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Development and sustainability: the role of Geology, Ecology and Climate Change Research

Scientific and Technical Advisory Council (STAC), of the Special Journals Publisher (SJP)

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Background

While there is no universal way of defining development, critical review of most definitions seems to tilt towards the fact that any process that leads to growth, progress, or change in physical, economic, environmental, and social components of a system may be taken as development (1). On the other hand, the ability to maintain or keep this growth, progress, or change continually both for today and for the future may be seen as sustainability (2). Development and sustainability, therefore, deal with any process that leads to a significantly measurable outcome in the growth, progress, and change of physical, economic, environmental, and social components of a system. Such change should provide our needs today without disturbing the ability of our children tomorrow to meet their own needs (3). A good Geology, Ecology and Climate Change research database provide information that can impact the achievement

of this goal through Good disease management prevention and control.

The United Nations Development goals

The United nation' suggestions about sustainable development goals are the most popular pendulum on which most if not all discussions about sustainable development swing around probably because the evidence and significance of the suggested development goals are so overwhelming. The interconnectivity of the issues raised by the 17 United Nations development goals is so amazing and realistic that one wonders what the world would look like when these goals are achieved in the long run (4). This is because a society devoid of lack and starvation, in which the citizens are relatively in good health with some levels of education for everyone and with no discrimination, and no inequalities would be a great and appealing society.

Examples of sustainable development research areas

Geology, Ecology and Climate Change research will provide the knowledge of host response to the use of high-quality drugs, to improve the quality of human resources for health that will join forces to make available clean water, clean energy, sanitation, education, good skills to impact the industry and infrastructure for sustainable cities and communities (5). Geology, Ecology and Climate Change research also encourage judicious use and re-use of natural resources through the elucidation of human and animal response to the exploration and recycling benefits derived from the environment including resources below water and land (6). Climate action and its influence on natural resources and the ecosystem is a threat to Geology, Ecology and Climate Change research, and understanding how we manage it will impact health security and safety both for us and for the future generation (7). Geology, Ecology and Climate Change research can impact the health status of the societies and a healthy society can be strong to talk about the partnership for Peace Justice, and strong institution, as a necessary panacea for war, conflicts instability, animosity, acrimony, and global confusion all of which militate against development and sustainability

Rationale

Geology, Ecology and Climate Change Research can play a central underpinning role in answering sustainable development research questions (8) that will invariably enhance our abilities to identify, harness, and utilize natural resources to our benefit. Geology, Ecology and Climate Change Research can also provide reliable and verifiable information that can impact interventions that will better the lives of people. Geology, Ecology and Climate Change Research-based information is reliable because the research question and research process are detailed and standardized and can be verified. (9)

Objective

In this 3-decade retrospective review of published papers that deals with development and sustainability, the role and contribution of Geology, Ecology and Climate Change research in development and sustainability is fully discussed

Materials and Methods

In this retrospective cross-sectional Geology, Ecology and Climate Change research, 346 published full-length original papers, were downloaded and perused including published addendum, corrections, editorials, abstracts

of meetings, conference proceedings, and review article, on the general concept of development and sustainability. This searching and corresponding download of relevant papers were made from a globally recognized research-based data repository that included but not limited to the Web of Science (WoS) (10) core collection database on the nineteens of July 2020 at about 10.25 GMT+2). The database of PubMed, Research Gate, and Google scholars was perused to be sure no new documents relevant and necessary for this study were missed out. However, the web of science formed the major and reference database for this study because our software was more compatible to recovered data encoded in the web of science database while other databases consulted served to provide other relevant articles, we considered imported but probably missing in the web of science.

Boolean topic search approach

The Boolean topic search approach (11) used included "(development * AND sustainability$) OR (Sustainability of * AND development$) to encompass all relevant and available documents (12) on the subject of development and sustainability between 1990 and 2019. At the time of this study, we judged that the Web of Science Core Collection database had enough user-friendly and accessible academic research database relatively covering enough journals, books, conferences as well as millions of records from clarivate.libguides.com (references). To ensure the inclusion of abbreviated or shorten words, the wildcard * and $ were added to the end of the search algorithms. Thereafter, all documents that meet the eligibility criteria of sustainable development were retrieved and exported into BibTex file format and the authors, titles, abstracts mined in PDF file format.

Data analysis

All the bibliometric variables were retrieved filtered and normalized for quality control. The results were analyzed in a bibliophily plugin package of the 3.5.1 version of R-studio software, while the codes and commands were adopted from Https://www.bibliometrics.org to evaluate the bibliometrics indices. Tables and graph were made in Microsoft excel 16 version and network maps were visualized in 1,6 Vox-viewer software

