the process of dividing the content of each text into a sequence of character strings called tokens. This process will generate a token consisting of a single word before building the word vector. Stopwords removal means eliminating the filler words called stopwords, which do not add value to the analysis. Words like 'the', 'is/are', 'to', and 'of' are the most common words in the English language. Stemming is not used in this study because upon inspecting its deployment no value-added was identified even the explanatory power was getting worse.

4 Results and discussion

The bibliometric data analysis from Scopus shows that the research topic related to the keyword 'community' on social innovation is the most studied topic (Fig. 2). The increasing trend of research related to community and governance indicates that the two are important key concepts. It is also interesting to observe the increasing trend in the word rural or village. The increasing trend of the words: 'community', 'governance', and 'village' indicates increasing attention on these keywords. Attention will be increasingly given to how these keywords are interrelated in the context of rural development challenges such as poverty, marginalization, poor public services, depopulation, and limited resources.

This result is also a proxy that most social innovations that occur in the rural context always involve the involvement of the local community. Experts usually view this phenomenon using the perspective of community empowerment. Community empowerment becomes the leverage in social change in rural areas. Articles that

focus on the community have been widely published in various international journals. It shows that social innovation has shown its impact on rural development. The results of studies in various European countries show that even community empowerment in rural areas can increase the capacity of the elderly community, which has been considered a burden for countries with an inverted pyramid population structure (Europe Commission 2013). The community is the central agency that makes social innovation work because it is performed by the community and for the benefit of the community. Empirical studies show that most social innovation ideas come from a bottom-up perspective, but intervention occurs at the scaling up by involving other actors. Most studies highlight that the leverage scaling up the level of social innovation is the intervention of the government, both the central government and the regional government, which is marked by the emergence of the concept of governance.

The study linking social innovation practice with governance has been carried out by Galedo et al. (2021) using a transdisciplinary research approach that provides a deep understanding of social innovation and governance. The disciplines that form the trans-scientific framework are political science and public administration, urban and territorial studies, sociology, sustainability and ecology, and culture and creativity studies. Meanwhile, the concept of governance contains the meaning of new ways of governing, including participatory and collective decision-making, along with conventional forms of government. The study results show that there are collaborative practices between civil society organizations and public actors to develop alternative solutions to meet social needs and often face comparable socio-political challenges (Galedo et al. 2021). Many social innovation ideas at the community level impact poverty eradication. Despite what little they have to spend, a poor community could become profitable potential consumers by acknowledging them as resilient and creative entrepreneurs and value-conscious consumers (Prahalad and Hart 2002). The combination of making a profit and helping poor people to eradicate poverty seems very promising for multinational companies (Streb and Janse 2017).

The visualization of the co-word analysis, as depicted in Fig. 3, is generated using VosViewer, whereby the dataset comes from a search in the Scopus indexed publications. The dataset is searched using the script: TITLE-ABS-KEY (“rural” AND “social innovation”), which resulted in 329 records. The analysis was carried out with the minimum number of occurrences of a keyword being three. Figure 3 shows the identified clusters of topics, namely related to ‘rural development’ (red-colored nodes cluster), ‘social farming’ (light blue cluster), ‘social entrepreneurship’ (green-colored cluster), ‘governance’ (blue-colored cluster), and ‘innovation’ (green-colored cluster), ‘digital social innovation’ (yellow-colored nodes), sustainability (purple colored nodes), sustainable rural territories development (brown colored nodes) and neo-endogenous rural development (orange-colored nodes). The co-word analysis, as visualized in Fig. 3, reveals the semantic network of concepts in rural social innovation as follows. The dominant term in the visualization is ‘rural development’ whose cluster topic (red-colored cluster) is broad in its scope (gender, migration, food security and safety, neo-endogeneous development, internet, housing, and diversity in rural areas).

The green-colored cluster of terms (social entrepreneurship, social enterprise, social capital, rural communities, elderly, marginalized rural areas, social network, rural hub, and cooperation) is called cluster topic on social entrepreneurship. Furthermore, the term social entrepreneurship is directly related to the term 'forestry'. This indicates that the issue of sustainable forest management has been extended to include the aspect of making a profit besides the main goal of protecting the environment.

The pink-colored cluster of terms (rural areas, resilience, cultural heritage, participatory approach, rural women, rural regeneration, philanthropy, empowerment, collective action, societal challenges) is called rural area resilience. Participative processes and citizen empowerment are considered crucial aspects of social innovation (Edwards-Schachter and Wallace 2017). Likewise, aspects of the identification of urgent societal challenges of rural decline, initiatives to increase the rural attractiveness through innovative forms of social service delivery, and empowering mobilization of vulnerable groups, such as rural immigrants, are of growing concern in Europe (Lindberg 2017). The sectors identified in Fig. 3 are (agro)forestry, food, healthcare (elderly), housing, e-commerce, and agriculture.

