

# Sustainable Project Governance: Scientometric Analysis and Emerging Trends

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**Abstract:** Though a relatively large number of studies on sustainable project governance (SPG) have been undertaken, the existing corpus of literature is bereft of a comprehensive review paper that scientometrically analyses the materials published hitherto and puts forward the research gaps and the corresponding future works to be conducted. To fill this knowledge gap, this study undertakes a bibliometric review and scientometric analysis by meticulously delving into the relevant body of knowledge of sustainable governance reported in different databases. From the results obtained using CiteSpace software, the following conclusions can be drawn: (1) most of the keywords with high centrality rankings are related to the environment, (2) “participation” and “land use” are the most important clusters, (3) the United Kingdom and the United States are by far the most advanced countries in the concerned field, (4) the hot topics within the defined clusters are “industry”, “transition management”, “property rights”, and “natural resources”, and (5) the two salient keywords are “public participation” and “insight”. The attained findings lay out a solid foundation for researchers and practitioners towards fostering the area of SPG, by focusing on land use, community participation, politics, climate change, and the water–energy–food nexus and finding ways to tackle the elaborated shortcomings.

**Keywords:** sustainability; project governance; CiteSpace; bibliometric review; scientometric analysis



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## 1. Introduction

As efforts toward sustainable development have gained in popularity, green project governance is increasingly included in the area of engineering construction, with the creation and supervision of green engineering projects dominating numerous project industries. Sustainable projects aim to achieve a harmonious coexistence between humans and nature, creating genuinely comfortable and healthy living conditions for people [1,2]. The three central variables affecting green engineering projects are the government, the consumer, and the project-monitoring organisation. Therefore, all three are considered in this study. This paper adopts several analytical methods to conduct a detailed study of sustainable project governance and research to predict the future direction of these projects in engineering construction.

“Going green” is a popular topic that raises several attendant issues [3]. Greening conventional governance is a complicated process that may entail altering the entire process of how projects are approached [4]. Sustainable project governance is when project designers consider the environment when making engineering decisions, “thinking green” throughout the project [5]. Key to making this process successful is the concept of “sustainability”, in which business growth also protects the world’s population and ecosystem. A lack of sustainable practices has resulted in severe climatological crises, with the world’s sea level

increasing since 1960 at a rate of 1.8 mm per year, and since 1993 at a rate of 3.1 mm per year [6]. The time has come to include green and sustainable development principles into project management procedures [5]. Many project management professionals agree with this sentiment that project management must “assist in resolving societal issues, bringing about constructive change, and building a better future for both people and the environment” [7]. To place green project management at the forefront, project professionals must cultivate new skills and resources that integrate social values and sustainability goals [8].

Recent demands for increased environmental protection due to the world’s current climate crises have given rise to a new corporate paradigm called sustainable project governance (SPG), which aims to better integrate environmental concerns with business operations and development. The SPG embeds environmental protection into business practices, adopts cutting-edge production technology, and minimises the environmental harm brought on by business development in the production sector [9]. However, the SPG has been slow to take effect as it is still not fully understood by the corporate sector, making the adoption of corporate regulation a difficult process. While encouraging corporate regulation for the sake of sustainable project enhancement fosters social responsibility, the environment is not seen as a primary business concern, and therefore, it is often completely disregarded by corporations [10]. While these conventional business models prioritise production and profit, if this pattern continues, it will negatively impact social development, leading to resource waste and climatological destruction. Therefore, to achieve both economic development and environmental benefits, firms must adjust their objectives to a more sustainable governance model, and the SPG model is one way that can help companies maximise economic and social benefits. The promotion of the SPG model contributes to both social and ecological development by restoring the balance between global businesses and environmental protection. Older corporate governance models prioritised outputs without considering environmental impact, a policy that has come at a heavy cost [11].

Even though a relatively large number of studies on SPG have been undertaken, the existing corpus of literature is bereft of a comprehensive review paper that scientometrically analyses the materials published hitherto and puts forward the research gaps and the corresponding future works to be conducted. To fill this knowledge gap, this study undertakes a bibliometric review and scientometric analysis by meticulously delving into the relevant body of knowledge reported in different databases. To make it more explicit, the scope of this review paper is limited to the studies dealing with the governance of sustainability-based projects. It is noteworthy that the projects considered are from different industries, including manufacturing, construction and building, IT, business, service, and production. In a nutshell, this review paper aims to tackle the following main research questions alongside the corresponding sub-questions:

- (1) How could a comprehensive scientometric analysis on the corpus of literature on SPG be carried out with the following related sub-questions?
  - 1.1 What are the trends occurring in the corpus of literature published on SPG?
  - 1.2 What are the leading countries, scholars, and corresponding collaborative networks?
  - 1.3 How could the co-occurrence, centrality, and cluster mapping of keywords be unveiled?
  - 1.4 How could the timeline clustering mapping and emergent words analysis on SPG be unravelled?
- (2) What are the existing research gaps and the corresponding future endeavours to be undertaken?

The remainder of the paper is as follows. Section 2 elaborates on three components in relation to SPG, namely sustainability, project governance, and project success. The steps of the review approach are expounded in Section 3. Section 4 elucidates the results of the

analysis undertaken, as well as discusses the obtained findings. Finally, the concluding remarks, limitations, and recommendations are provided in Section 5.

## 2. Contextual Background

This section expounds on sustainability, project governance, and project success, so as to form a proper linkage between the sustainability paradigm and project governance, and their roles in the realisation of a successful project. Notably, the materials covered in this section serve as the foundation for this paper's subsequent analysis.

### 2.1. Sustainability

While sustainability is already ingrained in certain nations' laws and planning processes, it is frequently only applied to engineering projects during their design and construction phases. Moreover, engineering technologies have rarely taken these sustainability requirements into account, instead focusing on environmental issues that can be evaluated, such as biodiversity and the use of building materials [12]. Sustainable development has attracted some attention in different fields: sustainability in power generation use and manufacturing; sustainability of different sectors, such as building projects and tourism [13]; sustainability of numerous new technologies, including photovoltaic cells or use of fuel cells. There has been a dramatic rise in sustainable construction across the world. Due to resource depletion, to address a variety of managerial challenges and issues, a strategic and practical viewpoint is necessary. Additionally, the building industry is crucial to addressing society's requirements since it is central to overall quality of life [14].

The bulk of environmental initiatives are now performed by small-to-mid-sized construction organisations (SMSCOs) in the judgment call process [15]. More specifically, following the criteria laid out by Leadership in Energy and Environmental Design, design principles (Principles for Product Designers), building systems, and costs are assessed in greater depth. During the execution of construction projects, project control and record-keeping procedures become indispensable assessment tools for managers and other participants in the construction process as well as for controlling and managing project costs. All of these elements reflect the importance of operational sustainability in engineering projects.

Governance is generally composed of a company's materials, administration, leadership, policies, and philosophy [16]. Non-linear governance models (including advisory model, cooperative model, management team model, and policy board model) often serve to handle cooperation between non-cohesive parties, generally by splitting tasks at several levels where needed. The governance model blends the connective aspects of joint planning with the dynamic learning features of adaptive management depending on the needs and purpose of the organisation, serving as an effective model for project design. There are different governances between complications in stakeholder atmosphere, and uncertainty (in some cases, it is not possible for stakeholders to agree on all issues, with some groups being more influential than others, which can cause uncertainty to occur) [15]. Sustainable project governance can be understood as "preparing, tracking, and attempting to control of project implementation and support functions, with evaluation of the environmental, financial, and social elements of the life-cycle of the project's assets, procedures, milestones, and effects, with an eye toward realising value for stakeholders, and conducted in a clear, reasonable, and responsible way". During the administration of sustainable projects, a sustainability perspective is used to examine the project governance and delivery processes. The project's procurement procedure [16], the creation of the business case [17], the involvement of stakeholders [18], and the project's monitoring are all processes of project governance [19].

Although project governance can be problematic due to different governance approaches and uncertainty in the stakeholder climate, introducing the concept of sustainability into project governance can aid in circumventing these problems.

Sustainability is currently a top governance issue, both for academics and practitioners of engineering projects. Conflicts between corporate and ecological concerns have been

present for the past 200 years, and finding a permanent solution to this tension requires joining together business growth with environmental considerations [18]. According to the 1987 Brundtland Report [20], sustainable growth should satisfy current demands without jeopardising the ability of subsequent generations to satiate their personal needs. Such a proposition is clearly different from some contemporary approaches to project governance and highlights the need to integrate sustainability with project governance. Sustainability requires modes of living that allow all the world's individuals to experience happy, meaningful, economically solvent lives without harming their well-being or that of the environment [21]. Currently, sustainability research is extending beyond strict ecological concerns, resulting in several perspectives that have expanded the concept's definition; for example, in the project governance framework, sustainability is the capacity of a project to retain an appropriate level of value inflows during its market economy", showing how this definition expands the insight of sustainability [22]. Sanchez connects this more firmly with governance and design, stating that economic, social, and environmental factors must be accounted for when evaluating project organisational goals. While experts advocate the enhancement of corporate sustainability, it is uncertain how such changes can be implemented effectively [12]. Consequently, it is important to consider sustainability from multiple perspectives, including financial cultural, and ecological standpoints. Therefore, the integration of project governance and sustainable development should be an important direction for scholars in the field of project governance as well as for the practical implementers of engineering projects.