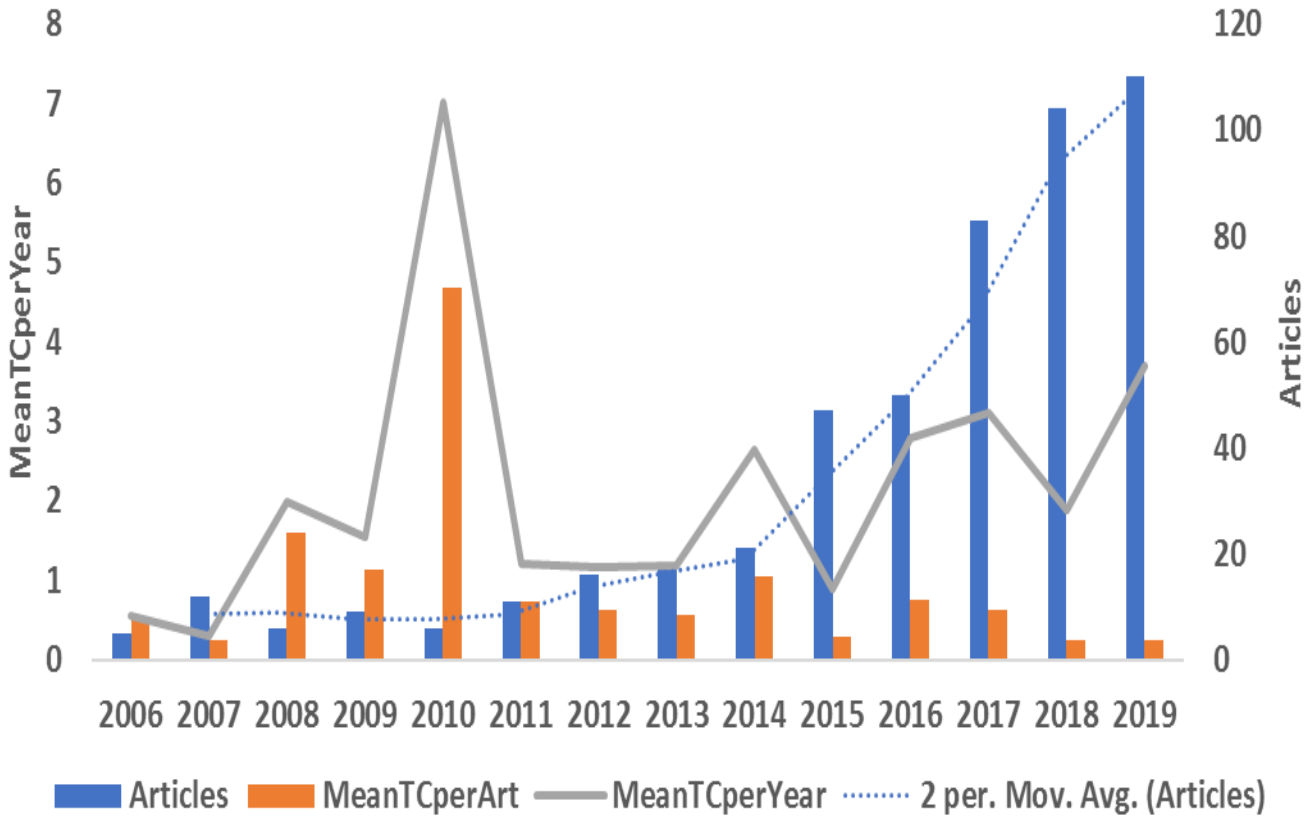
Results

In this Geology, Ecology and Climate Change research, 346 papers written by 1502 authors over three decades were recovered, perused, and analyzed as shown in table 1 below. Ninety-seven (97) documents were written by 95 authors while 1407 authors wrote 1407, multi-author documents giving 3.52 collaborative index and authors and co-authors per documents indexes of 3.02 and 3.15 respectively. Ninety-four proceedings papers, three of them were originally presented as journal articles while 25 were review articles and 14 articles were Editorial documents.

Table 1 Descriptive characteristics of extracted documents

Authors	1502
Author Appearances	1565
Authors of single-authored documents	95
Authors of multi-authored documents	1407
Single-authored documents	97
Documents per Author	0.331
Authors per Document	3.02
Co-Authors per Documents	3.15
Collaboration Index	3.52

Document types	
ARTICLE	346
ARTICLE; BOOK CHAPTER	1
ARTICLE; PROCEEDINGS PAPER	3
BOOK REVIEW	6
CORRECTION	6
EDITORIAL MATERIAL	14
LETTER	2
MEETING ABSTRACT	2
PROCEEDINGS PAPER	91
REVIEW	25
REVIEW; BOOK CHAPTER	1



Mean TC/Article = Mean Total Citation per articles, Mean TC/year =Mean Total citations per year,

Figure 1: Yearly distribution of article productions and citations concerning Geology, Ecology and Climate Change **Research**

In the yearly distribution of articles written and cited during the studied period (Figure 1), it was observed that the mean total citation of articles was highest in 2010, followed by 2008, and then 2008 and 2014 respectively. An upward trend was seen in articles publication from 2014 to 2019 while publication staggered between 2006 and 20212.

Table 1: **For authors keywords and keywords plus in** Geology, Ecology and Climate Change **Research**

Keywords plus	Occurrences		Author keywords	Occurrences
management	31		sustainability	126
framework	29		sustainable development	77
systems	24		environment	16
indicators	23		development	15
model	22		sustainability assessment	13
impact	20		china	12
performance	18		sustainable development goals	12
governance	17		climate change	11
knowledge	16		environmental sustainability	10
energy	15		indicators	10
climate change	14		higher education	9
policy	13		rural development	9
life cycle assessment	11		economic development	8
conservation	10		education for sustainable development	8
education	10		SDGs	7
cities	9		social sustainability	7
future	9		education for sustainability	6
impacts	9		community	5
innovation	9		education	5
strategy	9		governance	5

In the web of science, the term keywords plus appear to depict terminologies or phrases that regularly show in the titles of a paper's references, and may however not be seen in the title of the manuscripts in question. Authors' keywords show terms that authors prudently selected during manuscript development that they know or think most accurately represent their papers. The most common author's keywords terms in this study are ‘Sustainability’ which appeared 126 times followed by “sustainable development” which occurred 77 times, followed by environment and development that occurred 16 and 15 times respectively. Other keywords appeared in different decreasing order as shown in table 2 above. In the keywords plus section, management, framework, and systems were the terms that occurred 31, 29, and 24 times in decreasing order. The keyword plus and authors' keywords show the trend and direction of research going on in the past three decades covered by this study.