Coherent with the results from topic modeling, the co-word analysis identifies that the concept of 'rural community' within the rural social innovation is related to 'digital social innovation', 'community development', 'social networks', 'co-design', 'social entrepreneurship', economic and social impacts, and 'sustainable development'. Furthermore, the concept of sustainable rural development is clustered with the terms inclusive development, collective action, rural territories, and agro-ecology. This implies that the implementation of rural social innovation must involve community empowerment activities, collective action, and collaboration with various parties to achieve common community goals. Community involvement in every empowerment and government development program will be sustainable because it is culturally acceptable to the target community. The study by Saviera et al. (2022) shows that the involvement of the target community and other stakeholders from the planning stage of regional development is an important factor in the success of community empowerment programs.

Upon representing the figure using an overlay of nodes over time (Fig. 4), we could see the trends of the concepts (keywords) over time. The new emerging terms are such as innovation policy, social inclusion, participatory approaches, cultural heritage, rural women, spatial planning, spatial justice, transformative social innovation, neo-endogenous development, food safety, food security, tourism, poverty alleviation, sustainable development goal, rural hub, social-ecological system, and rural regeneration which are identified as emerging terms since the year 2020 (color of yellowish nodes) in Fig. 4.

The grid search in selecting the topic models identified three local minima from the curve of the perplexity. The topic size $k=150$ shows the global minimum value (2278.15), and the other two local minima are the topic size $k=15$ (2341.04) and the topic size $k=60$ (2348.94). Although the topic size $k=15$ and $k=60$ overall do not represent the best topic model, they have some noteworthy informative results. The result from the topic modeling analysis with size $k=15$ identifies some topics (with some selected top terms), namely: food (food-waste, production, security, consumption); healthcare (woman, children, worker, family); economy (circular economy,

Table 1 Terms Intensities from the Topic Model k= 150

Cluster	Topic No.	Topic with some selected top-terms and their intensity	Terms Intensity	Cat-egory
Community & Empowerment	25	Local engagement/participation: group(16), role(12), ability(9), experience(8)	854	Medium
	37	Community: indigenous(33), inclusive(30), collaborative(17), practices(15), processes(9)	855	Medium
	60	Society: role(28), welfare(17)	1011	High
	68	Knowledge: institution(19), learning(12), shared(10)	709	Low
	71	Actors: local(41), institutional(27), identify(22), potential(15)	1602	High
	121	Initiatives: Society(26), role(23), political(19), state(13)	858	Medium
	140	community: local(96), rural(36), social-capital(29), renewable-energy(12)	1311	High
Business & Economy	32	Sharing: Economy(23), knowledge(23), models(19), process(14), traditional(10)	659	Low
	6	Business Model: value(82), creation(41), corporate(23), environment(15)	1660	High
	48	Market: resources(20),innovation(15), mechanisms(12)	708	Low
	65	Market: value product innovation	992	Medium
	85	Consumption: production(78), lifestyle(27), pattern(34), practices(23)	937	Medium
	120	Economy: circular(83), bioeconomy(39)	1121	High
	143	entrepreneurship(92), social-entrepreneurship(79), social-entrepreneurs(24), pyramid(20), emergence(14)	1133	High
Environment	19	Water: ecosystem(73), services(30), management(27), quality(18), capital(17)	954	Medium
	20	Forest: management(32),ownership(25), community(17)	735	Low
	69	Risks: management(40), fishery(35), flood(20), river(14), coastal(9)	751	Low
Governance	74	Governance: initiatives(39),actors(38), co-production(32), policy(18), innovations(16), process(14), potential(13)	1303	High
	76	Institutional: actors(37), entrepreneur(21), interplay(15)	1110	High
	81	Policies: government(37), state(36), effective(18), control(9)	854	Medium
	104	Policy: economic (46), ecological(42)	782	Low
	109	Institutional: environmental(63), economic(37),scaling(27)	1176	High
Processes	149	policy: innovative(13), implications(8)	958	Medium
	26	Transition: sustainability(152), learning(54), management(40), processes(32), actors(27), government(19), role(15)	1627	High
	45	Processes: agency(37), role(32), innovation(21), policy(16)	1073	High
	99	Design: practice(42), collaborative(21), sharing(6)	1019	High

Table 1 (continued)