As sustainability has long-lasting consequences for social, political, and climatic problems, this investigation reviews three criteria for measuring sustainability in project governance and management. With regard to good governance practices in organisations, Martin and the APM Special Interest Group on Governance [23] have developed 10 golden rules to increase the probability of success: alignment of organisational strategy with projects; clear vision and strategic roadmap; reasonable and adequate delegation mechanisms; clearly assigned roles and responsibilities; continuous visibility of end purpose; comprehensive and detailed governance framework, processes, and decision gates; adequate capacity; transparency; assurance; and leadership, collaboration, and supportive culture. The majority of the critical elements influencing a project's success are connected to governance standards [24]. Therefore, he advises that every project design a special governance strategy that is best suited to its peculiarities. To achieve this, the business must be culturally adaptable and supportive of all good governance practices and project management methods. It is possible that many organisations have not yet attained this level of organisational maturity. Key board members should also set an example for others and promote good governance. In summary, project governance must not only have a sustainable vision but also focus on the role of people in the governance process.

Greater consideration of ecological and corporate culture issues in project governance, as well as the end result of the project, can help to improve business efficiency. Notably, these two considerations rarely coincide in practice [20]. Researchers recommend the use of environmental performance indicators for projects to assess project feasibility, while Ugwu recommends the use of outcome-oriented analytical decision support systems and methods for infrastructure undertakings [23,25]. Meanwhile, Shen created the Sustainability Achievement Evaluation Methodology (SPbEM) for PPP (public private partnership) projects, and Liang and Wang proposed a methodology consisting of five dimensions that allows for the assessment of project viability [25,26]. Other frameworks include commercial, cultural, and ecological considerations in the concept of sustainability [27]. An approach to development that can encourage more individuals to live sustainably by accomplishing a number of social goals, including health, safety, self-identity, simplicity of access, and a sense of belonging, is referred to as social sustainability [28]. Projects should consider energy use and environmental legislation in order to achieve environmental sustainability [29]. The above contradictions exemplify the controversy between scholars on outcome

orientation and sustainability in the project governance process, which is also studied in this paper.

## 2.2. Project Governance

Muller defines governance as a collection of methods and procedures that define an institution's goals, as well as provide a plan for monitoring a project's progress in achieving those goals [8]. Meanwhile, Cadbury defines governance as a comprehensive process that addresses the interests of all parties involved in a project. Ultimately, achievement is the main goal of governance [22].

In the context of engineering projects, governance refers to a framework through which a project's goals are established, along with methods for accomplishing them and gauging project performance. The interaction between a project's administration, sponsorship, operations, and stakeholders is a central focus of project governance. Similarly, Crawford asserts that company operations are carried out and driven by initiatives, making the effective governance of projects, conducted along government-directed lines, a critical priority for businesses [30]. In many cases, the company has chosen to prioritise the completion of government-related projects, which does not meet the requirements of sustainability as it does not take other projects into account and does not improve the overall operational efficiency of the company. Every project's primary goal is to produce and maximise an organisation's value, and the accomplishment of a project can serve as a primary barometer of organisational effectiveness [30]. It is therefore essential that these projects are effectively governed through the adoption of effective governance systems and the adoption of a holistic vision of sustainable development.

Project governance has been characterised in a variety of ways by various researchers, and frequently requires the use of techniques, methods, frameworks, philosophies, and technologies. According to the Project Information Centre, project governance occurs at the project, program, and spectrum management levels. Similarly, Muller sees project governance as pursuing corporate goals from the portfolio, program, venture, and project management dimensions [8]. Project governance is therefore a process for making important choices that affect a program's growth, and generally comprises a carefully constructed framework, a tight relationship between an initiative and the president of a project's overall growth plan, and the reasons why the project will ultimately be successful. Stakeholders are then alerted after a chosen engagement initiative is reviewed and with permitted participation. Further analysis is then conducted methodically to determine what the populace believes lawmakers intend with the project, while a probe is conducted to see whether the project remains feasible.

The goal of an efficient project governance system is to eliminate project failure and conduct proper projects frequently. No project that displays elements forecasting project delays should be permitted to move forward without the proper governance, and stage completion is necessary for goal achievement. This completion entails selecting, prioritising, and aligning initiatives with strategic goals [31]. Weaver has referred to successful project governance as a set of instruments [31]. Project delivery governance and control, meanwhile, are still challenging to achieve, and there must be a minimum commitment to reform and change regardless of how effectively infrastructure spending project governance is being implemented. The most successful projects are those with efficient front-end governance, without which projects risk confrontations and incompatibilities, resulting in failure and negative project consequences [8]. A project governance system's deployment, however, does not ensure successful projects, and all organisers' judgment, dedication, and enthusiasm are crucial factors for project effectiveness. Consequently, numerous administrative positions are currently creating project governance frameworks.

Project governance therefore creates the necessary connections that manage and oversee works across all enterprises [32]. This means that project governance frameworks are essential to project success [21]. Research by Sharma, Joslin, and Muller showed how analytical processes are not always apparent when regulating or intervening in project



governance functions, and thus the mechanisms for project success may be better served if preceded by effective project governance [21]. Their findings are consistent with those of other scholars. Using Delphi and hypothetical group approaches, Bekker performed qualitative case investigations in South Africa to investigate the links between project governance and project success for major investment projects [32]. After interviewing several participants, they found a high correlation between project governance and success. All of the above exemplify the relationship between project governance and project success, and how effective project governance can contribute to project development.

### 2.3. Project Success

To a certain extent, it is difficult to determine if a project is a failure or a success [33]. According to Muller and Judgev (2016), a good strategic plan is “mostly in the eyes of some people”, suggesting that projects are only viewed as profitable in the view of select stakeholders, and while some stakeholders may support a project, others may view it as a failure [8]. Shared awareness is therefore required to minimise a project’s uncertainty, and to accomplish this performance, standards should be integrated into the project from its earliest planning stages.

Criteria for success are interdependent variables that determine whether a project has achieved its goals. Strategic objectives are therefore important for the development and even the success of a project, and setting them at the beginning of a project will be more instructive and allow for greater clarity. Critically, some factors such as technological limitations or acceptance of innovative practices remain arbitrary in project plans, despite thorough specifications for success criteria. However, projects with different stakeholder groups are unlikely to agree on the identification of strategic objectives without setting metrics that can determine whether the development is judged to be successful [33]. Therefore, it is important to take into account the views of project stakeholders when setting strategic objectives for a project in order to set goals in a better way for the success of the project.

Recently, success factors for projects have progressed from straightforward, measurable moments, applicability, and expense initiatives, due to prototype efficiency toward measurements that have potential long-term efficacy and organisational impact [7–19,34]. Project achievement is one of the most studied subjects in the project management field, with the concept and significance of “project success” addressed and disputed by numerous scholars [21]. Basic productivity measuring tools have gradually been replaced by a record of project accomplishments as indicators of project success: Alam described project success criteria as the accomplishment of specialised performance indicators, and later added “accomplishment of project goals” to this description. Later, Shen proposed the notion of stakeholder satisfaction as a further metric of project success [24]. Building on these criteria, Khan identified five separate areas of project success: project productivity, organisational advantages, successful completions, demands for effectiveness, and enormous prospects. It is therefore clear from previous research that project success is measured on a variety of fronts to ensure that the average consumer is comprehensively satisfied with project results while also seeing that the project is completed within an allotted timeframe and budget.

The ability of organisations to link strategic goals with overall organisational objectives is one reason for highlighting project success criteria [21]. Project success allows firms to assess both their effectiveness and continuous improvement [33]. Muller notes that by finally passing their initiatives, businesses may boost their profitability, gain a larger market share, and provide shareholders with a higher return on their investments [8]. That said, Santos argues that the steps required to accomplish organisational goals have not been sufficiently studied. Recent researchers have therefore examined a variety of precursors that could potentially result in project success [35]. Koskinen argues that contact on projects should only be used to spread information because it might not ensure the project’s success [36]. Gray claims that project management’s main goal should be hazard elimination. Dvir [37] states that the amount of effort invested in a project impacts its subsequent effectiveness [38]. Raymond and Bergeron assert that project management

databases significantly aided in projects' accomplishment [39]. Others have suggested practical factors for project administration [20–22,34]. These are problems that some academics have identified that may arise in the course of project governance meetings.

Achievement is more than a simple binary between failure and accomplishment. For example, the Telescopes and the Melbourne Concert Hall demonstrate that even if a project has unsuccessful economic outputs, it may be successful in terms of expenditure productivity [28]. Similarly, if a project meets its deadlines, budget, and quality requirements but does not yield desired results, it may not be considered a successful investment. Even terms such as “achievement” and “disaster” in the context of business may be contested. The abandonment of a project due to shifting market demands may not rely on effectiveness or inability [40]. Project success is multi-dimensional, and accomplishing project management achievements may be distinct from a finished product. The success of projects is sometimes evaluated subjectively, and using a sustainability perspective to evaluate project success is a new way of thinking.

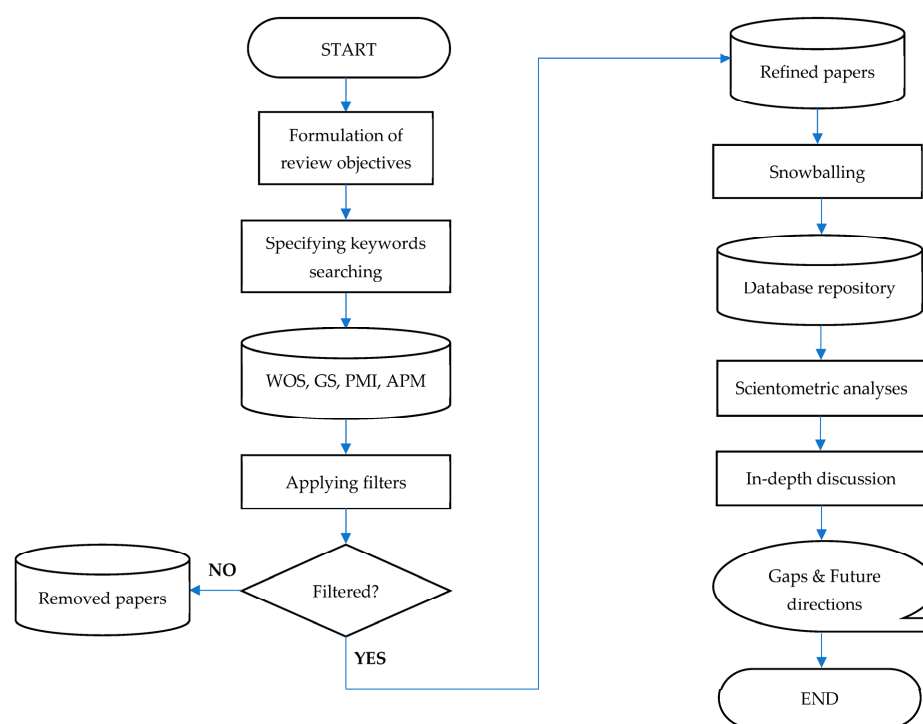
### 3. Methodology

This study comprehensively reviews the existing literature on the exploitation of sustainability within the realm of project governance. In doing so, a bibliometric review and scientometric analysis were undertaken. The bibliometric review refers to a comprehensive search tool for finding the relevant sources for achieving the specified objectives [41].