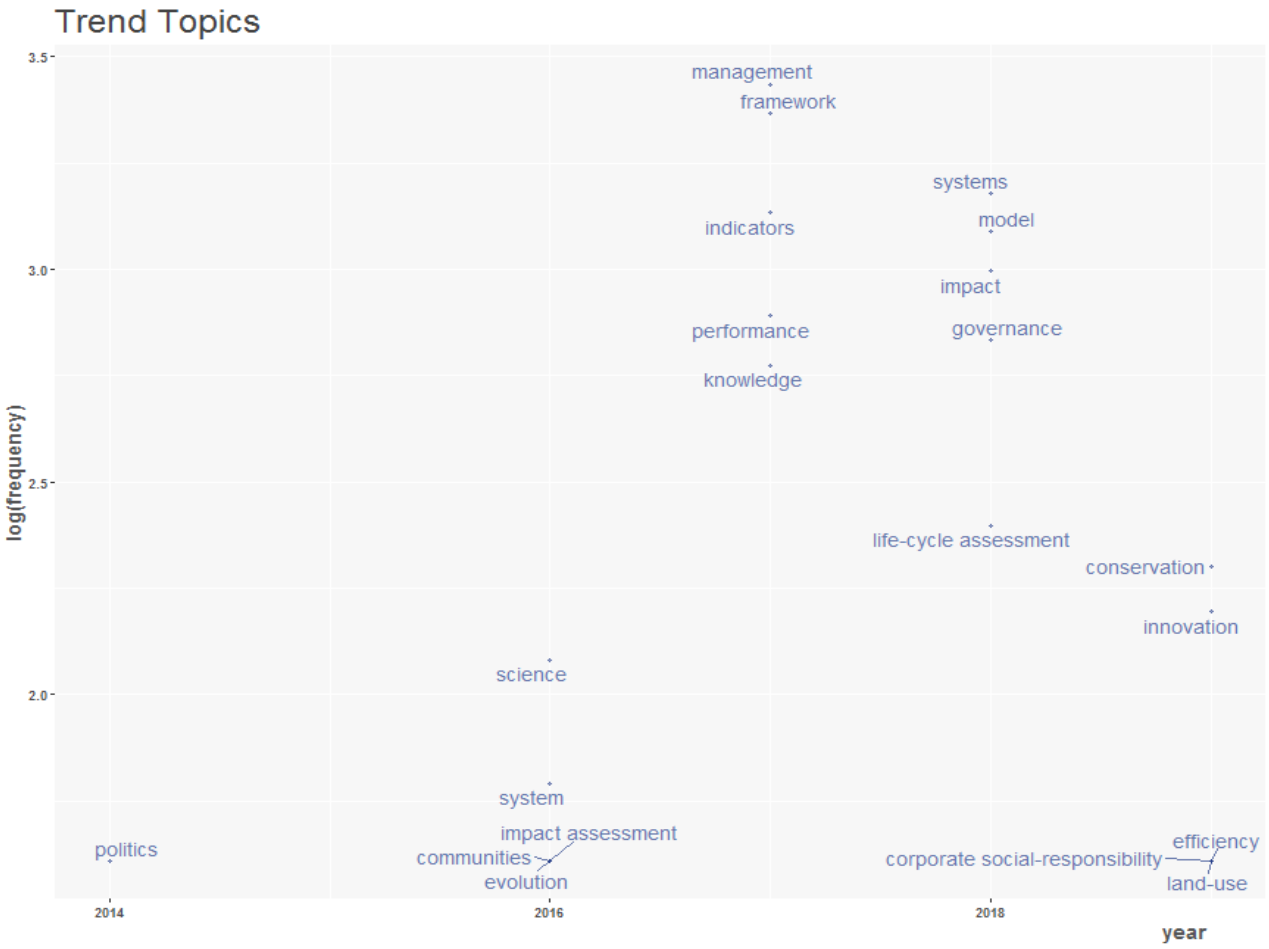


Figure 2: Topic trends associated with Geology, Ecology and Climate Change **Research**

Figure 2, shows a log scale over a year to explain the trends of topics used in the research of development and sustainability, over 3 decades. Politics was the only word used in 2014. In 2016, topic usage increased in logarithmic proportion, with the addition of evolution, communities, impact assessment, systems, and science to politics. In 2017, knowledge, performance, indicators, framework, and management were added to the topic bank used. In 2018 topic bank swelled by the use of corporate social responsibility, efficiency, land use, life cycle assessment, governance, impact, models, and systems in increasing logarithmic proportion.

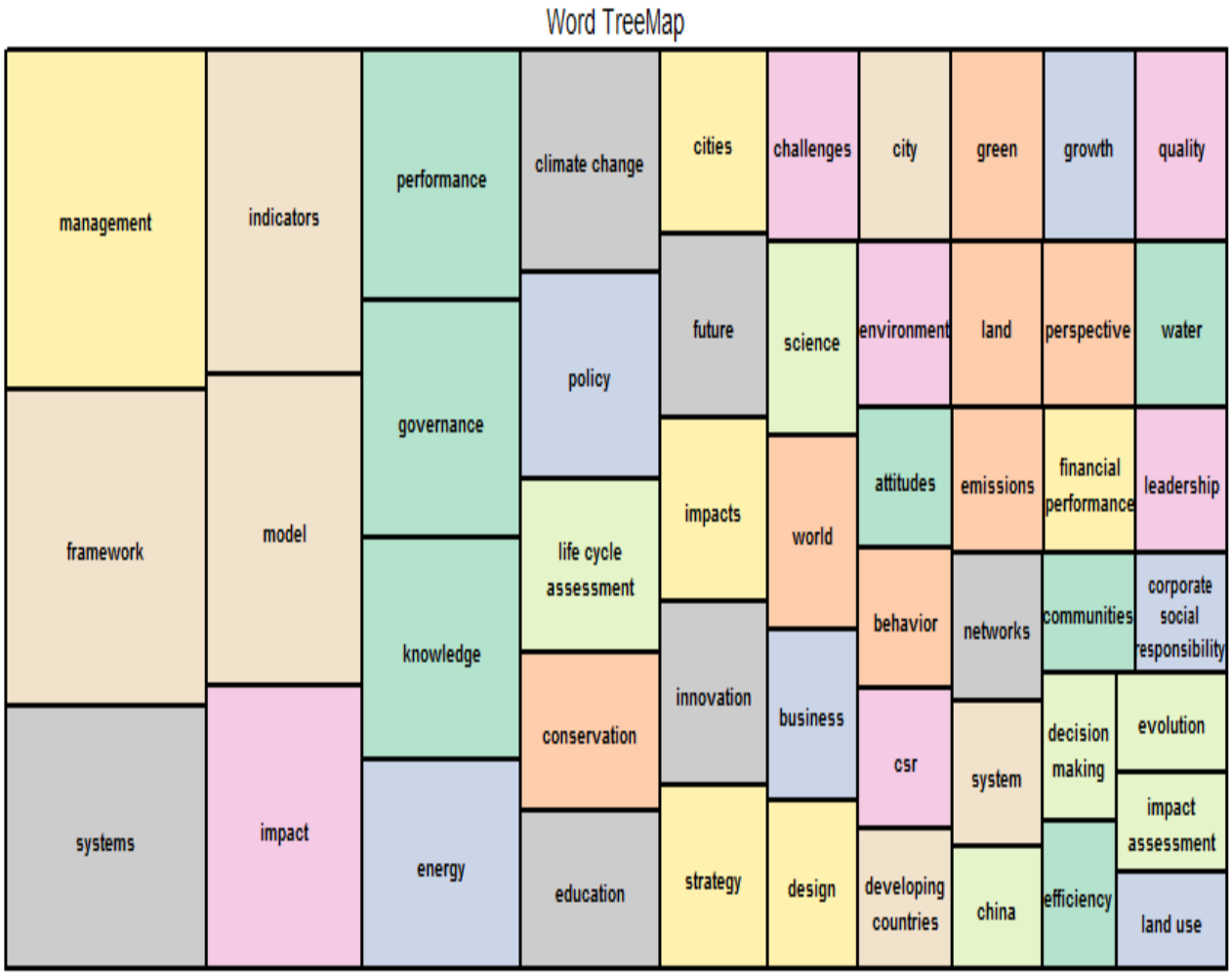


Figure 3: Word treemap of the development and sustainability in Geology, Ecology and Climate Change **Research**

The above word treemap was used to look at the ranked structure of a Tree Diagram and at the same time showing the value of each category through area size. Each category is assigned a rectangle area with their subcategory rectangles nested beside it according to the size. All quantities assigned to a category have their area size displayed in proportion to that quantity and the other quantities within the same parent category in a part-to-whole relationship.
Also, the area size of the parent category is the total of its subcategories. All subcategories with no assigned quantities have their areas being divided equally amongst the other subcategories within their parent category. However, in Fig 3 all categories are assigned. The way rectangles are divided and ordered into sub-rectangles is dependent on the tiling algorithm used. Many tiling algorithms have been developed, but the "square' algorithm" which keeps each rectangle as square as possible is the one commonly used.
In fig 3, **Framework** is the highest with subcategories of model and indicators next in rank followed by city and developing countries and finally by the system. **The management** category was followed in rank by cities, impact, and strategy, and next in rank was design and finally by

financial performance. The next category was **impacts** followed in rank by challenges followed by environment and followed by quantity and leadership. The next is **systems** followed by a subcategory of **climate change and education,** and then by future and innovations respectively. Performance, Knowledge, and governance are the next categories followed by attitudes; communities and efficiencies, and water. Again, **Energy, policy, business, growth, corporate responsibility,** and **land use** all follow each other in decreasing order or ranks as shown in fig 3. The way rectangles are divided and ordered into sub-rectangles is dependent on the tiling algorithm used. Many tiling algorithms have been developed, but the "qualified algorithm" which keeps each rectangle as square as possible is the one commonly used.