Cluster	Topic No.	Topic with some selected top-terms and their intensity	Terms Intensity	Cat-egory
Resources	137	Co-creation: initiatives(26), citizen(13), professional(3)	531	Low
	10	Resources: economic(121),technology(74), human(32), process(21), skills(9)	1334	High
	50	Networks: strategy(25), factors(18), develop(11)	1194	High
	70	Food: security(37), sustainability(20), organic(17), production(11), safety(9)	877	Medium
	82	Cultural creativity	605	Low
	88	Policy: bioeconomy(48), environmental(36), governance(28)	1280	High
	100	Water: rice(22), irrigation(18), natural-resource(13), species(7), capital(5)	596	Low
	118	Networks	891	Medium
	139	Local potential: cooperatives(49), residents(21), community(52), socio-economic(12)	851	Medium
	Sector	15	Food & Food waste: supply chain (56), vegetables(20)	1606
61		Agriculture: farmer(115), farming(107), system(106), food(34), role(17)	1370	High
72		Health: well-being(26), safety(23), program(16), impact(13), mental(5)	989	Medium
73		Waste: environment(53), health(15), biorefinery(10), reuse(9)	996	Medium
30		Renewable Energy: wind(39), technology(29), electricity(18), acceptance(14), market(12)	1147	High
90		Tourism: destination(21), cultural(13), marketing(10), enterprises(7)	483	Low
113		Electricity: barriers(47), transition(29), renewable-energy(25), government(18), technology(13)	1159	High
119		Child Care: behavior(55), parent(10), education(9)	591	Low
122		Healthcare: women(53), workers(19), adults(15)	921	Medium
9		Services: ecosystem(55), wellbeing(16)	921	Medium
Sustainability	1	Climate Change: governance(220), processes(20), institutions(12)	917	Medium
	3	Climate Change: mitigation(32), impact(20), scale(14), goals(11)	1273	High
	77	Sustainability: environmental(84), economic(44), society (13)	1141	High
	87	Sustainability: environmental(44), ecological(37), transformation(34)	1424	High
Technology	4	Technology: potential(44), design(13), innovation(11)	1135	High
	34	Digitalization: information(61), technology(50), service(33), access(28), internet(22), opportunities(11)	1281	High
	51	Technological Innovation	1041	High
	145	Technology: planning(42), policy(31), developing(18), transfer(14)	1142	High
Territorial	14	Urban Planning: space(44), scale(18), pressures(12), infrastructure(11)	1481	High

Table 1 (continued)

Cluster	Topic No.	Topic with some selected top-terms and their intensity	Terms Intensity	Cat-egory
	31	Urban: sustainability(33), mobility(32), environment(24), planning(23), transport(18)	900	Medium
		Rural: urban(30), initiative(13), experience(9), transformation(5)	925	Medium

development, such as cultural creativity, tourism, forest, and co-creation. Some of the results from topic modeling are confirmed by the co-word analysis. The co-word analysis has shown the dominant terms such as governance, forestry, agriculture, food, innovation policy, and networked territorial development. The co-word analysis also reveals state of the art in social innovation research, which is marked by emerging terms such as innovation policy, social inclusion, participatory approaches, cultural heritage, rural women, spatial planning, spatial justice, transformative social innovation, neo-endogenous development, food safety, food security, tourism, poverty alleviation, sustainable development goal, rural hub, social-ecological system, and rural regeneration.

The meaning of the words with the highest intensity can be interpreted as follows. First, it is essential to identify important actors that can assist the process of innovation development. Most publications present an explanation that actors play an important role in the successful implementation and scaling up of a rural social innovation initiative. The existence of actors involved in this activity requires an institutional framework and rules that form the basis for the relationships and interactions that occur. The actors involved are local government, non-government organizations, public figures, religious leaders, related associations, community clusters, academicians, researchers, and corporations. The institutional framework plays an important role because it provides formal, informal, and even rules of social interaction patterns that occur in the social innovation initiative.

Second, building collaboration among actors in accordance with the superior competence possessed and managing it in a sound business model. In the last few years, there have been several trends in the occurrence of a hybrid business model. This is in accordance with the findings by Michelini (2012) that along with governments, public institutions, and not-for-profit organizations, currently, companies are playing an important role in facing the world's unsolved social problems. Also, a study by Prahalad (2006) explains how the poor are the largest component of the population (read according to the pyramid structure that occupies the bottom) because this segment can become a market that promises profit if corporations can provide what is needed. Leading companies have recently developed innovative forms of social innovation by combining three elements: the concept of shared value creation, the theory of the fortune at the bottom of the pyramid, and a corporate social entrepreneurship approach through which they enter low-income markets by helping to solve global challenges while simultaneously generating profits (Michelini 2012).