On the other side of the coin, scientometric analysis is a quantitative technique for assessing and analysing a body of literature on a specific topic. During analysis, knowledge about authors, keywords, journals, nations, organisations, and citations is gathered, allowing the researcher to sense how the research field is developing [1]. Moreover, modern computer technologies allow scientometric analysis to be supplemented with visual data and co-citations, with connections formed when constitutional provisions are cited for one or more different articles. Graphical founder evaluation can make the conclusions more thorough and improve data understanding, tracking the majority of publication components such as contributors, phrases, organisations, and nations [11]. Visualisation thus reveals the interconnectivity between data, including the co-occurrence of research topics from various authors, research priorities of multiple agencies, and scientific ideas from established universities. With these capabilities, scientometric analysis has become a critical tool in the world of business and educational research, while numerous methodological and co-citation research programs have been established in a variety of sectors. In light of the mentioned explanation, this study uses scientometric analysis for objectively visualising the research status quo, by extracting valuable information on the details and trends of the published materials. Notably, though this state-of-the-art review is deemed a “scientometric-based review”, all the steps necessary for a systematic literature review paper have been carefully taken into account, which include bibliometric search, scientometric analysis, and in-depth discussion (Figure 1).

#### 3.1. Keywords Searching

The formulation of keywords, the choice of search engines, and the assessment of investigated publications all have an impact on how productive desktop research searching is [42], but this is not a one-time thing. Literature study frequently begins very early, even before the purpose and vocabulary are confirmed, and it is a continuous and recurrent procedure throughout the entire study procedure. The terms that were researched were not found at once, either. The search queries include the following keywords: (“sustainability” OR “environmentally friendly” OR “sustainable” OR “green”) AND (“project governance” OR “project organization” OR “project structure” OR “project strategy” OR “project management” OR “construction projects” OR “IT projects” OR “manufacturing” OR “infrastructure”). Those connected to the position description were used to begin this investigation. Later, the study was expanded by using synonyms such as “sustainability” and “environmentally friendly”. This led to the obtention of 1615 documents.



**Figure 1.** Review framework.

### 3.2. Search Engine

In order to come up with a prudent and comprehensive list of papers relevant to the goal of a study, the selection of appropriate database repositories is imperative [39]. In this sense, one of the most inclusive databases is Web of Science (WoS); as noted by myriad researchers, it is one of the most commonly used search engines, due to the fact that it includes numerous articles from different publishers in diverse disciplines (including journals, conference papers, newspapers, reports, books, etc.) [43]. In addition, Google Scholar (GS) was also taken into account in this review, owing to the fact that it covers a wide variety of published sources, including dissertations, articles, books, and so forth [44]. Additionally, in the professional field of project management, PMI (Project Management Institute) and APM (Association for Project Management) are both professional search engines. PMI is a multinational association of professionals working in the subject of project management. There are currently more than 850,000 participants and binds specifically in more than 185 nations throughout the world. The standard textbook for project management is presently *The Guidebook to the Project Management Institute*, which was created by the PMI organisation. The Association for APM—which has more than 35,000 members and more than 450 companies collaborating in its professional collaboration scheme—is the only recognised institution in the project industry.

### 3.3. Applying Filters, Snowballing, and Refinement of Relevant Papers

Once the relevant materials were retrieved, a number of filters were considered for the exclusion of irrelevant papers. The considered filters were as follows: (1) the publication date of papers should be within the past five years, (2) the discipline of publications should fall into the areas of engineering, business, or management, and (3) the found sources should be in English. Following this, the snowballing technique was considered for increasing the size of the data obtained for this review paper. To perform snowballing, each paper was scrutinised to extract the relevant papers. Then, the papers found through the snowballing technique were carefully checked, and if they were deemed suitable, they were added to the database repository. Otherwise, they were excluded from further analysis. At the end of this stage, 1115 documents (including academic and grey literature) were obtained for the next step.



### 3.4. Data Analysis

CiteSpace was chosen as the data analysis programme for this review due to several reasons. Firstly, when compared to other data analysis programmes, it can perform spatio-temporal analysis and data visualisation. These statistics can serve as preliminary indicators of how the research topic has evolved over time and serve as a basis for the subsequent research context, popular destination analysis (which can be used to showcase research hotspots using CiteSpace’s high-frequency word distribution and keyword co-occurrence map), and transformation situation (generally represented by time zone sequence diagram in CiteSpace). In addition, the temporal flowchart of reference co-occurrence can be utilised to identify the key papers. The ensuing results of CiteSpace data have their own distinct characteristics, merging co-citations, and graphical maps. CiteSpace can also locate rapidly expanding research subjects by locating burst words, grouping various analytic nodes by category, and labelling buzzword groupings to identify cooperating scholars and organisations [45].

The software includes various mapping views such as “cluster”, “timeliness”, and “local time”, which reveal details on a subject’s evolution over time, the structure of emerging knowledge, and different time scales, respectively. The CiteSpace software offers comprehensive information on its chosen publications, including writer evaluations, publication analysis, region assessment, and organisational analyzation. Primary research topics can be determined by carefully analysing larger fragments, allowing researchers to locate exact theories and methods efficiently with the aid of reference journal analysis. Moreover, academic authors can learn about various journals prior to submitting their work, evaluating peer-reviewed articles that offer more precise details on hypotheses, procedures, and conclusions. A scholar wanting to perform thorough research can examine the most cited publications and phrases, identifying a broader understanding of a concept such as a project governance by examining graph co-citations over the course of several years. For this study, use has been made of visual infographics and informative tables to illustrate successful outcomes, with figures indicating the gravity of each network (i.e., writer, organisation, nation, journal, and article) according to the regularity of usage or publishing and connections displayed in each graph (i.e., prominence). Table 1 summarises the inputs and the types of analyses undertaken in this review paper using CiteSpace software.

**Table 1.** Inputs and types of analyses undertaken using CiteSpace.

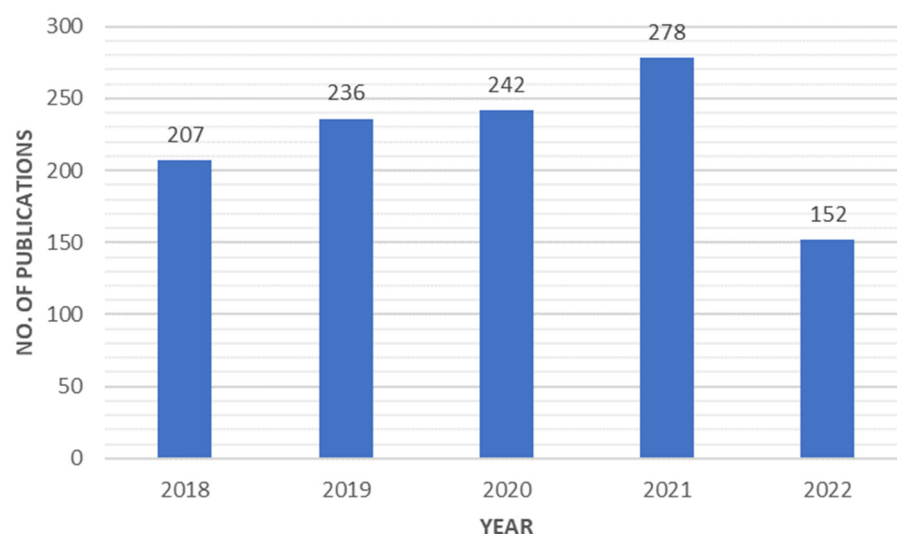
Type of Analysis	Explanation of the Considered Inputs	Output
Country contribution	The node type was set to “Author” and “Country”, the time span was set to “2018 to 2022”, and the sequence of data units was 5.	The most prolific countries are highlighted.
Institutional contribution	The node type was set to “Author” and “Institution”, the time span was set to “2018 to 2022”, the node types were “Author” and “Organization”, and the sequence of data units was 5.	The most active institutions are shown.
Leading scholars	The node type was set to “Author” and “Country”, the time span was set to “2018 to 2022”, and the sequence of data units was 2.	The most productive researchers are highlighted.
Co-occurrence analysis	The node types were adjusted to “Keyword” when the data were uploaded into CiteSpace, with 367 nodes and 2270 lines, using a time slice of 1 year, or five time slices from 2017 to 2022.	
Central keywords	The network had 367 nodes and 2270 connected lines, and the sequence of data unit was 5.	
Cluster mapping	The network had 367 nodes and 2270 connected lines, and the sequence of data unit was 5.	The relevant clusters are elaborated on.
Timeline clustering	The network had 367 nodes and 2270 connected lines, with the adjusted time span from 2018 to 2022.	The evolutionary trends of the research directions are revealed.
Emergent words	The network had 367 nodes and 2270 connected lines, with the adjusted period from 2018 to 2022.	Future research directions are provided.