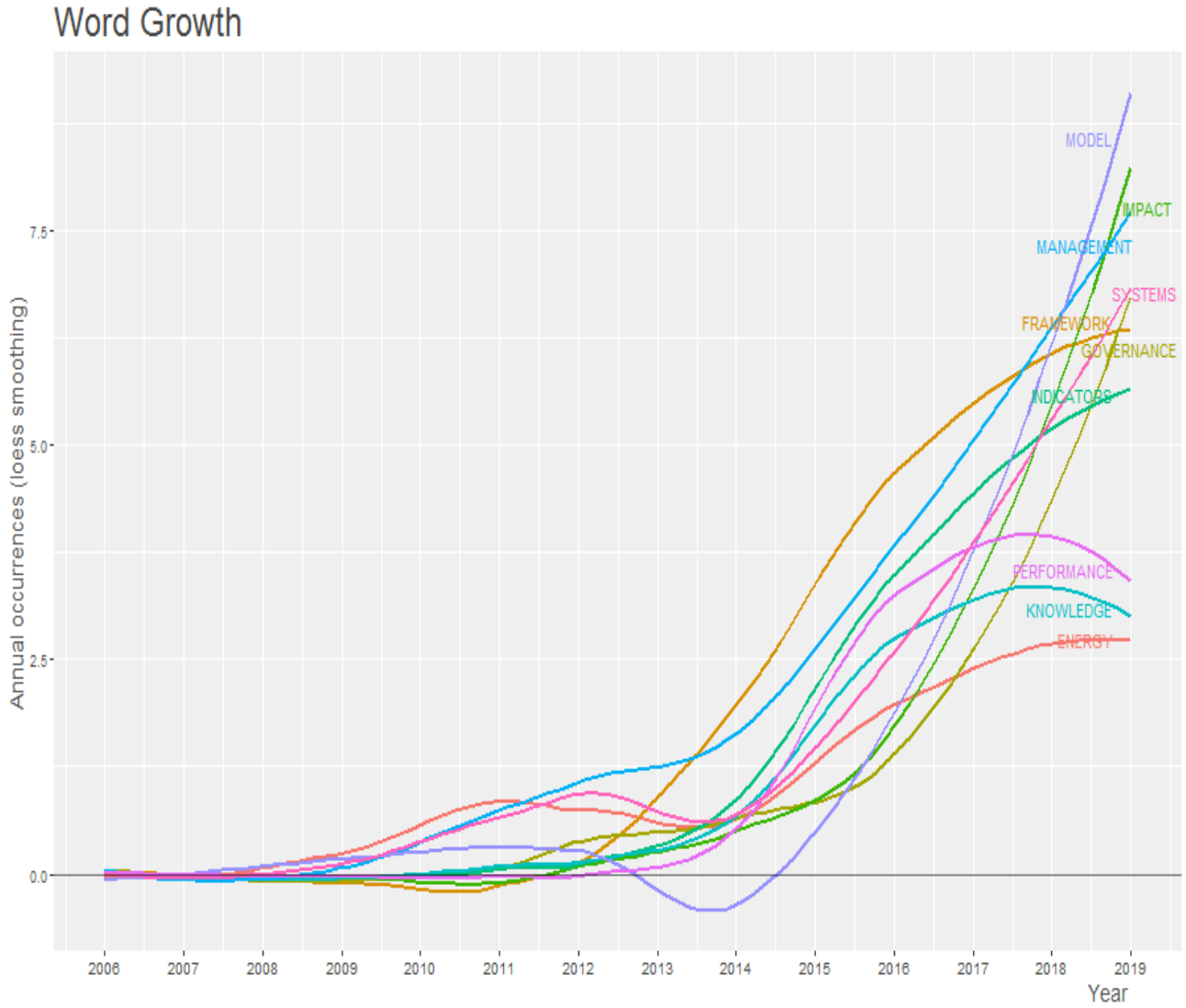


Fig 4. Word growth graph in Geology, Ecology and Climate Change **Research**

Word growth graph showing the trend of usage of the words in various studies over time. The following words stood out as most prevalent in the studies covered. The words are Model, impact, management, systems, framework, governance, indicators, performance, knowledge, energy

respectively. The use of the words in the covered research all had a steep logarithmic rise between 2013 and 2017 whereas model, impact, and management topped the list while performance, knowledge, and energy were least in occurrence as shown in Fig 4.