Third, according to the resource cluster, the highest density refers to rural social innovation related to natural resources. Utilization of natural resources in their respective areas, which ranges from activities to handling and managing renewable energy, water, agriculture, farming, biorefinery, or even cultural creativity. Usually,

Table 2 The results of co-citation analysis of social innovation from the Scopus database

Label	Topic
baker, s., mehmoor, a., social innovation and the governance of sustainable places, 2015; gerometta, j., haussermann, h., longo, g., social innovation and civil society in urban governance: strategies for an inclusive city, 2005; moulaert, f., martinelli, f., swyngedouw, e., gonzalez, s., towards alternative model(s) of local innovation, 2005; moulaert, f., nussbaumer, j., the social region: beyond the territorial dynamics of the learning economy, 2005; novy, a., leubolt, b., participatory budgeting in portoalegre: social innovation and the dialectical relationship of state and civil society, 2005; swyngedouw, e., governance innovation and the citizen: the janus face of governance-beyond-the-state, 2005, (59, 151, 38)	Social Innovation Governance
cajaiba-santana, g., social innovation: moving the field forward. a conceptual framework; lettick, f., parekh, m., the social innovation process: themes, challenges and implications for practice, 2010, (84, 241, 33); mulgan, g., the process of social innovation, 2006; mulgan, g., the process of social innovation, 2006; shaw, e., carter, s., social entrepreneurship: theoretical antecedents and empirical analysis of entrepreneurial processes and outcomes, 2007; zahra, s.a., gedajlovic, e., neubaum, d.o., shulman, j.m., a typology of social entrepreneurs: motives, search processes and ethical challenges, 2009.	Social Innovation Process
barney, j., firm resources and sustained competitive advantage, 1991; cohen, w.m., levinthal, d.a., absorptive capacity: a new perspective on learning and innovation, 1990; defourny, j., nyssens, m., conceptions of social enterprise and social entrepreneurship in europe and the united states: convergences and divergences, 2010; defourny, j., nyssens, m., social enterprise in europe: recent trends and developments, 2008; granovetter, m., economic action and social structure: the problem of embeddedness, 1985; mcelroy, m.w., social innovation capital, 2002; nahapiet, j., ghoshal, s., social capital, intellectual capital, and the organizational advantage, 1998.	Social Innovation Resources
battilana, j., dorado, s., building sustainable hybrid organizations: the case of commercial microfinance organizations, 2010; mair, j., marti, i., entrepreneurship in and around institutional voids: a case study from bangladesh, 2009; nicholls, a., the institutionalization of social investment: the interplay of investment logics and investor rationalities, 2010; nicholls, a., the legitimacy of social entrepreneurship: reflexive isomorphism in a pre-paradigmatic field, 2010; pot, f., vaas, f., social innovation, the new challenge for europe, 2008; westley, f., antadze, n., making a difference: strategies for scaling social innovation for greater impact, 2010.	Social Innovation Institutionalization
dacin, m.t., dacin, p.a., tracey, p., social entrepreneurship: a critique and future directions, 2011; miller, t.l., grimes, m.g., mcmullen, j.s., vogus, t.j., venturing for others with heart and head: how compassion encourages social entrepreneurship, 2012; phillips, w., lee, h., ghobadian, a., o'regan, n., james, p., social innovation and social entrepreneurship: a systematic review, 2015; tracey, p., stott, n., social innovation: a window on alternative ways of organizing and innovating, 2017; westley, f., antadze, n., making a difference: strategies for scaling social innovation for greater impact, 2010; zott, c., amit, r., massa, l., the business model: recent developments and future research, 2011.	Social Innovation Business Model
borzaga, c., bodini, r., what to make of social innovation? towards a framework for policy development, 2014; cajaiba-santana, g., social innovation: moving the field forward. a conceptual framework, 2014; edwards-schachter, m., wallace, m.l., shaken, but not stirred: sixty years of defining social innovation, 2017; grimm, r., fox, c., baines, s., albertson, k., social innovation, an answer to contemporary societal challenges? locating the concept in theory and practice, 2013; neumeier, s., why do social innovations in rural development matter and should they be considered more seriously in rural development research? proposal for a stronger focus on social innovations in rural development research, 2012.	Social Innovation Policy Development

Note: The numbers in the parentheses denote: (#links, total link strength, #co-citations). #links is the number of direct connections the article has with other articles; total link strength is the total number of the link strength, #citations is the total number of co-citations an article has

natural resource management related to this sector utilizes indigenous knowledge and

Table 3 The Knowledge structure of Rural Social Innovation and its main Components

Main Components	Knowledge Structure	Social Contexts	Sectors
Inputs	Resources (human capital, social capital, infrastructures, natural resources, local/indigenous knowledge)	Social Systems (Actors, Relations, Traditions/Practices, Norms/Values)	Agriculture, Tourism, Health-care, Food Production, Energy, Environment
Transformations	Social Changes (Governance, Social Relation, Perceptions, Behaviors) Social Process (Community Development, Institutionalism, Social Entrepreneurship, Diffusion of Social Innovation, Scaling Up)		
Outputs	New Products, New Service, New Process, New Model, New Market		
Objectives	Social Needs (Aging Society, Climate Change, Demographic, Unemployment)		
Outcomes	Sustainable Development Goals (Social, Economics, Environment, Institutional)		

local wisdom to obtain new knowledge that is beneficial for the local community.