## 4. Result

This section provides the results of the analyses performed in this study.

### 4.1. Analysis of Trends in the Corpus of Literature

Figure 2 shows the number of papers published in the field of SPG from 2018 to 2022. As can be seen, the number of articles published per year shows an upward trend; there was an increment from 207 to 278, with the number of articles published growing faster from 2018 to 2019 at a rate of 14%. On the other hand, the number of articles published from 2019 to 2020 tends to grow at a flat rate of 3%, while the fastest growth was from 2020 to 2021 at a rate of 15%. It is notable that the compilation of the relevant papers for this state-of-the-art review was undertaken between May and June 2022; thus, the year 2022 was partially considered.



**Figure 2.** Trends in annual paper volume in the field of SPG.

In light of the above considerations, one can infer that the research fervour in this area has continued to grow, and in fact, such fervour has not just started in recent years. The phrase “project governance” has drawn a lot of interest and discussion in project research since the mid-1990s [46]. The indignation with especially large investment project failures and the understanding that project management at a functional and technical level should be supplemented and endorsed at corporate strategy and governmental management levels are what spurred the search to characterise and ascertain quality management [47,48]. The International Standards Organisation (ISO) has been working on creating a global convention on the governance of enterprises, organisations, and commodities since 2012 through a particular thread group known as Technical Advisory TC 258. It has become clear that the conception of project governance has up until now been pushed from a “project management” point of view throughout different operating group meetings as well as in analyses of project construction governance literature. The bulk of contributors and discussion group members on project governance have backgrounds in project management and are seeking to build a structure from a project-centric perspective. Project management is still an emerging field that is gaining interest worldwide, and project governance for sustainability is a hot new topic.

### 4.2. Country-Specific Analysis

The sustainability of project governance was evaluated using the collaborative hierarchical clustering component of the CiteSpace programme. The information was loaded into CiteSpace in a standardised way and the necessary conditions were configured. The

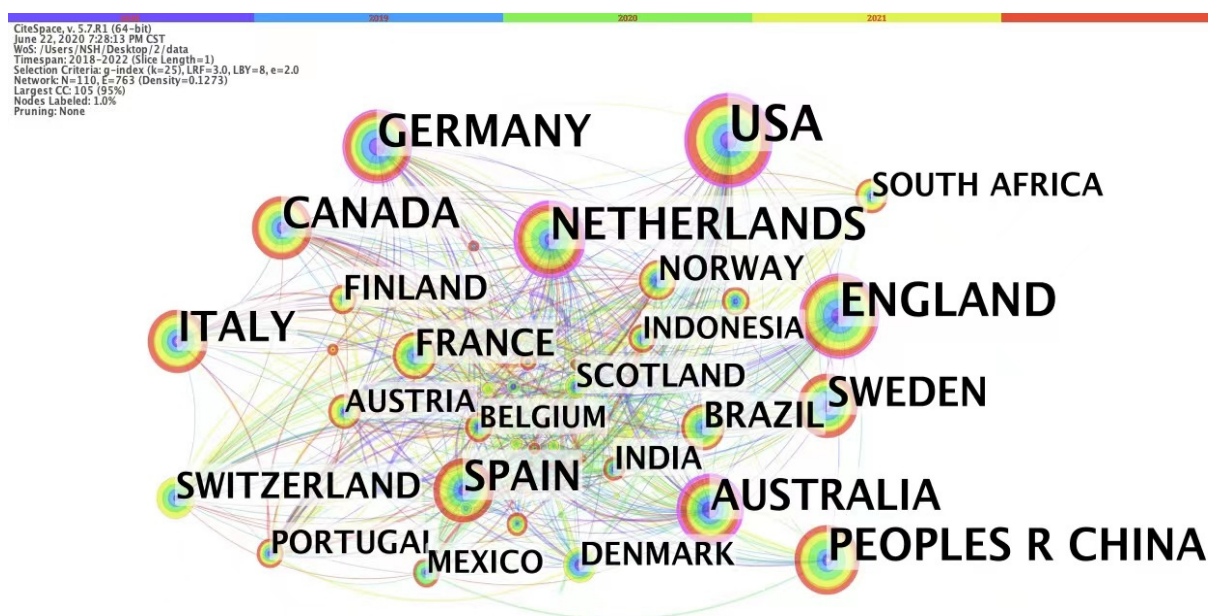
node type was set to “Author” and “Country”, the time span was set to 2018–2022, and the sequence of data units was set to 5.

With this in mind, the top ten countries or regions with the highest number of publications are listed in Table 2. As one may notice, the United States is the leader in terms of journal articles, because of its rapid rate of progress in digital data technology. It is important to note that the majority of all these countries are developed nations, whereas China, which is ranked third, remains a developing nation.

**Table 2.** Top 10 article-producing countries.

Country	Centrality	Count	Rank
U.S.	0.27	186	1
England	0.14	126	2
China	0.02	107	3
Germany	0.13	101	4
The Netherlands	0.22	101	5
Canada	0.06	87	6
Australia	0.23	82	7
Spain	0.09	79	8
Italy	0.02	76	9
Sweden	0.03	72	10

CiteSpace was also used to evaluate the relationship between these nations, then Pathfinder network scalability was used to create an accurate and thorough map (see Figure 3). As can be observed, the U.S., the U.K., and Australia have the highest number of nodes connecting to other countries; thus, it can be concluded that they are statistically the most interconnected nations in this research field, and these three nations have focused heavily on project governance and green project sustainability.



**Figure 3.** Country cooperation mapping.

It can be seen that there are other countries with a relatively high number of publications on SPG, such as China and Italy. However, the corresponding nodes are not connected

to the other countries. This indicates that there have been limited collaborations among these countries with the other active nations in the concerned area.

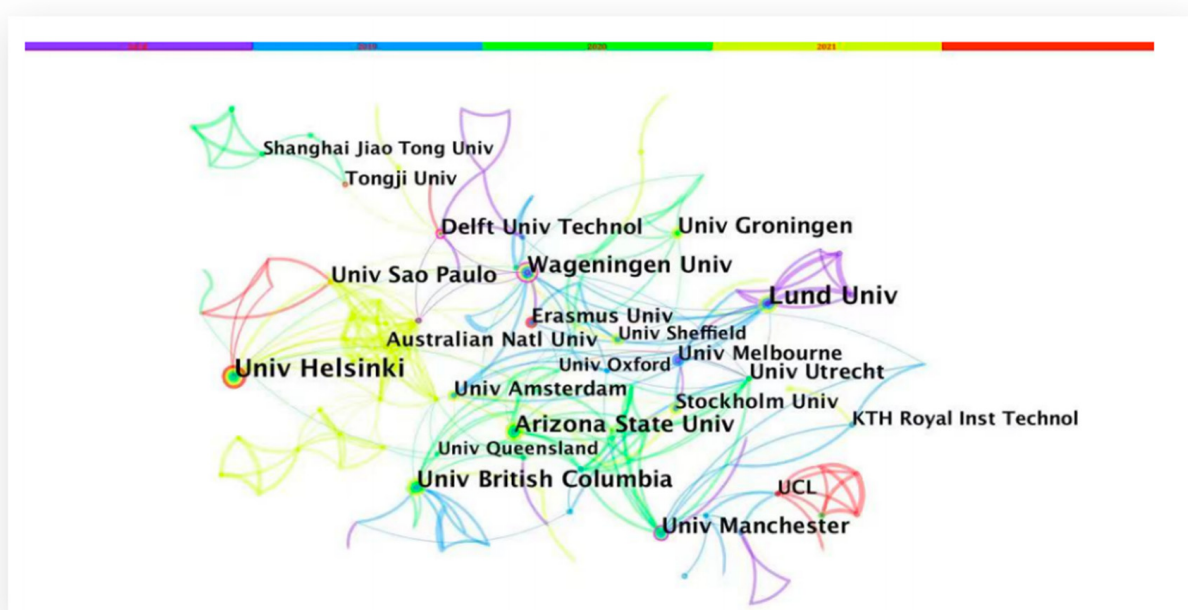
#### 4.3. Analysis of Institution's Contribution

The top ten most productive institutions and associated centrality are listed in Table 3. Of these institutions, Lund University, University of Helsinki, and Wageningen University all have a central position of around 0.1. The higher the centrality of a node, the more decentralised its reach; therefore, the more links it has.

**Table 3.** Top 10 institutions.

Institution	Centrality	Count
Lund University	0.08	14
University of Helsinki	0.05	14
University of Wageningen	0.15	12
University of British Columbia	0.09	12
Arizona State University	0.06	12
University of Manchester	0.14	10
University of San Paulo	0.04	10
University of Groningen	0.02	10
Delft University Technology	0.11	9
University of Utrecht	0.07	9

Figure 4 shows the partnership between the issuing institutions; more lines between the different institutions represent stronger ties between them. As can be seen, Lund University's central point is a dense line, and it is clear that Lund University has strong links with other institutions. In terms of cooperation, there is cooperation between different institutions at home and abroad, while the scale of cooperation is not very large, for instance, between Shanghai Jiao Tong University, Tongji University, and Delft University technology. Notably, although Lund University and the University of Helsinki have published the most papers, Wageningen University has the highest centrality value.



