

# Research Trends in Vernacular Architecture: A bibliometric study

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## Abstract

*Research about vernacular architecture is constantly evolving to include new building typologies, geographic regions, and new research approaches. The purpose of this paper is to examine the scientific literature in this field and identify the aspects and regions that might need investigation and the disciplines that can be involved in future research. A systematic analysis of published research about the topic was performed through a bibliometric methodology. Data related to more than 700 published articles was collected from the Web of Science and SCOPUS. Further computerized analysis was made to investigate the different characters of the collected data, such as the themes investigated, countries of the most published papers and the scientific fields involved in this research during the past 70 years.*

*The results show that the published scientific literature about vernacular architecture is progressively expanding, specifically after the turn of the third millennium. Research about this topic is not confined within the Humanities anymore. Rather, it has extended to include the field of “hard” sciences as well. It is being invested by multidisciplinary and transdisciplinary approaches. The present research also reveals a shift in the center of production of scientific literature, about the vernacular architecture from North America to Asia.*

**Keywords:** Bibliometric, Vernacular Architecture, Traditional Architecture, SCOPUS, Web of Science.

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## **Introduction.**

### **1. Definition and meaning of Vernacular Architecture:**

Vernacular architecture is a concept that is yet to be clearly defined in the field of architectural studies. The adjective “vernacular” is used interchangeably with other terms such as: “Folk”, “traditional”, “popular”, “local”, “indigenous”, “autochthone”, “ancestral”, “ethnic” and “rural”. It comes into contrast with the “intellectual”, “polite” or “formal” architecture. Etymologically, “vernacular” comes from Latin-Etruscan origin: “Vernaculus”, which means indigenous, native or domestic. The adjective “Vernacular” has been first introduced in the field of linguistics to identify a “vernacular” language as being the language specific to a particular era, region or group. In the field of architecture, this term defines the built environment, generally residential, which is particular to an era, a region, or to a certain people and was not imported from elsewhere.

In the Encyclopedia of the Vernacular Architecture of the World, vernacular architecture is defined as “the dwellings and all other buildings of a people, or a group, related to its environmental context and available resources” (Oliver, 1997). It is usually built by the owners (also users) or the community itself, for itself and with traditional technologies. As cited in Oliver (1987), F.L. Wright describes vernacular architecture as being a “folk architecture” that satisfies the actual needs of people, adapted to its environment with no intellectual thoughts. He claims that such architecture deserves to be studied by architects more than any other academic attempt for intentional beauty (Oliver, 1987).

As stated by Vellinga (2013), Brunskill defined vernacular architecture as a construction conceived by a “non-professional” builder, who would have followed a certain number of “rules” developed and adhered to within his community, without any consideration of what is “trendy” (Brunskill, 1978). The function that the building is meant for would be the main guiding consideration in the construction decisions. The aesthetic concerns, even though present to a certain extent, are of a rather limited effect on the building form. Similarly, the exclusive use of local materials and low technology construction methods is an important common character in all vernacular architecture throughout the world. Mercer (1975) elaborates this definition by using the concept of “common type” which is specific to a group in a given area and for a given period. For Mercer, a building is not of a vernacular character based on its own architectural properties. Rather, it is its “commonality” within a geographic area and for a certain span of time that makes it a vernacular type (Mercer, 1975). Furthermore, Rapoport (1969), distinguishes between “vernacular architecture” as being what people build for themselves by themselves, while “traditional architecture” is what is built for the people with the help of a trained person in the field of construction, a “master builder”, who knows the materials to be used and their properties, as well as the construction rules and codes to follow for this matter (Rapoport, 1969).

On the other hand, Noble (2013) argues that “folk” or “popular” architecture are those produced by people who are not trained in construction. He considers “vernacular architecture” also as part of the “common” production of construction, but could be built by “professionals” trained in the field, through apprenticeship for instance, and applying traditional technologies and local materials of construction. As for the “traditional architecture”, it is inherited and continued through generations. Its regulations and codes for construction are orally transmitted, mainly through imitation and repetition. This transmission takes place at all levels of the social hierarchy. Noble (2013) claims that this

“traditional” architecture includes also what is known as the “polite” architecture, which consists of the buildings with specific functions and with special aesthetic properties and symbolic meanings for the group. As for the “popular” architecture, it is the most commonly used in Eastern-Europe and is synonymous to “vernacular” (Noble, 2013).