Fourth, intense density is also shown for publications that focus on governance aspects. Villages and cities need to complement each other following their comparative advantages. Both are interconnected in terms of meeting needs and efforts to build an increasingly sustainable development synergy. This interconnectedness into the network and the concern of governance grows into territorial social innovation. Studies in Indonesia show that aspects of government policy intervention are leveraged to succeed in any social innovation in the community in the rural area. Social innovations in empowering women's communities, for example, are carried out by groups of traditional woven fabric craftsmen in Indonesia. Most of the weaving craftsmen in Indonesia are women. Almost all major islands in Indonesia have woven fabric craftsmen who represent the region's wealth in terms of motifs, colors, and materials. Because women as craftsmen produce woven fabrics with economic value, these women contribute to improving family welfare, regional economic independence, empowering women, preserving culture, and even sustainability. Indriati et al. (2018) show that these craftsmen's success in social innovations to form an indigenous business group requires support and intervention from government policies. Policy intervention from the regional government will encourage the necessary collaboration, so that good governance involves relevant actors in terms of scaling up, access to marketing, increasing competence, and capital.

This study also supports the findings in Table 1, which finds that the intensity of the discussion on community empowerment (topics no 25 and 140) is always associated with indigenous practices and inclusivity. Success is determined by various government initiatives (topic no 21) to encourage collaboration with related actors (topic no 71), both private, NGO and others. Traditional woven fabric craftsmen are community groups (topic no. 60 and 140) that produce local products that contain local wisdom values (topic no. 71) and indigenous knowledge (topics no. 37 and 68), which to some extent are difficult to imitate and unique.

The fifth intense density is related to food security related to aspects of agriculture, supply chain, farming, and food waste. In publications that take up this topic, they are generally local and casuistic, which present the practice of applying indigenous knowledge to a community in utilizing its environment based on local wisdom. Empirical evidence in Canada shows that social innovation that utilizes indigenous knowledge can help the region build food security (Vazquez 2017). The latest study taking the pandemic era carried out by Huang and Tsai (2020) presents a phenomenon in China about how the food industry in rural China carries out social innovation in food production and distribution to facilitate social development and mitigate poverty.

Sixth, another study group that relates to the current era of disruption is the rural social innovation in the context of the application of technology and territorial-based urban planning. Technology brings changes that help rural communities to solve various social problems. Development in rural areas is inseparable from development in urban areas. Rural areas get better access, bring public services closer, and open new opportunities for various other social activities if the development in urban areas is fulfilled. The emergence of the category 'urban' is in line with the findings in the study on structural exploration of the categories in rural entrepreneurship research by Shrivastava and Kumar Dwivedi (2021). They identified four major themes namely: Spatial Dimension, Sustainability, Income Generation, and Barriers. Sub-themes under the Spatial Dimension are Embeddedness, Spatial Dimension Network, Rural-Urban Proximity, and Village/Farmer. It seems the issue of rural-urban proximity in the regional development is also significant within the rural social innovation studies.

The analysis that becomes the key finding in our study is the result of co-citation analysis on social innovation publications that shows researches in rural social innovation are clustered in six themes, namely; (1) SI governance; (2) SI process; (3) SI resources; (4) SI institutionalization; (5) SI business model, and (6) SI policy development. Table 2 shows the details of the six themes which will be used to support triangulation. The results of co-citation analysis in Table 2 reveal that institutionalization is one of the six main themes in global social innovation research. The topic modeling shows that institutionalization is related to the strategy to organize various actors' functions and interplay within the networks. The term 'informal' is identified within the top terms of the topic which is interpreted as the dominant form of informal institutionalization that has its own challenges, for example, poor law enforcement, lack of trust, as well as norms and values that bolster patriarchal systems. However, social innovations are operating in spite of these challenges and are facilitating improvements in a number of challenging rural areas (Živojinović et al. 2019). An informal institution is an enduring system of shared meanings and collective understandings that, while not codified into documented rules and standards, reflect a socially constructed reality that shapes cohesion and coordination among individuals in a society (Scott 2005). Table 2. The results of co-citation analysis of social innovation from the Scopus database The discussion takes the intensity of the key terms into account, whereby the high intensity of topics or top-terms are seen as the starting points. From the results of the co-construction, it can be concluded that the structure of knowledge in the SI system is quite complex as shown in Table 3; however, it can be broken down into five main parts, namely objectives, inputs, transformations, out-