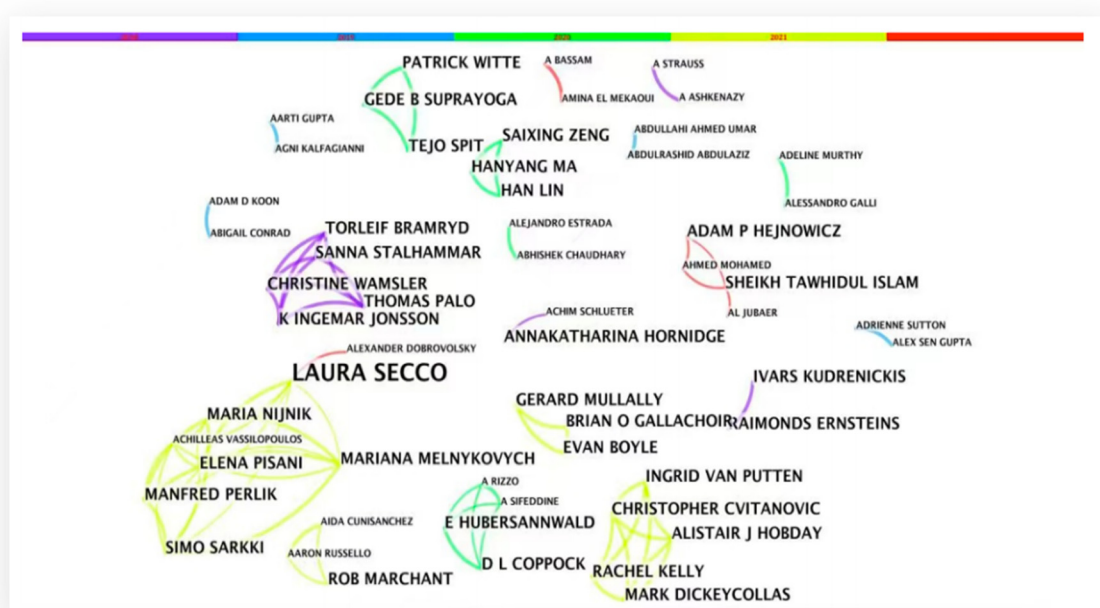
**Figure 4.** Mapping of institutional partnerships.

#### 4.4. Analysis of Leading Scholars and Collaborative Networks

Table 4 summarises the most productive scholars in a single year over the course of five years considered in this review paper. As can be seen, Laura Secco was the most prolific scholar in a single year, with four publications. On the other side of the coin, Figure 5 illustrates the top ten scholars who have published more than 10 publications in the time span considered in this review paper, as well as their pattern of cooperation. A particular author is represented by each node, which grows in volume as additional papers are produced. Their methods of interaction and the scope of their relationship are represented by the magnitude of these links as well as the individual connections between the various nodes. A larger font size for the author's name denotes a higher centrality for the cluster. In other ways, it is essential for tying together other publications or serving as the program's theoretical foundation. By examining the composition, we can not only determine the authors who have the greatest impact on SPG, but also their significant contributions that represent the main themes of earlier studies. Furthermore, any hypothesis or technique study in this field should be based on the publications of the authors who receive the greatest citations. For these considerations, authorship research is essential.

**Table 4.** Top 10 most productive authors.

Authors	Count	Year
Laura Secco	4	2021
Simo Sarkki	2	2021
Brian O. Gallachoir	2	2021
Francesc Pardo-Bosch	2	2019
Rachel Kelly	2	2021
Mark Dickeycollas	2	2021
Gede B. Suprayoga	2	2020
Alejandro Ortegaargueta	2	2019
Annakatharina Hornidge	2	2018
Damian Maye	2	2019



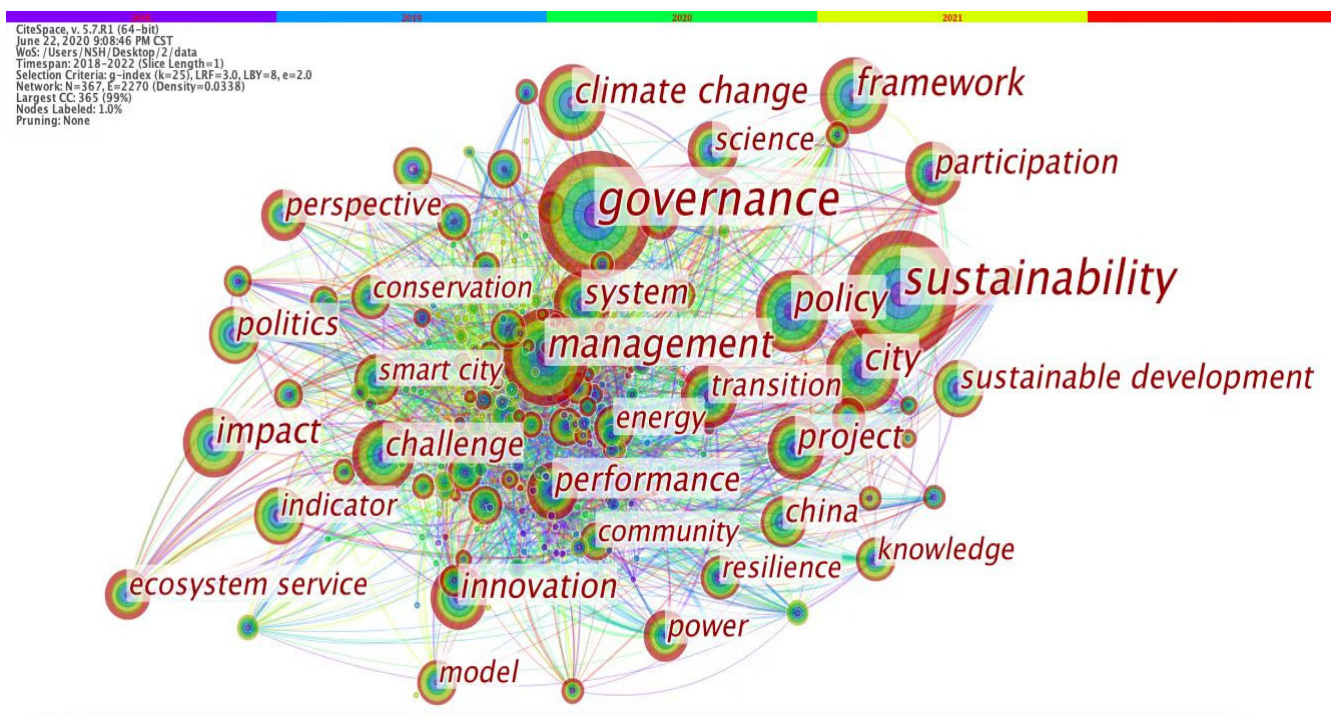
**Figure 5.** Author collaboration chart.



#### 4.5. Keyword Analysis

##### 4.5.1. Results of Co-Occurrence and Centrality Analysis

The top 15 high-frequency keywords according to keyword frequency are governance, sustainability, management, policy, city, framework, climate change, impact, system, project, innovation, participation, challenge, performance sustainable development, participation, challenge, and performance sustainable development (see Figure 6).



**Figure 6.** Keyword co-occurrence mapping.

The high-frequency words of the local clusters extended by “sustainability” are mostly related to projects as well as urban development. Although the idea of sustainability is widely accepted to be multifaceted, throughout time, its numerous facets have generated a variety of ideologies and are frequently discussed individually [49]. This division has, in some circumstances, reduced sustainability’s practical application to mere language. Companies are being compelled to embrace elements of social and ecological accountability within their objectives, processes, and management solutions in response to increasing challenges from domestic and international laws and society at large. The idea of sustainability is so pervasive that various discourses have developed throughout time, connecting it to ideas such as social responsibility, resource stewardship, and sustainable growth, which are frequently approached in various ways.

Mediation centrality, also known as attachment saturation, is the capacity of a node to regulate the relationships between all the other nodes by being at the shortest distance of a link among any two nodes on the network. Frequency spectrum and high secondary centralisation keywords are indicative of the concentrations and patterns in a given study area. The term “financial intermediary centrality” describes how frequently a node connects the shortest pathways of two other nodes. The more links a keyword node has with other keywords, or the more times it serves as an intermediate, the greater its intermediation centrality. Higher mediator centrality ratings indicate that a keyword is more closely connected to other phrases and is therefore more important to the issue. As can be observed from Table 5, the top 15 mediated centrality terms were identified as “barrier”, “environment”, “design environment”, “network”, “future”, “climate”, “knowledge

corporate”, “social responsibility”, “lesson”, “adoption”, “stakeholder”, “construction”, “culture”, and “organisation”.

**Table 5.** Project governance and intermediary centrality analysis of keywords in the field of SPG.

Centrality	Keyword
0.09	Barrier
0.08	Environment
0.07	Design
0.07	Environmental governance
0.06	Network
0.05	Future
0.05	Climate
0.04	Knowledge corporate
0.04	Social responsibility
0.04	Lesson
0.04	Adaption
0.04	Stakeholder
0.04	Construction
0.04	Agriculture
0.04	Organisation
0.04	Engagement
0.04	Partnership
0.04	Quality
0.03	City
0.03	Framework
0.03	Challenge
0.03	Politics
0.03	Ecosystem service
0.03	Community
0.03	Collaboration
0.03	Infrastructure
0.03	Transformation
0.03	Developing country
0.03	Water governance

By looking at the information provided in Table 5, nine keywords are related to the environment—environment, design environment, climate, agriculture, environmental design, environmental governance, ecosystem service, infrastructure, and water governance. This shows that the environment is an important link to sustainable development and project governance. Finding coexistence and peaceful growth based on the convergence of economic, social, and environmental acceptability is the goal of sustainable development. In order to achieve sustainable development, the environment must be protected to the greatest extent possible while the economy is developed and the resources and benefits required to live comfortably are obtained, while also ensuring that social groups and individuals share as fairly as possible in the benefits of development and the environment’s well-being and creating sustainable community patterns and lifestyles.

#### 4.5.2. Keyword Cluster Mapping Results

Based on the co-occurrence relationship between keywords and their intensity, the LLR clustering algorithm (likelihood ratio test) is used for clustering analysis, which is the log-maximum likelihood algorithm. The maximum likelihood is determined according to the probability density function, and the most appropriate clustering label is found. The follow-up process is as follows: using CiteSpace software, select “Find Cluster” and “Timeline View” operation to cluster keywords to obtain the clustering time spectrum of the research topic.