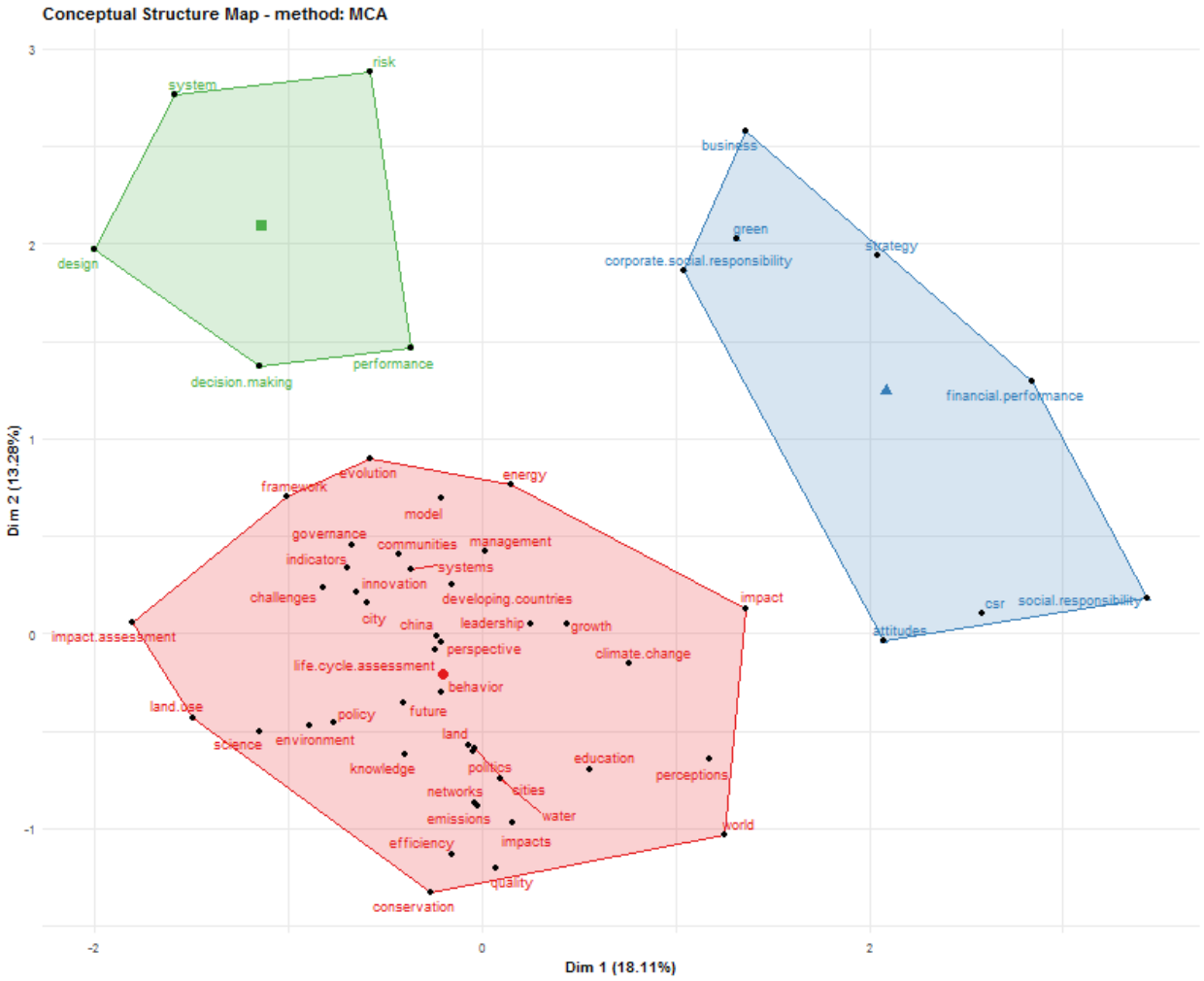


Fig 5: Conceptual Structure map using Multiple Correspondence Analysis in Geology, Ecology and Climate Change **Research**

Figure 5 shows the 3 different clusters of development and sustainability categories and the corresponding variables. There are also the vertical and horizontal dimensions of the multiple comparison analysis used to analyze the conceptual structure map above. The interpretation of category points is guided by the centroid principle whereby the category coordinates are the weighted average of coordinates clustering around that category. Thus, the interpretation takes its bearing from the central topic (development and sustainability) which is the category and located at the zero coordinate while the variables are clustered around the categories.

For the horizontal category, the left side has no sustainability and development while the right side has sustainability and development. For the vertical dimension, the upper side has strong sustainability and development while the lower side has week sustainability and development. The

father the variables are clustered away from the category the more they are decimated from the categories while the closer the variables are clustered away from the categories the less the discrimination and the more the association of the variables with the categories.

In Fig 5, the sustainability and development category are clustered in three different locations with associated variables depicting the strength and weakness of associations as well as the magnitude or severity of the category being studied. The green cluster depicts strong sustainability and development that is well discriminated by its associated variables (system, risk, performance, decision making, and design. The second blue cluster depicts very strong and better sustainability and development that is very well discriminated by its associated variables (business strategy, financial performance, social and cooperate responsibilities and attitudes)

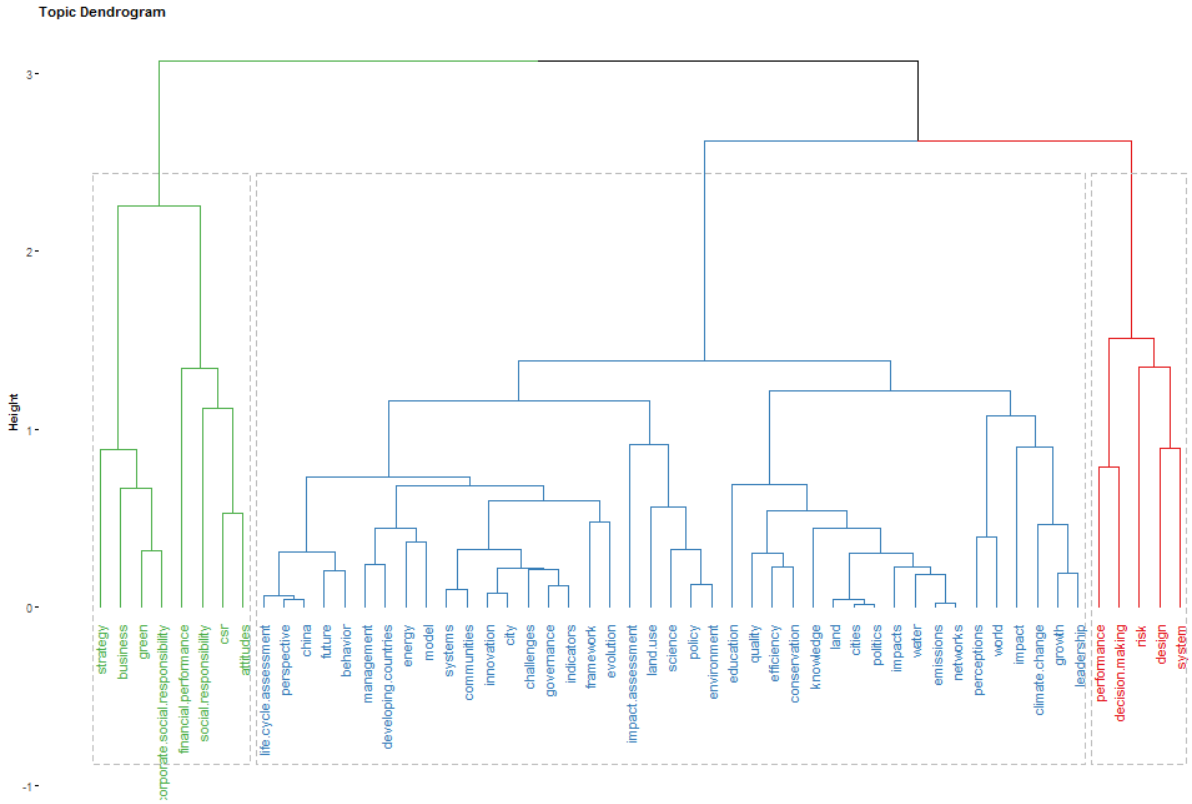


Figure 6 Dendrogram representing the key terminologies in Geology, Ecology and Climate Change **Research**

Figure 6 is a **dendrogram** that **shows** the hierarchical relationship between clades (category) and variables (leaves}. It is most commonly created as an output from hierarchical clustering with its main use being to find the best way to allocate variables to clusters. The clades of the clusters or the category are arranged according to how similar (or dissimilar) they are to each other and other clusters. Clades that are close to the same height are similar to each other; clades with different heights have some kind of dissimilarity — **the greater the height difference, the more dissimilarity** (measure using Pearson's Correlation Coefficient). Social responsibility, cooperate

social responsibility, and financial performance different from each other because the length of the branches is different in Hight. Perspective and china, behavior and future, developing countries and management, model and energy, innovation and city, policy and environment, framework and evolution, and more are similar to each other because their branch height is of similar length. All these are variables that cluster around the sustainability and development categories.

