Emerging Trends in the Territorial and Rural Vulnerability-Vibrancy Evaluation. A Bibliometric Analysis

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Abstract. The very strong and fast process of industrialisation and urbanisation over the last century has impacted strongly the rural space, leading to its decline and progressive abandonment. This phenomenon has a strong influence on the socio-economic structure of the rural areas and as a consequence is provoking a lot of challenges connected to the future development of these territories.

In the last years, it has started an extensive research activity on the topic of the assessment of the state of the rural territories, approaching the given problem with the aim to be able to better understand and counteract it. As observed, this research activity can have an origin from a lot of different phenomena, gravitating in between terms such as the territorial vulnerability, fragility, marginality, peripherisation, resilience, socio-economic sustainability, vitality and vibrancy.

The main research objective of the present paper is to examine the emerging research fields and gaps of the quantitative indicator-based approaches for the territorial and rural vulnerability-vibrancy evaluation in non-urban contexts. This study was performed through the adaptation of a bibliometric analysis, more specifically authors' keywords co-occurrence analysis, which is a very useful technique for the assessment of the research topic distribution and future research frontiers. As a result, emerged that the vulnerability and the peripherisation are more consolidated topics, the vitality appears as a recent emerging field of study, while the territorial vibrancy as an interesting research gap that could become more investigated in the future years.

Keywords: vitality assessment · territorial vibrancy · fragile areas

1 Introduction

The fast industrialisation and urbanisation processes during the last century have led to rural decline characterised by high levels and still increasing unemployment, depopulation, economic depression and decrease in the quality of life in the rural areas [1].

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Anyway, the trend of urbanisation that the world has been experiencing is very likely to continue. According to the UNs medium fertility scenario, is estimated that the global population will grow from 7,6 billion people (total in the world) in 2018 up to 9,8 billion in 2050, from which around 68,4% is expected to be living in urban areas [2]. As a result, it can be expected the problem of the rural decline to become even more intensified.

Over the years, it has been made an effort to support and try to stimulate the development of the rural areas through some initiatives regarding the agricultural sectors [3], the diversification of the economy by promoting new forest products [4], the tourism [5] or the production of renewable energy [6]. Even though, some rural areas continue to face a lot of problems and to struggle to maintain their living conditions, often strongly influenced by the combination of population loss and population ageing [7]. Some other challenges that these rural areas are continuing to face are the poor access to essential public services, mobility problems, lack of employment opportunities, specifically in regards of the women and young people [1].

With the objective to counteract this global and very important problem, a lot of scholars have started researching quantitative methodologies for evaluation of the socio-economic conditions of the rural territories with the aim of being able to better understand the specific needs, threats and opportunities of a given territory [8]. As it emerges from some studies [9, 10], it is present a higher attention to the socio-economic problematics in urban contexts than in the rural ones [11] and a certain duality of the aspects from which the quantitative evaluation research of a territory can starts from. There are series of studies which base their evaluation on terms such as vulnerability [12], fragility [13], marginality [14], peripherisation [15, 16], all phenomena which carry an evident negative meaning. Still, there are others that have been approaching the same evaluation objective but from a different perspective, starting their research from positively meaning terms such as – resilience [17], sustainability [18], vitality [19], vibrancy [9, 10]. As it seems, some of these sub-fields of study have been more developed in the last years, while others still haven't reached their full potential of investigation [9, 10]. Still, it is important to mention that whatever of the terms the studies are being referred to, it is mainly studied the socio-economic aspect of the relative phenomenon. Nevertheless, a clear framework summarising the use and the relevance of these terms and related research topics has never been developed, at least at our knowledge.

The main research objective of the present proceeding paper is to examine the emerging research fields and gaps of the quantitative indicator-based approaches for the territorial and rural vulnerability-vibrancy evaluation in non-urban context.

In order to do that a bibliometric analysis is being performed, which is "a popular and rigorous method for exploring and analysing large volumes of scientific data" [20] and it is gaining more importance thanks to its utility to handle large amount of data and produce high research impact [20]. To support these analyses, in the last years a lot of bibliometric softwares have been developed such as Bib Excel, Ucinet, SCIMAT, VOSviewer and CiteSpace [21]. More specifically in this study the VOSviewer software (version 1.6.18) will be used, given its functionality to handle large amount of data and also visualise the outputs.