All forms of vernacular architecture are built to respond to specific needs, while considering the economy, lifestyle and values of the communities that produce them. The physical context (climatic and geographical) is among the most influential factors in the built forms and solutions provided in any vernacular architecture. Through the process of trial and error, each people or group shaped its own vernacular architecture to adapt the best to the local environmental and geographic conditions, while responding to the requirements of the social codes and common worldview. Through the study and comparison of several types of dwellings in a variety of geographic locations in the world, Rapoport (1969) showed that in similar geographic and climatic contexts, different groups would adopt different solutions in their architecture. He asserts that, in the adoption of a certain form or composition in vernacular dwellings, it is indeed the socio-cultural requirements that supersede the climatic or other conditions of the geographic context (Rapoport, 1969).

## **2. State of the research about the vernacular architecture**

The study of vernacular architecture attracted the interest of researchers and practicing architects alike. Vellinga (2013) traces the earliest scholarship in this field back to the second half of the 19<sup>th</sup> century, in the works of Isham & Brown (1895) and Kimball (1922) in USA, and Scott (1857) in UK. The Arts and crafts movement in Europe triggered the interest of architects and designers in vernacular architecture and some of them even claimed that they were inspired by it. The early publications about what was referred to as “vernacular architecture” consisted of architectural and photographic surveys of built forms in a specific region and their classification based on formal criteria and architectonic details into types and styles (Upton, 1990). However, this period was marked mainly by the scholarship about vernacular architecture rather than by the architectural experiments in this matter. The vernacular architecture in these “catalogues” was depicted with admiration towards its “intuitive aesthetics” and “harmony” with its natural and social contexts (Vellinga, 2013).

In the early 1960s, the research scope in vernacular architecture spread beyond the western world to establish itself through cross-cultural, world-wide studies. The key publications of the time included the newly independent countries especially in Latin America, Africa, the Mediterranean region, Middle East, Asia and Australia (Rudofsky, 1964; Oliver, 1969; Rapoport, 1969; Bourdieu, 1970; Fathy, 1973; Upton, 1990). In fact, the term “vernacular architecture” was coined by Bernard Rudofsky, in 1964, in his book *Architecture without Architects*, which accompanied the exhibition, with the same title, curated for the Museum of Modern Art (MoMA) in New York, and featured several forms of vernacular architecture from the world. The work of Rudofsky and his predecessors was an influential step that triggered a worldwide interest into vernacular architecture by academics and practicing architects. The particularity of this movement lies in its approach to this architecture, not only as a heritage that needs to be documented, described, and “admired”, but as a source of knowledge and wisdom that needs to be deciphered and applied in new constructions (Fathy, 1973; Ravéreau, Roche and Fathy, 1981; Abu-Ghazze, 1997). It is worth mentioning that this new interest in vernacular architecture was different from the initial one in the fact that it was mainly happening in “emerging”

countries, confronted with a Western standardized modernity, and in cultures that needed acknowledgement and celebration through the recognition of their local architecture.

The work of the Egyptian architect Hassan Fathy in the village of Gourna (1945-1948) was the first experience of an architect in addressing social and environmental requirements by adopting a vernacular architectural language, using local materials and low-technology construction methods. In his project, Fathy studied the technique of the Nubian vault and integrated it in his designs, which were executed by Nubian masons. Due to economic and social complications, the new village of Gourna did not attract the population it was aimed for, but its buildings are still standing and inhabited until today. This experience, which Fathy narrated in his book *Architecture for the Poor*, marked the emergence of a new movement in architectural practice: “regionalism in architecture”, as an alternative to the modern and international styles (Fathy, 1973). Other architects followed Fathy in re-discovering their own vernacular architecture in order to propose some viable alternatives to the imported styles that started showing their shortcomings especially in adapting to the social and environmental contexts of regions they were built in. Among those pioneers was Charles Correa, Balkrishna Doshi, Sheila Sri Parkash (India), Muzharul-Islam and Bashirul-Haq (Bangladesh), Geoffrey Baura (Sri-lanka) and Aldo Van Eyck (Holland). They were followed by Samuel Mockbee, Paolo Soleri and Christopher Alexander who tried to find the adaptive characteristics of traditional architecture that could be applied “trans-culturally”.