puts, and outcomes. The analysis technique of co-word analysis with an input/output relationship framework has also been used to understand regional research networks by Turner and Rojouan (Turner & Rojouan 1991). Table 3. The Knowledge structure of Rural Social Innovation and its main Components. In understanding social innovation, especially in the rural context, the perspective of using views in the scientific field per se is not sufficient. In line with Galedo et al. (2021) and Moulaert (2021) who view Social Innovation using a transdisciplinary perspective. The results of the co-word analysis show that in the transformation component (Table 3), most of the published documents discussing rural social innovation pay attention to aspects of social change and social process. Various theories that are used to understand the process of social change and social process are how governance and institutionalism are enforced to manage community development, changes in community behavior, engineering social relations, public perception and the dissemination and scale-up of social innovation itself in order to have the expected impact on society. Almost all studies show the phenomenon of co-creation, although many documents do not state clearly that this relates to collaborative governance as a main concept in their publications. Open innovation, cooperation, triple helix relations and coordination between actors have occurred. Another color in governance besides the collaborative side is the nature of the direction of policy design and governance of social entrepreneurship development from the relevant local authorities. It is undeniable that social innovation is an interdependent process, governance will play an important role in achieving success. The transition from the old pattern of governance, one of which was characterized by state domination, to the new governance administration requires a transformative role between the state and civil society. This transformative role is critical in consensus-oriented decision-making, especially in carrying out programs that involve the community on a large scale. In a seminal paper on governance, Ansel and Gash (2008) state several determinants in collaborative governance that include face-to-face dialogue, trust-building, and the development of commitment and shared understanding. Meanwhile, in the context of rural social innovation, governance remains largely unexplored in facing the challenge of marginalization (Georgios and Barraí 2021). Social innovation is about the transformation process that occurs in a community. The result showed that in the 'process' cluster, all the topic refers to a high-intensity index, although not as high as the 6 (six) cluster concepts above. It means that most of the social innovation in rural sectors deals with the social transformation process that leads to sustainability and social welfare. The processes that occur in rural social innovation include aspects of community learning, knowledge sharing, social practice, and collaborative work. In some literature, the process that occurs in rural social innovation is seen as a community of learning. In the early stages of a social innovation being implemented, individuals will usually begin the process of changing behavior that is different from their previous habits so that it becomes a common and regular practice. The process that occurs is then carried out in groups to create new shared behavior. The greater diffusion stage is when other communities start imitating to adopting this innovation (Kuthrakun, 2013). Analysis of published journals confirms that many rural social innovations result from appropriate technological development, so almost all topics on technological intervention in social change have very high intensity (in technology clusters). On

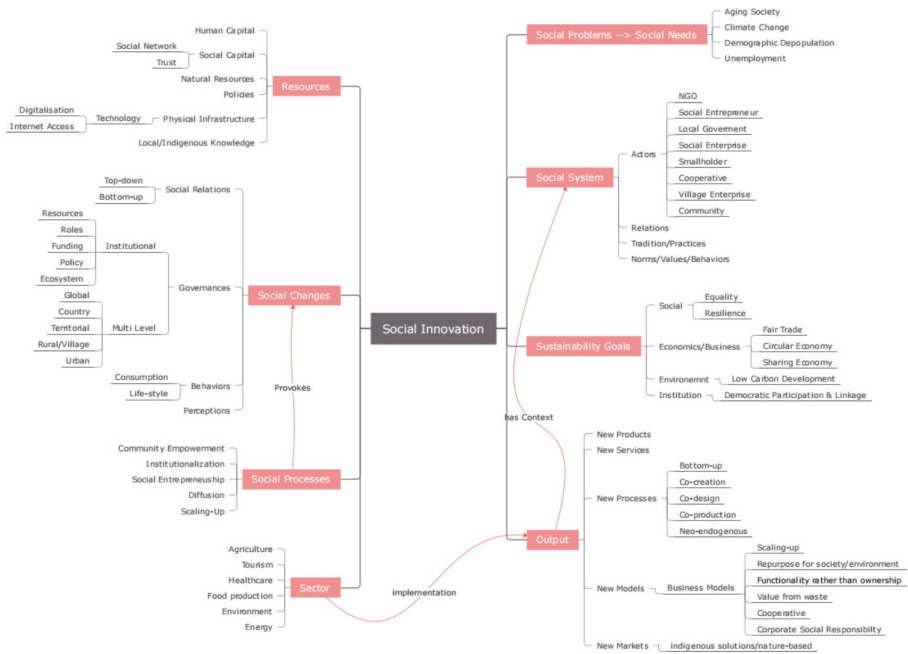


Fig. 5 Rural Social Innovation Knowledge Structure

the other hand, the intensity of other clusters is still uneven distributed. Likewise, the intensity of research related to rural SI in the tourism sector is still low. The identified keywords are i.e., how to market destination, cultural heritage, and creativity. In addition, the scope of research in tourism is still comprehensive, whether related to policy, forest and water management, risk management, or co-creation. In the context of rural social innovation, resources and capabilities are limited, so co-creation is a prerequisite for social innovation.