2 Methodological Approach

The methodological approach consists of 3 main processes, each of which can be divided in sub-steps, called phases. The process can clearly be observed in Fig. 1 and could also be applied for other bibliometric researches.

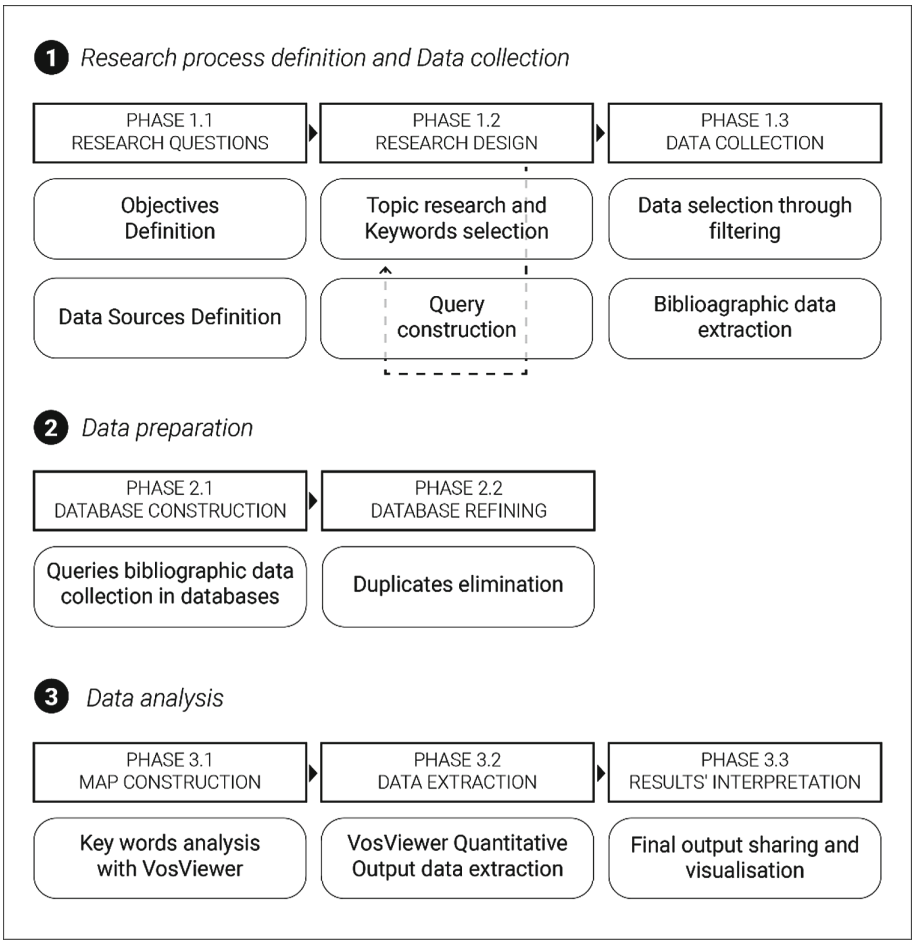

Fig. 1. Scheme of the methodological approach, showing its 3 main processes and related phases (Source: Authors' elaboration).

Research Process Definition and Data Collection. The first process of the methodological approach consists in defining the objective of the research and the main data sources to be analysed.

A critical point in the process is the identification of the keywords to be used for the construction of the research queries. Preliminary research of the topic can be done in order to better understand the state of the field of study, the main studied questions and

which are the appropriate keywords to be selected. Afterwards, the search queries are being constructed.

All queries are being applied in the chosen database and subsequently the results of each have to be refined through the engine criteria of limitation and/or exclusion. Thereafter, the bibliographic data of the final refined research results is being extracted.

Data Preparation. After all the separate bibliographic datasets (equivalent to the obtained results from every refined research query) are being downloaded from the chosen data source, they have to be merged in the final databases that would be subsequently used for the analysis.