After the descriptive approach by Rudofsky (1964), and the comparative analytic approach by Rapoport (1969), the scientific literature about vernacular architecture had another peak in the 1980s as a reaction to globalization that spread its industrialized uniformity all over the world. Many traditions and cultures were fading away along with their vernacular architecture. In order to preserve this ancestral knowledge, anthropologists, historians, geographers, sociologists and architects took the responsibility to document these traditions before their irreversible loss. An increasing number of architects have turned towards vernacular architecture in search for new inspirations and more authentic solutions to the problems of that time, largely dominated by concerns related to cultural authenticity and “bioclimatic” solutions in the habitat (Coch, 1998; Manzano-Agugliaro *et al.*, 2015). Research in this field was primarily focused on the arid and tropical regions of the world (Al-Motawakel, Probert and Norton, 1986; Alp, 1989; Al-Hinai, Batty and Probert, 1993; Manzano-Agugliaro *et al.*, 2015; Ozorhon and Ozorhon, 2019). Vernacular architecture was rediscovered under its ability to adapt to the geographic and climatic conditions. This aspect was also evoked in the previous periods, but was central since the 1980s onward (Didillon and Donnadiou, 1977; Ravéreau, Roche and Fathy, 1981; Fathy, 1986; Ravéreau, Roche and Lacheraf, 1989; Coch, 1998; Manzano-Agugliaro *et al.*, 2015).

The “bioclimatic” trend will culminate in the 2000s with the increase of the awareness about climate change and the need for more sustainable and less energy consuming solutions in architecture (Singh, Mahapatra and Atreya, 2009; Vissilia, 2009; Manzano-Agugliaro *et al.*, 2015). The interest in vernacular architecture mutated from its bioclimatic characteristics, to the properties of energy efficiency, passive design strategies and thermal performance. These questions were approached through quantitative research methods proper to the “hard” sciences, such as physics, mechanical engineering and the like (Ratti, Raydan and Steemers, 2003; Borong *et al.*, 2004; Ali-Toudert *et al.*, 2005; Şerefhanoğlu Sözen and Gedik, 2007; Singh *et al.*, 2010; Zhai and Previtali, 2010; Manzano-Agugliaro *et al.*, 2015; Toe and Kubota, 2015; Chandel, Sharma and Marwah,

2016; Nguyen *et al.*, 2019). Moreover, As it shall be demonstrated by the present bibliometric analysis, most of the scientific literature in the field of vernacular architecture studies focused on Asia (Zhai and Previtali, 2010; Manzano-Agugliaro *et al.*, 2015; Ozorhon and Ozorhon, 2019; Tuan *et al.*, 2019).

While some publications have questioned the validity of the “lessons”, to be found in vernacular architecture, for the development of the contemporary designs of dwellings and settlements (Meir and Roaf, 2006; Foruzanmehr and Vellinga, 2011; Vellinga, 2013), research in this field continues to investigate new aspects, such as local materials development (Al-Temeemi and Harris, 2004; Oikonomou and Bougiatioti, 2011; Niroumand, Zain and Jamil, 2013; Dixon *et al.*, 2015; Alrashed, Asif and Burek, 2017; Fernandes *et al.*, 2019; Meddah, Benkari and Al-Busaidi, 2019; Reddy, Mani and Walker, 2019; Meddah *et al.*, 2020), natural lighting performance (Michael *et al.*, 2017) and anti-seismic solutions (Oikonomou and Bougiatioti, 2011; Ahmad *et al.*, 2017; Lala, Gopalakrishnan and Kumar, 2017; Ortega *et al.*, 2017).