The graph shows that there are 367 network nodes, 2270 connected lines, and the network density is 0.0338. Modularity (Q value) is 0.352, greater than 0.3, indicating a significant clustering structure. Silhouette (S value) is 0.5589, greater than 0.5, indicating reasonable and convincing clustering. Figure 7 shows that the closely related keywords are clustered into 10 categories: #0 land use, #1 corporate governance, #2 adaptive management, #3 participation, #4 politics, #5 Russia, #6 climate change, #7 mining, #8 Japan, #9 water–energy–food.

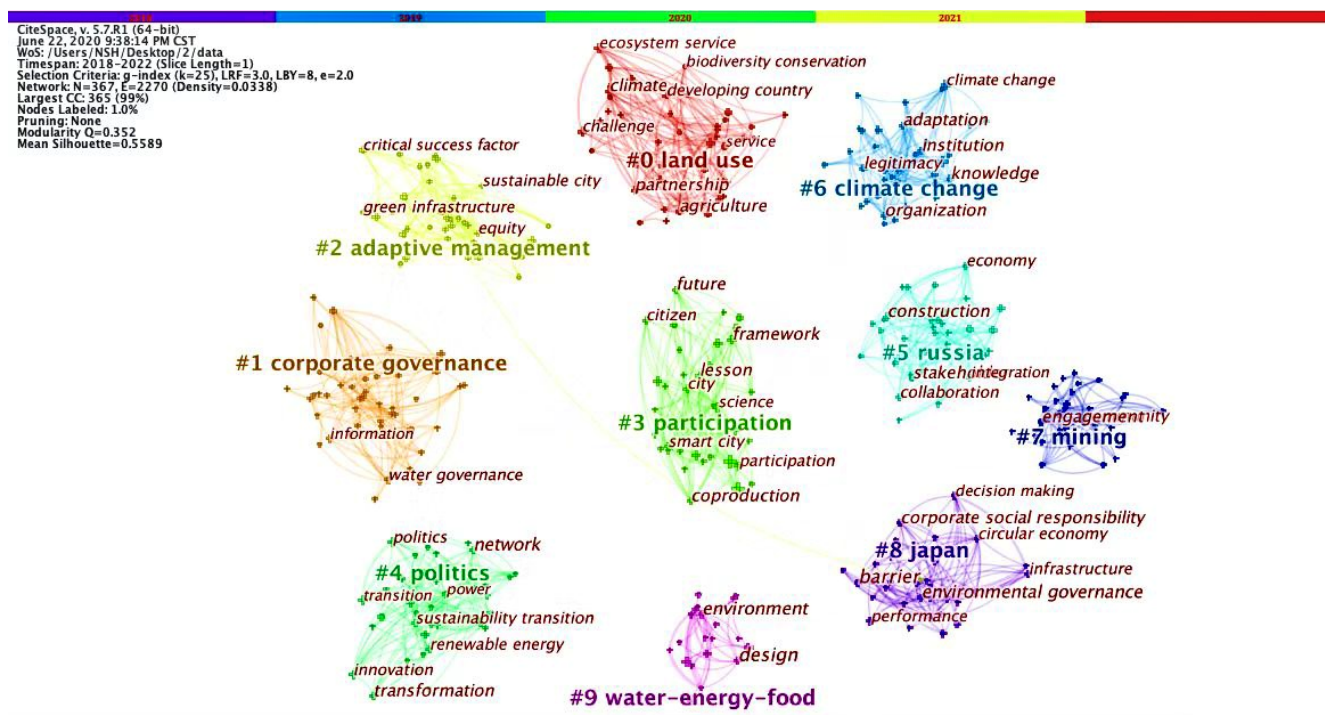


Figure 7. Keyword clustering mapping.

The labels “#0 land use”, “#3 participation”, “#4 politics”, “#6 climate change”, “#9 water–energy–food”, and “#8 Japan” have broad meanings. A detailed analysis should be carried out in combination with various contents. The cluster contents of “#1 corporate governance” and “#2 adaptive management” intersect and overlap, and the cluster spacing is relatively small, so they can be considered as one class analysis. Through a comparative study of the subject keywords and high-frequency keywords that form clusters, it is found that there are eight main directions in the field of SPG, as follows.

**Land use:** Although land use has always been seen as a regional concern for the environment, it is increasingly important on a worldwide scale. The demand for nutrition, fibre, water, and habitat for more than six billion people is increasingly impacting woods, croplands, streams, and the atmosphere [32]. The expansion of farmlands, grasslands, orchards, and urban areas around the world in the past few decades has been accompanied by substantial growth in the use of electricity, fresh water, and fertilisers, as well as major losses in species. The ability of habitats to support agricultural production, preserve groundwater and natural resources, manage temperature and pollution levels, and reduce

infectious illnesses may be threatened by such changes in land use, which have allowed individuals to demand an increasing proportion of the planet's natural resources. Given the benefits of living in cities, the trend of urbanisation will not end soon, especially in developing nations. Rapid urbanisation has important side effects, one of which is uncontrolled urban development. The city has a sizable amount of constructed zones located throughout it. Unplanned growth has already had a variety of detrimental effects, including the persistence of squatter camps, expanding wealth and poverty gaps, a lack of safeguards for land tenure, inadequate land use, and poor land administration [50]. Land management and project development are closely linked, projects and economic development must be premised on environmental protection, and sustainable land use development also has an important role to play.

**Participation:** This keyword cluster includes smart cities, participation, future, and science, all with word frequencies greater than 1000. The former, as the basis of research in the field of management, has remained stable. At the same time, industry organisations and institutions are increasingly focusing on the construction of information systems based on industry development trends and the development of related application software to improve their core competencies. In the meantime, industry organisations and institutions are focusing more and more on the construction of information systems and the development of related application software based on industry development trends, in order to improve their core competitiveness. In addition, most of the keywords such as framework, future, and citizen have a word frequency greater than 200, indicating that the future prospects and even the participation of all people in this field remain intensely researched.

**Politics:** In this cluster, the keywords sustainability transition, renewable energy, and innovation transformation all appear in relation to green projects. The next ten years will be crucial for addressing urgent sustainability issues, including the environmental crisis. Rosenbloom et al. (2020) state that to solve these issues, an aggressive and timely contribution to the increase strategy is required to hasten the shift from diesel industries to reduced economic systems and clean renewable energy systems [34]. A large-scale regulation transformation, however, is by its very nature prone to bitter political disputes. The importance of such politics has been emphasised more and more in transformation studies over the past ten years, particularly for the speeding up of changes. Rosenbloom states that to solve these issues, aggressive and appropriate contributions to the increasing policy are required to hasten the shift from diesel economics to low-carbon sectors of the economy and clean renewable energy infrastructures [51,52].

**Climate change:** Organisations, knowledge, and institutions are high-frequency keywords for the climate change cluster. The issue of climate change and its potential effects on our civilisation and the sustainable and equitable growth of the entire planet have become more and more prominent in the latest media awareness programs and continuous substantial conversations among specialists [53]. It is not always clear how realistic alternatives for governance to reduce and optimise the impacts of climate unpredictability in order to result in the least amount of environmental harm are to be offered. According to Layfield, the effects of exhaust sources and living beings on climate change are widely documented at present. In order to address the effects of climate change, different countries (local governments) have different interests and take different measures. This is because the unpredictability of the climatic factors depends not just on the period but also on geography.

**Water–energy–food:** Within this cluster, keywords such as water, energy, food, and environment are closely related to green projects and sustainable development. One idea being proposed for sustainable growth is the water–energy–food confluence. The World Economic Forum initially proposed “nexus thinking” to advance the interdependence of resource usage and the provision of fundamental and unconditional rights to nutrition, fresh water, and energy supplies. Despite the fact that the World Economic Forum introduced the nexus foundation from a safety standpoint (water–energy–food security), later versions have included various aspects with individual components, such as groundwater sources as



a core element, property utilisation, and nourishment as fundamental elements with land–water–energy interconnections [54,55]. The application of nexus thinking is encouraged as an improvement over the sector-specific control of resource extraction use currently in place.

**Japan:** In the cluster of Japan, environmental governance, social responsibility, and infrastructure are all high-frequency keywords. This indicates that Japan has been fruitful in research on environmental governance and infrastructure development as well as in project governance and green projects. According to Morita, all nations must work together to accomplish the Sustainable Development Goals (SDGs), and each nation must assess its progress forward towards the SDGs, establish the objectives that still need to be accomplished, and establish highly efficient governance structures to speed up this process. The creation of entirely new governance structures for the SDGs, which involved a wide range of parties and the occurrence of large and powerful research and evaluation functionality, has resulted in comparatively well-structured “visual acuity and impartial configuration”, “investigations and evaluation”, and “development strategies” in Japan. However, Japan faces difficulties when it comes to “administration” and “tracking, assessment, and review” of the SDGs, particularly in light of the SDGs’ insufficient internalisation, the absence of an effective legislative framework, and insufficient local governance [11].

**Corporate Governance and Adaptive Management:** In both clusters, green infrastructure and sustainable city are the two most frequently occurring terms. According to Arora, in light of the ongoing global financial crisis (GFC), where CSR is rapidly being explored as a tactic to address governance shortcomings and associated reputational threats, the focus of growing media, governmental, and societal conversation is on enhancing administrative, directorial, and corporate citizenship behaviours [56]. Instead of what are sometimes referred to in practice as concrete situations, corporate governance must make use of psychological principles. The surveillance model of financial regulation may rely too heavily on the autonomy and objectivity of the guardians. At the very least, current systems need to be modified to take into account the influences of displays of emotion on decision making [54].