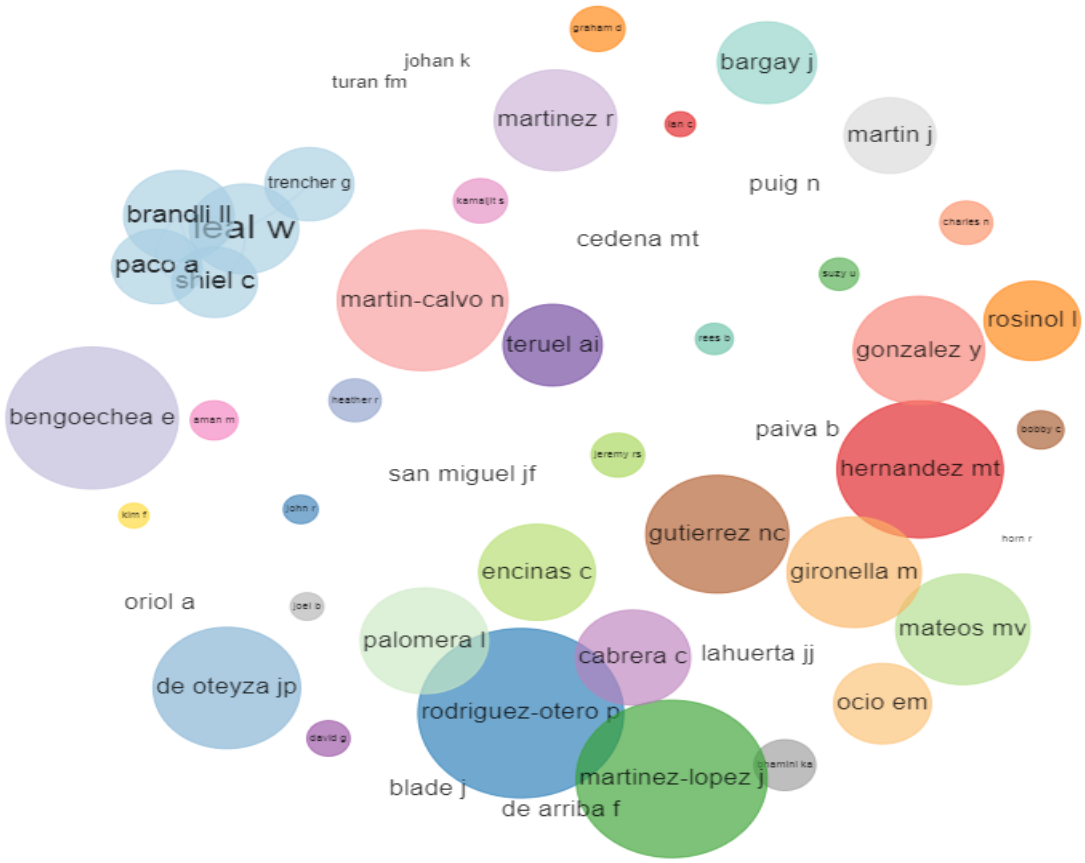


Figure 7. Topmost Authors collaboration networks in Geology, Ecology and Climate Change **Research**

Fig 7 depicts 30 topmost authors collaboration networks. It should be noted that the circles represent authors and the close the circles the more likely there may have a collaboration network and collaboration should be represented by connecting lines. Generally, figure 6 shows that there was no significant collaboration as the circles are mainly far apart from each other with no connecting lines. Instead, there was some cooccurrence each time the circles coincided with each other. There was no collaboration but there were merely cooccurrence

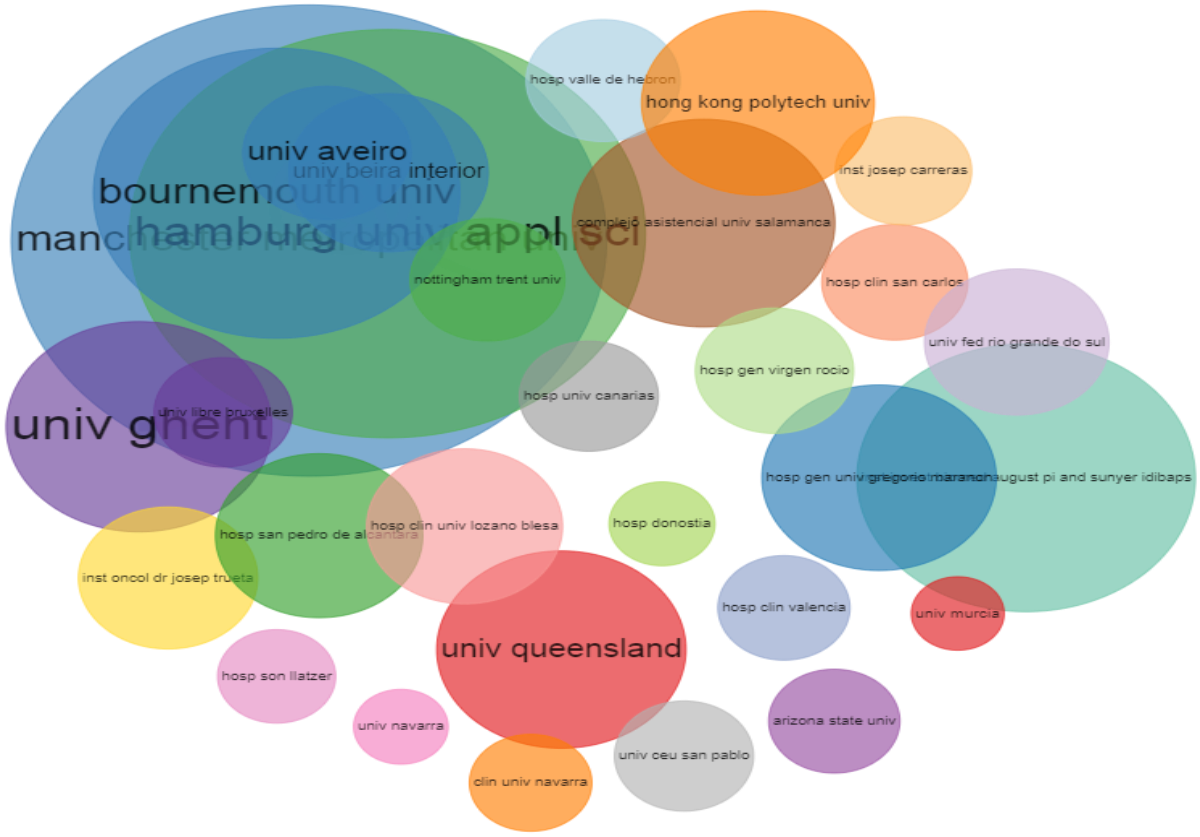


Figure 8: Institutional collaboration network in Geology, Ecology and Climate Change **Research**