The next phase consists in eliminating the duplicates of the records in each database created, an important operation that would allow to obtain valid and uncompromised results in the end of the whole process. With the completion of this phase, the databases could be considered ready to be used for the analysis.

Data Analysis. For the keyword analysis, the software VOSviewer is being used, which is a software tool for constructing and visualizing bibliometric networks, developed by the Centre for Science and Technology Studies of the Leiden University, The Netherlands. This analysis would allow to understand the main trends and gaps in the studied topic by visualising and obtaining quantitative information about the number of occurrences of the keywords, their links, the total link strength and their time relevancy according to the average year of publication.

After the definition of the combination of the most appropriate VOSviewer settings to be applied, two maps for each Database can be processed – one visualising the clusters of keywords, the number of the occurrences of the keywords and the links between them (in Network visualisation, with the Occurrences as a visualisation weight), the second visualising again the number of occurrences and the links but also the average year of publication of each keyword (in Overlay visualisation, with the Occurrences as visualisation weight and Average publication year as visualisation score).

Instead, for obtaining the quantitative information of the authors' keywords present in the Databases, it is possible to apply the same or different combination of the VOSviewer settings, basing the decision on the specific research objectives, and as a result two files can be extracted – a Map file and a Network file. The Map file contains information about the Clusters, the Links (the number of the links that a keyword has), the Total link strength (indicating the number of publications in which two keywords occur together [22]), the number of Occurrences, the Average publication year, the Average citations, the Average normalised citations of each keyword. Instead, the Network file contains information about the strength of the links between pairs of keywords. These two files can be connected in one unique one that allows to read correctly the whole information.

This dual process of analysis, gives the opportunity to obtain legible visual maps from the first process and a complete database containing all the information about the authors' keywords, from the second one.

Reading the outputs correctly is of a crucial importance. For the maps in the network visualisation, the circle size represents the number of occurrences of the keyword, the distance between two keywords - the relative strength and topic similarity, the colour of circles - the cluster of belonging [22]. In the overlay visualisation, the circle size again represents the number of occurrences of the keyword, instead the colour - the

average publication year according to the colour scale on the bottom right corner of the map. Analysing the VOSviewer Map and Network files is quite immediate. To read the Network file, it is important to link it correctly with the Map file. The last sub-step of the whole process is the critical analysis of the obtained outputs.

3 Results

Research Process Definition and Data Collection. The research objective in this case, as already mentioned above, is the examination of the main emerging research fields and gaps of the quantitative indicator-based approaches for the territorial and rural vulnerability-vibrancy evaluation in non-urban context and as a main data source the Scopus database was selected.

After brief research on a world-wide level, it was confirmed the duality of the research topic, and indeed that for the evaluation of the state of a given territory two perspectives of study exist – one starting from a negative presumption (the territorial vulnerability and fragility) and the other one levitating towards the positive (the territorial vitality and vibrancy) [8, 9]. Given this feature of the research topic, it was made a selection of key words representing both its negative and the positive aspect. The keywords representing the negative one are as follow: *fragility*, *marginality*, *vulnerability* and *peripherisation.* Instead, the ones representing the positive aspect: *vitality*, *vibrancy*, *resilience* and *socioeconomic sustainability*. Since this study is concentrating on the indicator-based approach for evaluation, additional key words such as *indicator*, *evaluation*, *index*, *indices* and *assessment*, were added to each research query. For limiting the results to papers concentrated on studying the rural or territorial vulnerability-vibrancy, key words identifying the type of populated area, such as *rural area*, *inner area*, *fragile area*, *rural territory*, *mountain*, and *villages*, were added to the queries. Additionally, for limiting furthermore the geographical coverage, papers containing the keywords *urban* or *city* in the title field were excluded. Some query-specific additional keywords were used in order to filter more effectively the results and refine the queries. On the basis of the considerations made, as a result 14 queries were constructed – 5 representing the negative aspect and 9 representing the positive one.

After the refinement of the results through the engine criteria of limitation and exclusion, the bibliographic data of the final research results was extracted.