In accordance to write this paper, topic modeling, co-citation, and co-word analysis are used for constructing the thematic and strategic map of a rural social innovation field of knowledge. As shown in Fig. 5, the resulting knowledge structure is co-constructed from the results above. In the next section, we will discuss interesting findings in the constructed knowledge structure concerning rural social innovation.

In the output part of sector implementation, social innovation is characterized by the development of a new business model (Fig. 5). A business model is the design or architecture of the value creation, delivery, and capture mechanisms (Teecce 2010). The business model concept emerges to explain how complex businesses function and how value is created (Linder and Cantrell 2000; Barth et al. 2021) investigated how sustainable business models have developed in the agricultural sector. It maps eight archetypes of sustainable business models, clustered in three groups, focusing on technological, social, and organizational innovation. Technological archetypes cover such as (1) maximizing material and energy efficiency, (2) creating value from waste, and (3) using substitutes with renewable and natural processes. Social archetypes: (4) ‘delivering functionality rather than ownership’, (5) adopting a stew-

ardship role, and (6) encouraging sufficiency. Organizational archetypes include (7) repurposing for society/environment and (8) developing scale-up solutions. Results from the topic modeling reveal that the business model in rural social innovation is signified by organizational archetypes, namely the ‘repurposing for society/environment’ archetype and ‘developing scale-up solutions’ archetype.

Research results related to social innovation in the European continent show that the social innovation model changes to the new hybrid business model, which combines a people-oriented but profit-seeking business model (Michelini 2012). This new hybrid business model is also in line with the concept of the bottom of the pyramid proposed by Prahalad and Hart (2002), which puts forward the argument that large companies can help various social innovation programs in low-income markets. Multinational companies investing in the poor (like the “bottom of the pyramid” and “corporate social responsibility” model) means lifting billions of people out of poverty and despair, avoiding the inevitable social recession, political chaos, terrorism, and environmental collapse. Doing business with poor people requires radical innovations in technology and business models, such as how to create ‘values from waste’. Changes in business models are needed even if social innovation takes the form of micro start-up companies or medium-scale (de Jesus Marques and Guerra 2019). Many small-scale companies have changed their business model where this new business model can increase the levels of employment and welfare.

From the perspective of social entrepreneurship, corporate social responsibility, inclusive business model, and corporate social innovation are business models widely discussed in social innovation (Portales 2019), while cooperative is widely discussed in developing countries (Rajasekhar et al. 2020). Cooperative is an active community participatory movement in groups of individuals to seek alternative solutions to peaceful political, social, and economic conflicts and socio-economic. Cooperative is a business model in rural social innovation that is identified in the topic model wherein the term ‘initiatives’ are identified with other top terms indicating that these initiatives were carried out in renewable energy such as solar PV projects by local/rural communities. We argue that future rural social innovation research will also comprise other renewable energy options such as biomass and small hydropower, which are the characteristics of rural areas.

The concept ‘social network’ in Fig. 5 is categorized under the ‘resources’, within the ‘social capital’. A good network of relations between interest groups and public institutions can favor the improvement of infrastructural facilities and the efficient provision of economic and social services as well as the influx of capital and investment from both local and external firms. A study by Lombardi et al. (2020) shows that a reconfiguration of the social network structure provides innovative solutions to activate social relations amongst farmers in Italy and thus strengthen relationships among the members of the rural community. This will provide an exchange of information that leads to professional collaborations among actors.

Moreover, networks provide resources for the social innovation process. Both organizations from the local community and other geographies provide significant tangible (e.g., financial resources) and intangible resources (e.g., trust and legitimacy) in rural areas (Müller and Korsgaard 2018; Richter 2018). Networks with non-local actors can be instrumental in gaining and diffusing knowledge, attracting resources

that are not available within the locality, and scaling up social innovations. Therefore, networks related to social innovation tend to gather different actors from different geographical scales, which is established in implementing a pilot project case. The local government drives these collaborative projects with the local community's key actors based on grassroots innovations ('bottom-up' process). Collaboration refers to citizen engagement and networking, which have been long perceived as the means underlying rural development processes. The process constitutes activities, practices, learning, diffusion, and knowledge transfer within the social networks.