With the purpose of completing the knowledge about the state of research addressing the vernacular architecture in the world, the present study aims to assess the trends of the scientific research that investigated vernacular architecture and measure the scientific progress in this field. It also aims to identify the topics and regions that might need further studies and the disciplines that can be of a good insight in future research.

Through a bibliometric methodology, this study was designed to address the following questions:

- What is the intellectual structure of the field of research that addresses “vernacular architecture”?
- What are the networks of collaboration among countries in the field?
- What are the domains or subject clusters that are identified in “vernacular architecture” field?
- What is the relationship among top countries, top keywords and top sources?

To the authors’ best knowledge, this is the first bibliometric study with this amplitude that investigates the scholarly publications about vernacular architecture in English, Spanish and French.

## Literature Review

The analysis of the research produced about the Bibliometrics of vernacular architecture is still preliminary. As showed in the above paragraphs, several authors have contributed to research on vernacular architecture (Oliver, 1997, Fathy, 1973; Rapoport, 1969; Noble 2013). There are few publications related to the impact of literature in vernacular architecture and very few related to vernacular architecture bibliometrics.

Most of the publications in the literature of vernacular architecture are related to specific elements such as thermal comfort, energy, earthquakes, or geographic region (Upton, 1983; Campbell, 2003; Ortega *et al.*, 2017). There are several publications related to Bibliography of Vernacular Architecture without the inclusion of bibliometrics studies (de Zouche Hall, 1972; Gailey, 1979; Cuthbert, Ward and Keeler, 1985). The

Archeological Data Service of the United Kingdom has an online Bibliography of the Vernacular Architecture Group (Vernacular Architecture Group, 2016). Various bibliometric data analysis may include vernacular as part of a specific architecture theme in areas such as construction (Minhas and Potdar, 2020), or Islamic architecture (Harande, 2015). A study published bibliometric data analysis for heritage buildings (Morkūnaitė, Kalibatas and Kalibatienė, 2019). In this study, the main categories found in publications in the subject were: Environmental Sciences, Geo-sciences Multidisciplinary, and Environmental Studies. Other publications are historical vernacular studies (Upton, 1990) or literature reviews of vernacular architecture (Brunskill, 1983). None of them included bibliometric research. There is a book in French about Bibliography of vernacular architecture in France, (Meirriion-Jones, 1978). This book has some references to older publications, but there are many errors in the citations (Bernot, 1979).

There are very few studies about the general impact of literature in the vernacular field. One example is a study that employed archival research methods to examine 127 studies on vernacular architecture with data from Scopus, SpringerLink, and Google, (Nguyen, *et al.*, 2019). The number of samples for this data is relatively small; the results show an uneven geographic and climatic distribution of the studies. China, Iran, Malaysia, Turkey, and India have emerged as research centers of vernacular architecture, while Russia, Central Asia, Africa, America, and Australia still lack studies. It was observed in this investigation that there are more studies in warm and hot climates than in cold climates.

The work of Vellinga presented a general review of the research published in the West and English language (Vellinga, 2013). This research affirms how all forms of architecture, such as vernacular are dynamic and complex and possess sustainable qualities and others that are not. Using an archival methodology, Manzano-Agugliaro *et al.* (2015) investigated the scientific research that addressed bioclimatic architecture using vernacular architecture strategies in different climatic zones. This research concluded how vernacular architecture represents a development basis for bioclimatic architecture strategies in different climatic zones of the world.

More recently, (Ozorhon and Ozorhon, 2019) analyzed the profile of 428 articles in the area of vernacular architecture, and endeavored a bibliometric study about this topic based on papers between 2000 and 2018 posted on the Web of Science (WoS). The studies of vernacular architecture were analyzed using the keywords: protecting, learning, and developing. The study found that most literature reviews in vernacular architecture can be categorized in to two parts: the transfer of vernacular architecture in modern design, or its relation with location (context). It concludes how publications related to the integration of vernacular architecture with contemporary knowledge and technology have increased in recent years. There is no bibliographic reference to any similar study in this publication.

None of the above mentioned publications has addressed research about vernacular architecture through a systematic analysis of the scientific literature in this field since the turn of the 20<sup>th</sup> century. Therefore, the present study is justified, timely and may contribute to future development of research about this topic.