#### 4.5.3. Results of Timeline Clustering Mapping and Emerging Words Analysis

The evolutionary trends of the eight research directions described above are revealed on the basis of the timeline clustering of keywords. The timeline view provides a visualisation of the development and evolution of the keywords in the research area. With the same parameters as before, the clustering analysis presents the dynamic evolution of the different keywords under the eight hot clustering themes, as shown in Figure 8. The corresponding year is marked above the timeline clustering map, with the colour of the connecting lines representing the years in which two or two thematic keywords co-occur within or between clusters, from dark blue, light blue, green, yellow, and red, in that order. The length of the timeline for each cluster represents the duration of activity for that cluster.

By examining the timeline graphs, it is possible to make reasonable predictions about what will be prominent in the coming period. It can be discerned that the clusters “corporate governance”, “participation”, “adaptive management”, and “participation” are highly related to SPG. There are still many keywords related to SPG after the top 10 clusters (for instance, project development, data governance, and infrastructure governance), which means that these clusters will remain hot for some time to come. These topical keywords are as follows: transition management and natural resources.

Transition management was created in response to the failure of Dutch protection of the environment and has origins in environmental science, innovation and technology studies, and internal components. Even though many stakeholders wanted to switch to more ecologically friendly practices, many were unable to do so due to the enormous financial costs involved [57]. This signalled a change in focus away from people and organisations toward the network level. Because of the fact that sustainability challenges could not be fully handled in traditional policy venues, the TA’s founding concept was



inspired by this realisation. As a result, transitioning scholars claimed that a TA was necessary in place of the typical brief, interest-driven policy arena in order to achieve long-term sustainability. The definition of a TA is “a group of people who agree on the necessity and potential for structural reforms and communicate among themselves to advocate and build an option”.

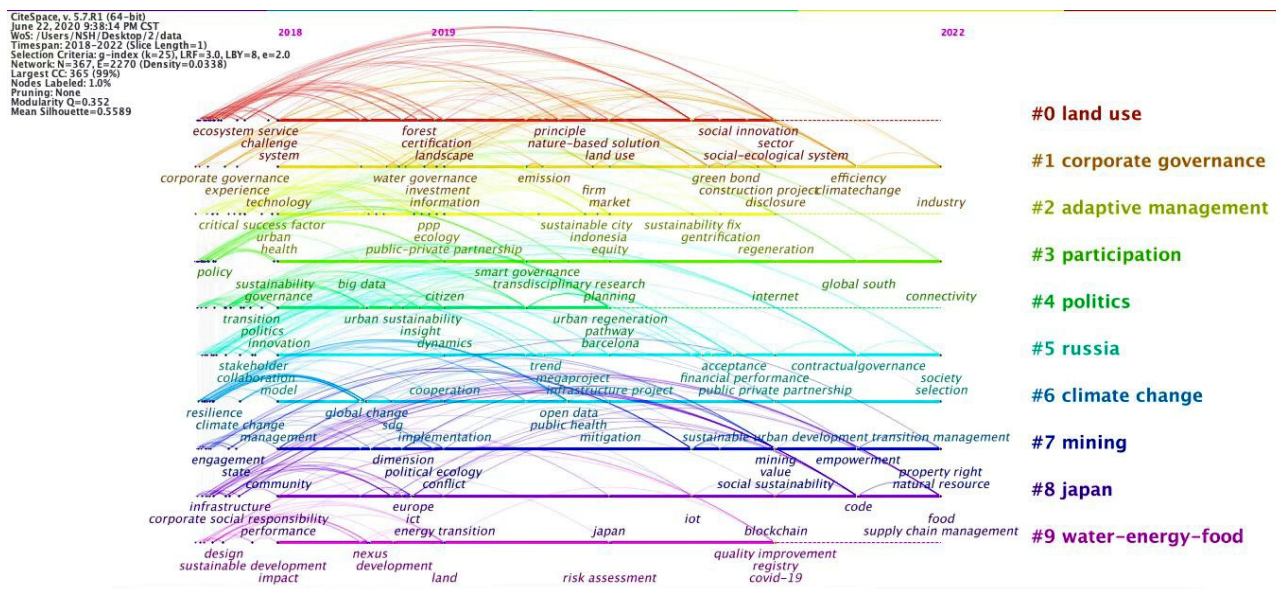


Figure 8. Timeline clustering mapping.

The two major threats to environmental sustainability are the loss of natural resources and demographic aging. However, there is presently little research that combines population aging and mineral wealth in a single ecological regulatory framework. It is commonly known that having a wealth of natural resource reserves is a crucial component of a nation’s economic foundation [21]. Natural resource-rich advanced countries have dominated global economic growth for the past 50 years. Elevated nations, led by the G7, have a tendency to place a higher value on the material prosperity and fulfilment they obtain in consideration of natural resources. Since 2020, economies have been hit hard by the impact of the new coronavirus, and natural resources and aging populations have received even more widespread attention worldwide. This will also become a popular research trend afterward. The essential organisations of intellectual property establish the guidelines for who is permitted to utilise, manage, and regulate natural resources.

Our knowledge of how property ownership control actors’ access to the natural ecosystems these natural resources supply, however, is still limited. In the coming years, the study of property rights will continue in depth and will be integrated with research in the area of project governance and sustainable development [58]. The ten clusters above were grouped into two categories according to keyword similarity and analysed chronologically, year by year, as follows. The categories are decided based on the emerging keywords. Since the keywords are related to two relevant themes (sustainability and governance), the emerging keywords are clustered under these two themes. This is methodologically in line with the scope and focus of this review paper, which is related to SPG. This categorisation leads to deep understanding on the overlapping of sustainability and governance. However, they are closely related to each other. The first category has keywords mostly related to sustainability, with #0 land use, #4 politics, #7 mining, #8 Japan, and #9 water–energy–food. On the other side of the coin, the keywords in the second category are related to governance: #1 corporate governance, #2 adaptive management, and #3 participation.

**Category I:** The keywords ecosystem service, sustainable development, infrastructure, and climate change were prominent in 2018, indicating that the hot topics in the

research field of sustainable development in 2018 are mainly focused on these areas. All elements of human, communal, intellectual, and fiscal health are supported by biodiversity, environments, and the benefits they give [46]. The unsustainable extraction of ecosystems, nevertheless, has contributed significantly to human economic and social growth [59]. As a result, mankind is on the verge of or has already exceeded the number of environmental limits [60]. Human well-being has not yet reached a minimally adequate standard for all people around the world, despite extensive usage of many environments and significant advancements in several development-related areas over the past century. It can be seen that the above keywords were less prominent in 2019, while forest, landscape, urban sustainability, and political ecology are the new hotspots. Urban sustainability is a subject that is incredibly relevant right now, and urban growth that is sustainable has gained political relevance. Numerous cities throughout the world are dealing with serious problems related to protecting the environment from escalating threats and guaranteeing the standard of living for their citizens. Urban sustainability assessment indicators are gaining recognition as they relate to cities accomplishing their own objectives for sustainable development. In 2020, the keywords evolved into sustainable cities, urban regeneration, and public health, and these areas are becoming research hotspots. According to Deniz, it is essential to assess how the reliability dimension affects a community's quality of life and well-being. Designers and architects are aware of how critical it is to raise the standard of living in a society that supports public health. Aspects of public health seek to broaden safe and healthy surroundings to include quality of life in order to achieve long-term sustainability. By 2021, the research focus will be on social innovation, social ecosystems, social responsibility, and COVID-19. Social responsibility refers to commercial practices that engage in environmental conservation, human rights, and group needs. It is particularly clear in times of crisis when the public has heightened anticipation of how the organisation will implement its guiding principles. As a crisis event for businesses, the COVID-19 pandemic prompted modifications in marketing strategies that also affected their stakeholders [61]. In this area, corporate social accountability can be a practical and efficient means of reducing the pandemic's possible implications and making crisis management simpler.

**Category 2:** Corporate governance, stakeholders, collaboration, and sustainability were prominent in this area in 2018. Over the past few decades, senior managers, managerial academics, and legislators have all become increasingly interested in the topic of corporate governance [62]. The issue, which was once restricted to the fields of commerce and banking (as well as law), has recently branched out to include organisational context and business strategy. According to Hambrick, stakeholder exploitation is a principle that has a major impact on how the organisation is run and managed. In 2019, the above-mentioned hotspots faded away, and water governance, public-private partnership, and cooperation became new hotspots.

Particularly when governmental and organisational borders are irrelevant, it is difficult to come to governance arrangements that can support sustained resource management while the resource itself is changing and evolving, frequently with high degrees of analytical uncertainty [63]. Since water management practices typically vary more between nations than within nations, water management is inherently more difficult than domestic water management. In 2020, the buzzwords translated mainly into smart governance, risk assessment, and mitigation. According to Timmerman, technology, administrative, and external factors threaten sustainable smart cities, rendering their administration challenging and vulnerable to fraud. Different components linked to both the uniqueness of the problems and the fundamental collaboration between both the countries either help or inhibit transboundary interaction in water governance. Although when governmental and political divisions are irrelevant, it is difficult to come to governance arrangements that can ensure ongoing resource management when the commodity itself is changing and evolving, frequently with high degrees of conceptual uncertainty. Since water governance practices typically vary more between nations than within nations, water governance is inherently more difficult than domestic water governance. In 2021, the buzzwords trans-

formed into construction projects, internet, and quality improvement. The sustainability of an infrastructure project depends greatly on the prompt communication of data among the stakeholders involved, including landowners, project managers, subcontractors, and designers. Amongst many other things, it is also one of the industries that depends on the most on knowledge [58].

Emergent word analysis is needed to predict future research or grasp valuable research directions. Emergent words are words with high-frequency change rates in a certain period of time detected from a large number of subject words based on word frequency, that is, subject words with a strong abrupt trend. The prediction principle lies in the accurate identification of keywords with high-frequency growth in a specific period according to the emergent word monitoring algorithm first proposed by Kleinberg [59]. As time goes by, prominent emergent words turn from blue to red, and some words turn from red to blue again. The length of the red line represents the time when the emergent words appear. Through frontier exploration, a total of 13 salient keywords were obtained, as can be seen in Figure 9.