Fig 8 depicts the collaboration network, of institutional affiliates and the observations show that again there was no collaboration among analyzed institutions as there were no connecting lines seen linking the circles. However, there was a cooccurrence of institutions concerning development and sustainability research. The bigger the circle the more likely the institutions are involved in the development and sustainable research. Manchester, Aero, Hamburg, Bournemouth, and Nottingham Trent with big circles all show good involvement with development and sustainability as seen by their circles coinciding one with another but showed no collaboration with other institutions as there were no connecting lines to show collaboration on the sustainable development topic

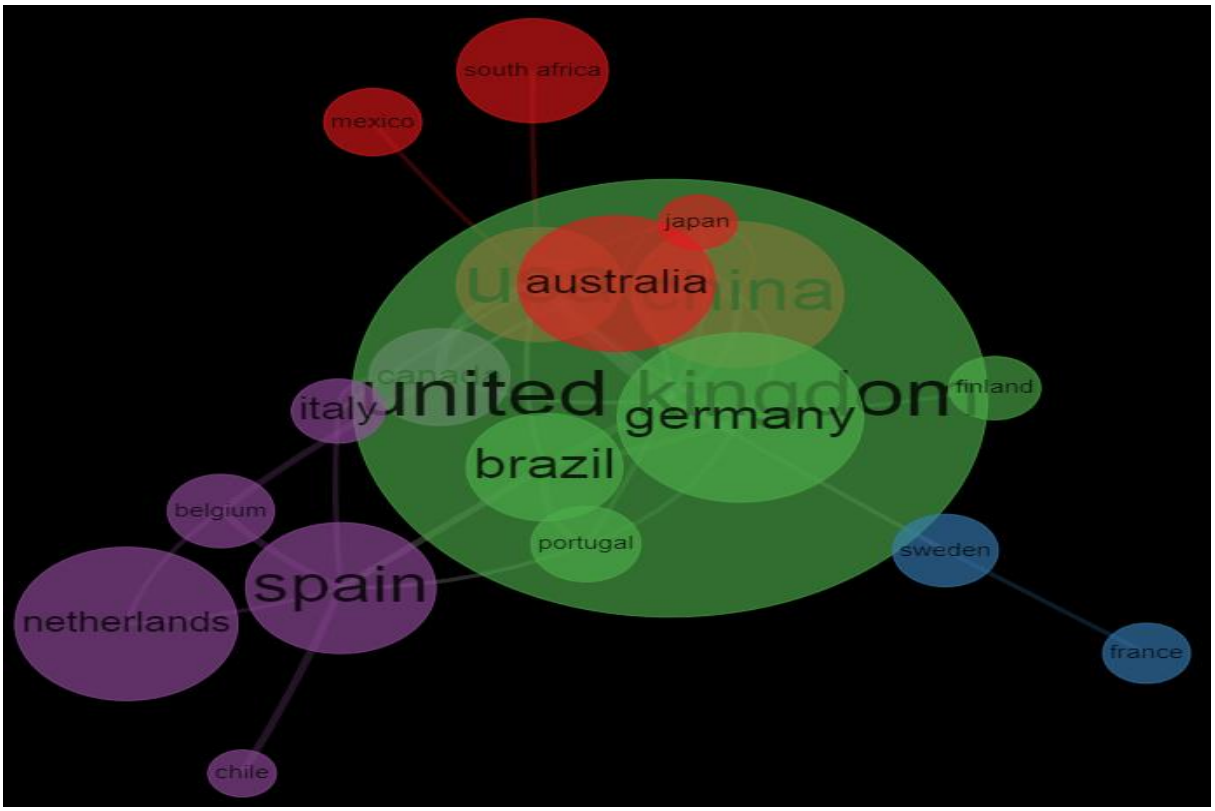


Figure 9. Countries collaboration network in Geology, Ecology and Climate Change **Research**

Fig 9 shows four clusters of green, blue, red, and purple with a clear collaboration, and cooccurrence was seen among participating institutions analyzed. In decreasing order of magnitude of involvement with sustainable development, the United Kingdom, Germany, Netherlands, Australia, Spain brazil, and South Africa all depicted sustainable development activities with different levels of cooccurrence. On the other hand, it can be seen that countries collaborated more than the authors with the United Kingdom, Australia, Brazil, Japan, Portugal, Germany, and Finland collaborating with other counties. The bigger the circle the greater is the magnitude of the Institutions involvement with development and sustainability. Therefore, the United Kingdom showed the greatest activities followed by Germany and Australia while the Netherlands and Spain led the others that did not collaborate with other countries

Figure 10: Co-occurrence of author keywords network in Geology, Ecology and Climate Change **Research**

Figure 10 shows the Co-occurrence of author keywords network showing 4 main clusters led by four key words category: sustainability (red), sustainable development (purple), sustainable development goals (green), and social sustainability (blue) respectively. The thicker the line connecting two words the closer the relationships. Therefore, looking at the sustainability cluster, it can be seen that sustainability and development have the closest relationship, followed by sustainability and the environment. Sustainability and education, china, and innovations. For the purple keywords category cluster sustainable development and indicators, sustainable development goals (SDGs), governance, life cycle assessment, and climate change has a similarly close relationship while the rest had similar relationships.

Discussions

Fig 1-10, depicts the results obtained from this retrospective review. The use of the words such as framework, model, education, science, systems, challenges, growth among others points to the facts that studies conducted in the past 3 decades took into consideration some elements of Geology, Ecology and Climate Change Research. The analysis involved topic trend, word treemap, word growth, conceptual structure map, using Multiple Correspondence Analysis, a dendrogram of key terminologies, collaboration networks of authors, institutions and countries respectively, and cooccurrence of authors key words. There was no collaboration among authors and institutions (7 and 8) but there were Country collaborations (Fig 8) with the United Kingdom taking the lead. There was also cooccurrence of authors' keywords with two major categories being sustainability and sustainable development with many subcategories Fig 10. These indicate to some extent compliance with the principle's development and sustainability

The development debates

The concept of development has continued to generate debate because of its relevance to the very factors that matter to the general populace all over the world. Inequality, hunger, and poverty are the common offspring of the market designed to favor advanced countries when they offer their services to help the underdeveloped countries to identify, harness, and utilize their natural resources (13, 14). The markets are made to make the services to utilize the resources more expensive than the resources themselves while the reverse should have been the case. Any developing country that can break out of this cocoon will be reclassified as its dependency on the services will have decreased drastically. That's where Geology, Ecology and Climate Change research comes in to provide detailed knowledge of the best ways to detect, manage, prevent and control diseases for the greater good of the general public (15, 16)

Subject-specific significance

Subject-specific areas where Geology, Ecology and Climate Change research can impact sustainability and development may include but are not limited to the following thematic research areas of global significance.