The link to the concept 'social behavior' can be found from the topic modeling analysis, which reveals the topic 'consumption behavior/lifestyle' related to the terms 'organic' and 'sufficiency', and 'cleaner production' co-occurs with the term 'ecological'. This co-occurrence implies that addressing complex social challenges requires behavior change. For example, to mitigate the effects of climate change, we need a new business model that embraces the concept of 'sufficiency' (Fig. 5). We will need to cut our energy use and conserve what is used through downsizing without reducing the quality of life, for example, in housing (Lorek and Spangenberg 2019). Likewise, in the rural social innovation context, this is pursued through the focus on renewable and sustainable energy forms (solar, wind, micro-hydro, and bioenergy) for rural areas. Social innovations challenge the creation of multiple forms of value for society since a single form of value would not have the capacity to generate the expected 'social change' (Carvalho and Jonker 2015). In all its complexity, contemporary society is developing many interesting cases in which people have invented new and more sustainable 'lifestyles and consumption'.

The previous section mentioned the importance of identifying actors and how to find a concerted effort between the actors. Social enterprise is one of the actors in a social innovation system to solve social problems; it can conduct economic activities to provide goods or services, but these economic activities must serve their social activities. Meanwhile, the closely related 'social entrepreneurship' is part of a social process (Fig. 5) to successful social innovation projects, and it can be understood as a process involving the innovative use and combination of resources to pursue opportunities to catalyze 'social change' in addressing 'social needs' (Mair and Marti 2006). Social innovation is a vital entity that can survive and prosper only in a favorable environment. Creating such a favorable regulatory and economic ecosystem is a concrete contribution that national and local institutions should make to this process.

5 Conclusions

Rural social innovation has developed into a critical factor for economic development, social life, and environmental sustainability. Rural Social innovation can be an accelerator for accelerating growth. In the context of social innovation in rural areas, some structures and mechanisms need to be understood well because it is complex. Rural development must overcome poverty, marginalized communities, limited public goods provision services, out-migration, gender balance, and enrich local resources.

In many cases, rural social innovation is challenging to develop because of cultural factors and structural conditions in society that need more time to change. This study shows that knowledge structure in the rural social innovation system is quite complex; however, it can be broken down into five main parts: objectives, inputs, transformations, outputs, and outcomes. Since social innovation is a complex and interdependent process, governance will play an essential role in success. The Social Innovation process will be dynamic and, from time to time, requires ‘social change’ whereby ‘governance’ is one of the elements. In the output part of ‘sector implementation’, rural social innovation is characterized by developing a ‘new business model’.

This study illustrates a pronounced difference in the focus of social innovations between developing and developed countries. Cooperatives characterize the business model of rural social innovation in developing countries. The developed countries use a model derived from a corporate model such as corporate social responsibility, inclusive business model, and corporate social innovation. Results from the topic modeling reveal that the business model in rural social innovation is of organizational archetypes, namely “repurposing for society/environment” and “developing scale-up solutions” archetype.

This study also identifies topics with high-intensity terms, such as actor, business model, natural resources, food security, governance, and urban. Some second-layer high-intensity terms are networks, institutions, and policy which are considered key elements. There are terms whereby the intensities are low but interesting to future development, such as ‘cultural creativity’, ‘childcare’, ‘tourism’, ‘forest management’, and ‘co-creation’, which constitute the elements in ESG financing. This means there are research gaps related to cultural creativity, childcare, elderly, tourism, forest management, and co-creation that can be the next agenda for scholars’ future research.

In developing countries where the sustainability of social innovation originating from the grassroots is mainly dependent on government intervention, research related to the concept of ‘collaborative governance’ in social innovation will give a novelty.

Because understanding the knowledge structure is very important, it can provide complete building blocks related to the study of social innovation. This structure also provides a convenient way to see the knowledge gaps and how topics show trends as inputs for further research in social innovation research related to rural development. Finally, there are four topic recommendations for further study as follows:

- The governance cluster provides space to test the latest concepts such as collaborative governance and meta governance because local authority interventions are still leveraged to sustain various bottom-up initiatives.
- In the community and empowerment cluster, a more in-depth study is needed regarding knowledge management, such as indigenous knowledge conversion, institutionalism, and community learning in practice to encourage social innovation in rural areas.
- In the business and economy cluster, the global shift towards information technology begins to change business models and patterns of economic interaction

towards a knowledge-based economy and sharing economy, which also needs attention so that rural areas do not get left behind.

- In the sector implementation cluster, there is still a lot of space for studies that can present how rural social innovation initiatives can build local communities by relying on creativity, culture, and local resources to become tourist destinations based on local wisdom.

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Data Availability The dataset generated and analyzed during the current study is available in the SCOPUS repository.

Declarations

Conflict of interest The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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