Data Preparation. All the datasets downloaded from Scopus were used to create two databases – the first one reflecting the negative perspective of the research topic and the second reflecting the positive one. For the creation of Database 1, the datasets obtained from search queries 1–5 were merged together, resulting in 731 records in total. Instead, for the creation of Database 2, datasets 6–14 were used, resulting in 441 records in total. It is important to mention that these results are referred to the date 02/02/2023.

Afterward, it was proceeded with the elimination of the duplicates of the records in each of the two databases. In Database 1 56 duplicates were encountered, resulting in 675 final number of records (Fig. 2). Instead, in Database 2 57 duplicates were present, resulting in 384 final number of records (Fig. 2).

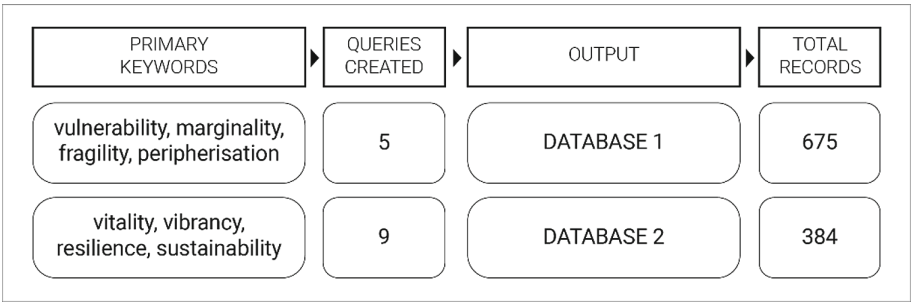

Fig. 2. Scheme representing the two created Databases and their total number of records, update date 02/02/2023 (Source: Authors' elaboration).

Data Analysis. For the construction of the visual maps the following analysis settings were chosen: analysis of the co-occurrence of the authors' keywords, using the full counting, setting the minimum number of occurrences of the keyword as 2, selecting all the keywords and visualising the largest set of connected items. This operation was performed for each of the two Databases. As a result, two visual maps were extracted: a first one constructed on Database 1, containing 215 final items/keywords, and a second one constructed on Database 2, containing 144 items/keywords.

Instead, for obtaining the quantitative information about all existing author keywords in the databases another settings combination was followed: analysis of the co-occurrences of the author keywords, using the full counting, setting the minimum number of occurrences of the keywords as 1, selecting all the keywords and visualising all of them. This operation was also performed for each of the two Databases. From Database 1 2341 keywords in total were extracted, instead from Database 2, 1489 in total. As a result, after running the analysis with the second combination of settings, for each Database were extracted the VOSviewer Map file and the VOSviewer Network file.

Database 1 - Authors' Keywords Analysis

From the map, visualising the keywords' occurrences and link strength, constructed on the basis of Database 1 (Fig. 2), can clearly be seen that a central position takes the keyword vulnerability. It is interesting to notice that 5 stronger clusters were formed on the map. The first in yellow, which is composed by the key words like *vulnerability*, *development, environment, rural, sustainable development, sustainable livelihoods*, etc., is showing the opposition of the sustainable development to the vulnerability. The second interesting cluster is the red one, containing keywords like *inner areas, land use, local development, marginalisation, territorial capital, territorial vulnerability*, showing the topic of the territorial development of marginalised areas. The third strong cluster is the orange one, containing terms like *accessibility, depopulation, inner peripheries, peripherisation, polarisation*, etc., showing the connection between the accessibility and the abandonment of the territory. The fourth one is the grey one, composed by terms like *GIS*, *ICT*, *multicriteria*, *fuzzy logic*, *urban planning*, *fragile area*, etc., showing some of the tools and techniques used in the urban planning discipline. The fifth cluster is the green one, containing keywords like *rural areas, rural community, renewable energies, quality of life*, a cluster showing the attention given to the study of aspects of the rural

life that has the potentiality to foster the development and to improve rural areas' living conditions (Fig. 3).