### Top 13 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2018 - 2022
trust	2018	2.2922	2018	2019	
knowledge management	2018	2.0051	2018	2019	
public participation	2018	3.4421	2018	2019	
decision making	2018	1.93	2018	2019	
leadership	2018	2.0051	2018	2019	
public sector	2018	1.9865	2019	2020	
urban sustainability	2018	2.5555	2019	2020	
sdg	2018	2.271	2019	2020	
deforestation	2018	1.9865	2019	2020	
insight	2018	3.4102	2019	2020	
local government	2018	1.9865	2019	2020	
market	2018	2.0323	2020	2022	
indonesia	2018	2.0323	2020	2022	

**Figure 9.** Salient keywords with the strongest citation bursts.

According to the information provided, “trust”, “knowledge management”, “public participation”, “decision making”, and “leadership” were emergent words in two consecutive years from 2018 to 2019. Among them, “public participation” is the most popular word (3.4421). It is a frequent word in the research direction of project governance and green participation and was a hot research topic in 2018 and 2019. It also can be seen that “public sector”, “urban sustainability”, “SDG”, “deforestation”, “insight”, and “the local government” are salient keywords between 2019 and 2020. From 2020 to 2022, “market” (2.0323) and “Indonesia” (2.0323) are key words, which shows the same word frequency. It indicates that in the past two years, project governance and sustainable development have paid more attention to developing countries and gradually shifted the market focus to some less developed countries and regions. With the development of project governance, developing countries have attracted more and more research interest among relevant experts, especially for promoting the sustainable development of project governance [60].

## 5. Discussion

For some time, the research hotspots in the field of project governance and sustainable projects were focused on environmental governance, including land governance, environmental sustainability, etc. The analysis of these is consistent with the views put forward by some previous scholars. Projects are business aspects, and recent literature has underlined the significance of including sustainability in projects [1]. Project governance needs to be more effective and efficient on the commercial side as well as pay more attention to environmental considerations in the twenty-first century. The study of relevant literature from 2018 to 2022 in this paper supports the views put forward by Lapia and Aramina [64]. Sustainability is growth that also protects the economy, society, and environment [65,66]. Because of the lack of sustainable practices, the average worldwide sea level has increased since 1960 at a rate of 1.8 mm per year, and since 1993 at a rate of 3.1 mm per year [6].

Thomson explains the importance of sustainable development [6], and the results of this paper's analysis of hotspots support his judgment well. The results of analysis in previous articles show that the future research hotspots for project governance and green projects are mainly focused on studies of developing countries and emphasise government involvement in governance, keywords that foreshadow future research hotspots [67]. In order to achieve environmental sustainability, Koppenjan advocated in 2015 that projects should take into account energy utilisation and environmental legislation [68]. This view of his coincides with the findings of the present study, which also indicates that environmental legislation is more conducive to the sustainable development of green projects at the project governance rate and will be a focus in this area for some time to come [10]. Furthermore, to the best of our knowledge, there are relatively few empirical data on the relationship between project governance and sustainability in the context of developing nations [69]. Additionally, the business sector is clearly the centre of the extant literature. Concurrently, developing nations are showing a significantly worsening trend in terms of failed initiatives. Public sector projects costing billions of dollars in India failed to meet their goals and were subsequently abandoned [70]. Similarly, Asian Development Bank noted that only 21.6% of Pakistan's partially funded public sector projects have been successful in the past eight years. Previous studies only addressed the impact of project governance characteristics on project success and relied on secondary data to comprehend the link [21,22]. The paper's prediction that developing countries are likely to be a hotspot for research in the subsequent period is also consistent with these views. Based on these facts, it can be understood why developing nations are lagging behind developed ones.

Although research on both project governance and sustainability has been considerable, Brent and Labuschagne contend that there is rarely agreement between the two subjects [67]. However, the results of this study show that in the past, project governance and sustainable development have been intermingled topics with increasing interest, which is contrary to the judgment of Brent and Labuschagne. The purpose of project governance is to provide leadership and a framework for decision making that relates corporate governance for long-term sustainability to the accountability and obligations related to the organisation's economic activities. Argwal's definition of project governance is consistent with the findings of this paper that project governance and sustainable development are closely linked [71].

Businesses have recently adopted environmental, social, and economic principles among their constituents in an effort to enhance sustainability within their organisations and among policymakers. Project-based companies should be ready to take on sustainability-related initiatives because projects and project governance are frequently regarded as crucial tools for carrying out the corporate strategy.

For project governance, the relationship between sustainability and project success, no keywords with a high correlation to project success were found in this study—but this does not mean that there is no correlation between them. In previous literature, the relationship between these three keywords has been studied, and it was concluded that sustainability is another component that contributes to project success. The European Union has created



over 530 million tonnes of demolition and construction garbage from various projects, which amounts to 25–30% of the total solid waste produced. After conducting a thorough investigation into the causes of project failure, Pinto and Mantel came to the conclusion that weak governance, unattainable project goals, and a failure to satisfy stakeholder demands were the primary culprits [10]. Similar to this, Sage thought that inefficiency and a lack of governance were two of the few potential causes of why initiatives failed [31]. Similarly, the majority of public sector projects in Pakistan are failing as a result of subpar project governance. Project governance has been found to be the most important factor in ensuring project success among the various factors mentioned. Additionally, Young and Joslin and Muller suggested the chances of project success [21,22].

With the above in mind, it can be stated that there is a strong affinity between project governance and sustainable development. For instance, one of the main pillars of governance towards realising sustainability is the implementation strategy, which depends on the mode of governance and perspective on sustainable projects. In addition, another steering wheel for achieving sustainable development is that societies are committed to take appropriate actions in bringing about such a paradigm. In this regard, diverse types of governance dominant in the community play a pivotal role in shaping the related paradigm—either to enhance or lessen it. Aside from that, project governance can promote sustainability pillars by overcoming the uncertainty that is intertwined with the type of governance controlling the related projects. The importance of uncertainty is due to the fact that sustainable projects have mostly been poorly understood, and their success has been doubtful. To solve this problem, the successful epitomes of sustainable projects being governed under an appropriate governance strategy need to be highlighted and presented to different stakeholders and end users involved in the related projects.

## 6. Limitations and Future Works

Though this review paper offers insightful pictures to the concerned academicians and practitioners, it is not bereft of limitations. In light of this, the following are the limitations intertwined with this study and the corresponding potential future works to be considered.

- Based on the comprehensive review undertaken, it is observed that the concept of artificial intelligence has not been yet introduced to the realm of SPG. This is the major limitation in the body of existing literature. The lack of such consideration leads not only to extra expenses imposed on the respective projects, but also it consumes the required resources at a great pace. Thus, the exploitation of artificial intelligence in SPG can yield fruitful results. Machine learning-based algorithms, soft computing-based algorithms (such as fuzzy sets theory), and meta-heuristic algorithms, amongst many others, could be the epitome of such utilisation.
- Another shortcoming observed in this review is tangled with the concept of probability; very few and scattered studies—if any—hitherto have been undertaken on SPG, in which the probability of the factors leading to the failure of respective projects has been taken into account. As such, the exploitation of probability- and stochastic-based algorithms, including the Bayesian technique, Monte Carlo simulation, Markov chains, and so forth, can tackle the uncertainty associated with such projects.
- Another major gap witnessed is that there have not been any studies delving into the cost–benefit analysis of SPG; thus, future research endeavours can focus on the cost–benefit analysis between the traditional type of project governance and the new type of project governance coupled with the sustainability concept.
- This review paper provides a detailed and comprehensive scientometric analysis, and as such, it has not critically reviewed the corpus of the literature. Thus, there is a need to conduct a critical review in future research.
- The focus of this work was to scientometrically review the existing body of knowledge (which is limited to the studies dealing with the governance of sustainability-based projects), the failure and the success of the related projects are beyond the scope of this



study. Thus, further studies can be undertaken to examine the failure and success of the related projects.

- The coverage of published studies on SPG is limited to five years in this review paper; thus, future research could take a wider span into consideration.

## 7. Conclusions

Despite the fact that the concept of sustainability has been well-studied and explored within the realm of project governance, there has been a dearth of a comprehensive review paper that meticulously analyses the existing corpus of literature hitherto and puts forward the research gaps and the corresponding future works to be undertaken. To fill this knowledge gap, we carried out a bibliometric review and various types of scientometric analyses by delving into the relevant body of knowledge reported in different databases. The major conclusions drawn from this undertaking are reflected in the following.

- (1) The inclination towards SPG among researchers and practitioners has been on the rise over the past years.
- (2) It is seen that the developed countries, led by the United Kingdom and the United States, are more advanced in the concerned field. It is also observed that there is a robust academic exchange between these countries.
- (3) Most of the keywords with high centrality rankings are related to the environment, stressing the importance of sustainable development in the area of project governance.
- (4) Within the realm of SPG, two important clusters are found, namely participation and land use, based on which the future hot topics can be predicted. The hot topics within the defined clusters are “industry”, “transition management”, “property rights”, and “natural resources”.
- (5) The two salient keywords are “public participation” and “insight”.

This state-of-the-art review offers several different research and managerial implications. As regards to the research implications, the emerging trends put forward in this study provide the researchers with fertile ground for exploring untouched research streams. Likewise, the researchers are given insight about the active scholars and prolific institutes, through which they can build up their connections towards promoting SPG. On the other hand, this study provides the concerned decision makers with crucial clusters to be focused on within the realm of SPG; thus, they can invest in those areas by assigning appropriate resources and budgets. Moreover, the concerned policy makers have been given insight about the areas and countries that are tangled up with difficulties in fostering SPG, and hence they can take the necessary actions to promote SPG in these regions.

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