a. The influence of the nature of Earth's interior, plate tectonics, plate boundaries on human development, and how very slow geological processes can have enormous impacts over time (17, 18)
b. The relationship between Environmental safety, Vulcanism and sustainability of human development (19, 20)
c. Assessing the Importance of geological resources to our way of life (21, 22)
d. Understanding human develop and the significance of albedo to climate and how the melting of ice or snow and forestry affect albedo, the roles of the melting of permafrost, breakdown of methane hydrates, and temperature-related solubility of CO_2 as positive feedbacks (23-25)
e. Ecological perspectives of Preventive medicine with attention to indoor and outdoor pollution, water quality that can affect a population's health, neighborhood safety, and political empowerment, (26, 27)

f. Climate change and Disease management using Vitamin & mineral nutrition, Nutrients in growth, development, and reproduction, Nutritional epidemiology (28, 29)
g. Ecology and climatic influence on Nutritional disorders and related diseases (30, 31)
h. Climate change and human disease and their bio predictors to avoid health complications (32, 33)
i. Biological control and with details on the best technique for use of the natural enemies and predators of pests to control damage to crops and this is based in part on knowing the ecology of pests, (34-36)

Sustainability of development

Sustainability of development appears to hinge on a certain lifestyle and culture that characterizes the standard of living and expectations of every society in the world not minding the geographical or ethnic inclination (37). There is also an associated peculiar challenge that seems to seek the attention of such unique communities if life must go on (38). Ability to manage the challenges while still trying to live a normal life in society defines the living condition of society (39). The availability of natural resources and the skills to harness and utilize these natural resources to the maximum benefit of the general populace in a particular place and point in time defines the so-called levels of development (40, 41). Three kinds of development according to the United Nations include developed, developing, and developed. This classification is largely based on the economic growth and security of nations of the earth (42). Developed countries are on top of the list of high economic and security status followed by developing and underdeveloped respectively and all these are better understood when studied vis-à-vis the standard of living of the people in question (43)

Role of Geology, Ecology and Climate Change research

Geology, Ecology and Climate Change Research methods offer the best approach to the struggle to understand how best to improve on our abilities to identify, harness, and utilize these natural resources (44). A society is developed if it can harness and process and utilize these resources in the best interest of the. Thus, the concept of development endorses how to best manage the identified resources to be enough to solve the challenges of the society as well as provide the necessary security of the society (45). The sustainable aspect of society's development is seen when a society can manage its resource to solve its problems as well as provide for security for its citizens today and for their children tomorrow (46). The human development index measures a countries average achievement in life expectancy, education, and income (47). Dependency refers to reliance on other nations for growth and by international trade and domestic development, low-income countries depend more and more on rich nations for support (48). There is an unequal power relationship between the rich and the poor nations and rules are made to favor the rich and making the poor even poorer (49)

Development concept debates

Geology, Ecology and Climate Change Research can impact the broader concept, of development and sustainability because the topic is very popular and extensively discussed in Social, Economic, and Environmental circles (50). There are many proposed definitions widely publicized but a generally acceptable or universal definition is yet to emerge. Most definitions available for perusal are contextual with everyone defining

development based on prevailing circumstances or situation at hand. It centers on the use of economic principles to reduce poverty, remove inequality, and unemployment. It entails critical evaluation of our ability to ask ourselves what we can do effectively, what we can do with help, and what we cannot do even with help. So, development can be seen as people's ability to utilize their resources for their benefit as well as others in need (51), while sustainability of development may be seen as an ability to harness and manage these resources in such a way for it to be enough for us today and our children tomorrow (52).

Disparities in these abilities' contingent on the level of dependencies on other nations before utilizing these resources define the level of development in our societies (53). For developed countries, the Geology, Ecology and Climate Change Research that they can do without help from other countries are bigger than what they can do with help (54). For Developing and underdeveloped countries, the Geology, Ecology and Climate Change Research they can do with help are bigger than what they cannot do. Thus, disparities in the interdependence of counties in Geology, Ecology and Climate Change Research define their development and sustainability status. To impact the Geology, Ecology and Climate Change abilities of nations, there is the concept of balanced growth and development that requires all sectors including industries to start and grow at the same time and each generates the market demand and supply for one another (55). This again is defined by the income base of a country that also has a measurable influence of their support for Geology, Ecology and Climate Change Research. Thus, the main income base of countries (low income, middle income, and high-income) directly or indirectly influence the level of support for Geology, Ecology and Climate Change Research of that country (56).

Time factor

The time factor appears to be the major difference between the developed, developing, and underdeveloped countries are time (57). Time brought about positive changes in Geology, Ecology and Climate Change Research, and these measurable changes are the major drivers of development and sustainability. Those societies and stakeholders that belong to different stages of development have passed through challenges, setbacks, conflicts, disputes, explorations, experimentations, mistakes, lack, and more (58). All these milestones add up to their experiences and discoveries in Geology, Ecology and Climate Change Research components for making society better than yesterday and these took place over time. While there is no specified amount of time for each Geology, Ecology and Climate Change Research developmental process to be complete, the guiding principle should be that time is needed for development to move from one level to another.

While we struggle to harness our environment to impact on Geology, Ecology and Climate Change research, all to our best benefit, we still have the challenge of preserving the society for our children tomorrow (45). Many confounding variables interfere with our ability to make Geology, Ecology and Climate Change Research development sustainable in the context of the economic, social, and environmental impact of activities and critical decisions we make. The resources we need to make Geology, Ecology and Climate Change Research development sustainable appears to be theoretically available but why the attainment of the different stages of development

remains elusive to many stakeholders continue to be a topic for public debate (59). This debate and curiosity for answers provides the horizon for the next generation Geology, Ecology and Climate Change Research and curiosity for lasting answers

New tools and paradigm shift

The rationale for new Geology, Ecology and Climate Change Research tools and justification for a paradigm shift in the drive for sustainable development is predicated on the partial insight of the problems of poverty, environmental degradation, confusion about the role of economic growth, and the concepts of sustainability and participation (60). How these factors and weaknesses can lead to Geology, Ecology and Climate Change Research inadequacies and contradictions in relevant policy-making is seen at the global level of global trade, agriculture, manufacturing, and forestry. Therefore, if sustainable development in Geology, Ecology and Climate Change Research is to have a central impact, on the society and the stakeholders, then political foot-dragging will have to be given up in favor of research-based intellectual clarity and precision (61). This will be the tool that will drive the speed, direction, and content of Geology, Ecology and Climate Change Research development in the next couple of decades

Conclusion

Because of the diverse nature of our society today and the changing dynamics of associated challenges, the need for Geology, Ecology and Climate Change Research development and sustainability cannot be overemphasized. Geology, Ecology and Climate Change Research Databases that help expand our knowledge on how to be to identify, harness, and utilize our natural resources with minimum dependencies on others will significantly impact the sustainable development goals. Special Journal of Geology, Ecology and Climate Change Research published by the Special Journals publisher was launched to fill these gaps.

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