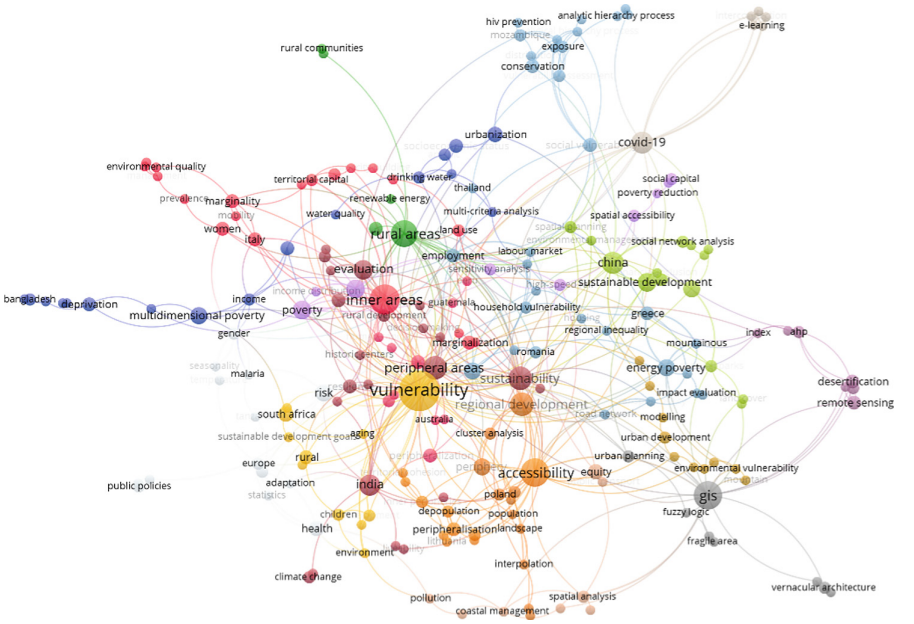

Fig. 3. Co-occurrence network visualisation of authors' keywords of Database 1, based on number of occurrences (Source: Authors' elaboration by using VOSviewer).

It is interesting also to observe the proximity of the terms on the map, showing the strength of the relation between them [23]. It is noticeable the vicinity and the connection between the terms *vulnerability* and *inner areas*, *vulnerability* and *sustainability*, *rural areas* and *inner areas*, *regional development* and *sustainability*, *regional development* and *accessibility*.

From the extracted Map file, it can be observed that the term *vulnerability* is the one with most occurrences (33 in total), the one with highest number of links (140 in total) and with the strongest total link strength (151 in total) (Table 1). The following most recurrent keywords are *inner areas*, with 18 occurrences, and *accessibility* and *GIS*, with 16 occurrences (Table 1). It is also interesting that the terms *vulnerability* and *inner areas* are appearing with higher difference between the Total link strength (indicating the number of publications in which two keywords occur together [22]) and the number of the links, showing that these terms have appeared in more than one publication in certain combination with some other keyword. From the extracted Network file, it can be seen that some of the term combinations (relevant for our research field) in which the keyword *vulnerability* appears in more than one publication are with the keywords *development*, *resilience*, *rural households*, *sustainability*. The same observations can be made for the keyword inner areas, which appears in more than one publication in combination with keywords such as *rural areas*, *territorial capital*, *territorial cohesion*,

territorial vulnerability. Another important observation is that from the most recurrent keywords there are some, in the field of interest of the studied topic, which are also quite recent. A term like this is *inner areas*, with average publication year 2020, and also *peripheral areas* and *accessibility*, with average publication year approximatively 2019. While the term *vulnerability*, even though with the highest number of occurrences, results as an older field of study with average publication year 2016 (Table 1).

Table 1. Extraction of the Map file showing the top 10 keywords of Database 1, ordered by the number of occurrences (Source: Authors' elaboration by using VOSviewer).

Keyword	Occurrences	Links	Total link strength	Avg. pub. year
Vulnerability	33	140	151	2016,03
Inner areas	18	67	75	2020,00
GIS	16	70	72	2017,44
Accessibility	16	69	72	2019,25
Rural areas	14	64	68	2016,57
Regional development	11	52	55	2017,36
Sustainability	11	48	50	2014,09
Peripheral areas	11	47	49	2019,55
China	10	46	46	2016,50
Covid-19	10	38	44	2021,40

From the Map file output, it is possible to observe that there is only one of the predefined keywords (*fragility*) that shows very low number of occurrences (only 2 occurrence). It is also interesting the position that the keywords originating from the term peripherisation take in the Map file, appearing in its pure form but in the same time also in a lot of different configurations, such as *inner peripheries*, *periphery*, *peripheral areas*, etc.

Database 2 - Authors' Keywords Analysis.
From the visual map constructed on the basis of Database 2 (Fig. 4), can clearly be seen that the term *resilience* takes a central position. It is interesting to see that there are 5 stronger clusters formed on the map. The first one is the purple one, containing terms such as *resilience*, *cluster analysis*, *UNESCO*, *village*, etc., which results as a quite heterogeneous cluster, showing that the concept of resilience can be associated to a lot of sub-fields of study. The second one is the red cluster, composed by keywords like *sustainability*, *urban development*, *poverty*, *food insecurity*, *food security*, *livestock*, *farming systems*, etc., giving attention to the importance of the food system for the sustainable development. The third cluster is the dark blue-grey in the bottom left, composed by keywords like *sustainable development*, *social sustainability*, *rural tourism*, *rural sustainable development*, *economic sustainability*, *environmental sustainability*, *community resilience*, etc., which is totally concentrated on the sustainable development in all its aspects. The fourth cluster if the dark blue one, composed by the keywords such as *rural*

areas, *rural development*, *sustainability assessment*, *decision making*, *boosted regression tree*, *interdisciplinarity*, *modelling*, *multifunctionality*, *participation*, etc., which is an interesting cluster showing some of the techniques used in the rural planning field. And the fifth cluster is the pink one, on the left part of the map, containing terms such as *rural*, *rural communities*, *aging*, *livelihoods*, *socioeconomic status*, etc., which is giving more attention to the study of the social structure of the rural areas.

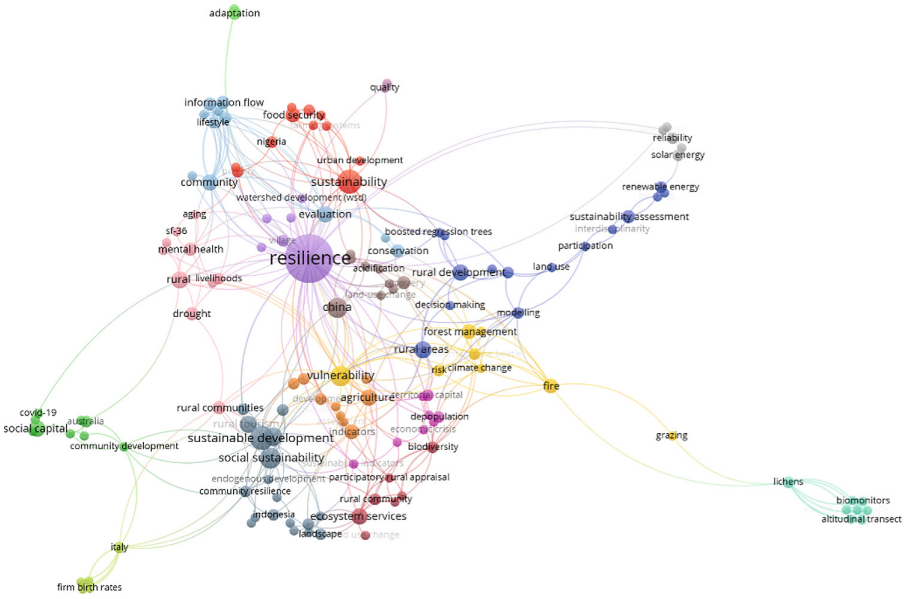

Fig. 4. Co-occurrence network visualisation of authors' keywords of Database 2, based on number of occurrences (Source: Authors' elaboration by using Vosviewer).

As mentioned before, it is also important to analyse the vicinity and the relations existing in between the different terms. It should be noticed the close connection between the terms *resilience* and *evaluation*, *resilience* and *sustainability*, *resilience* and *village*, between the terms *rural areas* and *rural development* but also *rural areas* and *vulnerability* and between *indicators* and *social sustainability* and *indicators* and *rural areas*.

From the Map file it also can be observed that the term *resilience* it is indeed the one with highest number of occurrences (53 in total), highest number of links (255 in total) and highest total link strength (271 in total) (Table 2). The other two most recurrent terms seem to be *sustainability* and *sustainable development*, with 13 occurrences for both of them (Table 2). It is interesting also the higher difference between the Total link strength and the number of links that the keywords *resilience* and *social sustainability* show, meaning that they appear in a certain combination with other keywords in more than one publication. From the Network file it can be observed that the keyword *resilience* appears in more than one paper in combination with the keywords *sustainability*, *vulnerability*, *rural*, *community*, *indicators*, *poverty*. The same analysis was performed for the keyword

social sustainability, which seems to appear in more than one study in combination with the keywords *sustainable development*, *economic sustainability*, *environmental sustainability*. Another interesting observation is that among the most recurrent keywords there are some that can be considered more recent, such as *sustainability*, *rural areas*, *rural tourism*, with average publication year 2019 (Table 2).

Table 2. Extraction of the Map file showing the top 10 keywords of Database 2, ordered by the number of occurrences (Source: Authors' elaboration by using VOSviewer).

Keyword	Occurrences	Links	Total link strength	Avg. pub. year
Resilience	53	255	271	2018,23
Sustainability	13	65	68	2019,31
Sustainable development	13	59	63	2018,77
Social sustainability	10	47	53	2017,70
Vulnerability	9	50	53	2016,22
China	9	39	39	2017,11
Economic sustainability	8	26	31	2013,38
Rural areas	7	36	38	2019,43
Rural	7	28	31	2016,57
Rural tourism	7	24	26	2019,14

Since it was noticed the absence of two of the main predefined keywords (*vitality* and *vibrancy*) in the map and in the list with the most recurrent keywords, it was made an extraction, by filtering the outputs contained in the Map file, relative only to these two keywords. It can be seen that these terms present low number of occurrences but very recent average publication years. Another interesting result is that they rarely appear in their pure form – only by themselves - but mostly in word combinations, which also tend to be quite heterogeneous. The one representing the term *vitality* are such as *space vitality*, *vitality assessment*, *rural vitality status assessment*, *community vitality*, *rural vitality* - giving attention to the field of the evaluation of the status of the rural space. Instead, the term *vibrancy* appears with only 1 occurrence, specifically in the form *territorial vibrancy*, showing a gap in this research field.

4 Discussion and Conclusions

The main research objective of the present paper is to examine the emerging research fields and gaps of the quantitative indicator-based approaches for the territorial and rural vulnerability-vibrancy evaluation in non-urban context.

The obtained results further prove the duality of the above-mentioned topic, confirming the existence of two perspectives from which the topic can be studied – originating from and gravitating between negative meaning phenomena and positive meaning ones.

In conclusion, firstly it can be said that generally the research of the given topic is more consolidated in its negative aspect, showing higher number of research results, earlier average publication years and higher heterogeneity in the research subtopics, which also tend to be quite strongly investigated. Furthermore, from the clusters analysis we can conclude that the topic, both when approached from its negative perspective and its positive one, is being studied in heterogeneous way, giving attention to different sub aspects – such as the tools and techniques that could be used, the importance of the sustainable development principles as opposition to the rural degradation, etc.

Considering the negative aspect of the research topic, it is possible to say that most consolidated subfields of study are the vulnerability and the peripherisation, followed by the marginality, which haven't achieved the same degree of investigation of the two mentioned before but still results more developed than the fragility, which results as rarely considered subfield. Even though the negative aspect has been widely studied, still there are some aspects of it that are more recent and can be seen as emerging ones, such as the question of the accessibility and the evaluation of the inner areas.

Instead, considering the positive aspect, it is possible to notice some consolidated areas of study, such as the resilience and the sustainability of the rural areas, but in the same time they appear some strong emerging subtopics, such as the ones originating from the term vitality. Instead, an interesting research gap shows to be the territorial vibrancy, that could become more investigated in the future years.

The further study of the phenomena of the vitality and the vibrancy and the establishment of a consolidated methodological approach for their monitoring could be of a great help to the decision-makers in the local territorial programming and funding for transformation and enhancement of a given territory.

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