## Materials and Methods

This study applied a bibliometric method for a systematic and exhaustive analysis of the scientific research about the subject of “vernacular architecture”. “Bibliometrics” consists of the study of the quantitative aspects of the scholarly publications, dissemination,

and the use of citation information by the application of mathematical and statistical methods to papers, books and other resources (Jamali, *et al.*, 2015). The bibliometric approach is generally used to assess research trends in a specific scientific area or discipline (Ale Ebrahim, *et al.*, 2019; Li, *et al.*, 2009). Bibliometric methods are also used to measure scientific progress in the different disciplines of science and engineering. They are a common research instrument for the systematic analysis of publications (Kalantari *et al.*, 2017). The number of papers published and citations received are two of the main indicators for a bibliometric analysis (Hirsch, 2007; Patterson and Harris, 2009). The information generated from bibliometric analysis can contribute to further developed studies and guide scholars towards producing effective and qualified research (Asgari, Hamid and Ale Ebrahim, 2017).

Nowadays, a number of tools have made it easier to produce bibliometric reports (Ellegaard and Wallin, 2015). These tools range from databases such as Web of Science (WoS), SCOPUS, and Google Scholar (Martín-Martín *et al.*, 2018). As a free-of-charge database offered by the giant Google search engine, Google Scholar, has been suggested as an alternative or complementary resource to the commercial citation databases like WoS or Scopus (Aguillo, 2012; Ale Ebrahim *et al.*, 2014). However, Google Scholar provides free access to all types of scholarly documents which makes it questionable as an effective source for scientific papers, due to its sporadic coverage. WoS and Scopus are the most widespread databases on different scientific fields, which are used for searching literature (Aghaei Chadegani *et al.*, 2013). Therefore, in the present study, the coverage of “vernacular architecture” research from SCOPUS and WoS databases were compared to each other against the number of documents and then the best one was selected.

### Data collection

The present research objectives intersect with some of the previous publications such as (Meir and Roaf, 2006; Manzano-Agugliaro *et al.*, 2015; Ozorhon and Ozorhon, 2019). It is however based on a wider spectrum of publications and a larger span of time (since the second half of the 20<sup>th</sup> century). The initial sets of data collected were based on “vernacular architecture/buildings” title search. The results were first investigated manually. Many irrelevant documents to our research area were identified. Therefore, the search used the double quotations (“”) to force the database to return documents which contain the exact search term like “vernacular architecture”. The second round of data was collected based on title search, from two well-known databases Web of Science (WoS) and SCOPUS. The title search terms consisted of “vernacular architecture/building\*” OR “traditional architecture/building\*” OR “local architecture/building\*” OR “popular architecture/building\*” OR “folk architecture/building\*” OR “indigenous architecture/building\*” OR “ethnic architecture/building\*” OR “primitive architecture/building\*” OR “aboriginal architecture/building\*” OR “ancestral architecture/building\*” OR “anonymous architecture/building\*” OR “spontaneous architecture/building\*” OR “non-Pedigree architecture/building\*” OR “rural architecture/building\*”. The “star” symbol (\*) represents any characters like “s”. The same search terms were used to retrieve data from WoS and SCOPUS. The search returned 715 and 437 documents from WoS and SCOPUS respectively. The WoS is the most appropriate and trustworthy database for literature retrieval and analysis (Aghaei Chadegani *et al.*, 2013; Ghanbari Baghestan *et al.*, 2019). Therefore, the data collected from WoS database was considered for this research. The 715 documents were analyzed by Bibliometrix-package (<http://www.bibliometrix.org/>), which is an R-Tool for science mapping (Aria, M.

and Cuccurullo, 2017). Table 1 shows a summary of the main information of collected Bibliometric data from WoS.

The primary limitation of this bibliometric study was the data collected from the Web of Science database. Therefore, due to less coverage in the field of vernacular architecture, SCOPUS database was ignored. This may have introduced some data collection bias. The limited number of documents which were indexed by SCOPUS only allow to think that this research results provide reasonable confidence of the findings within the field of study.

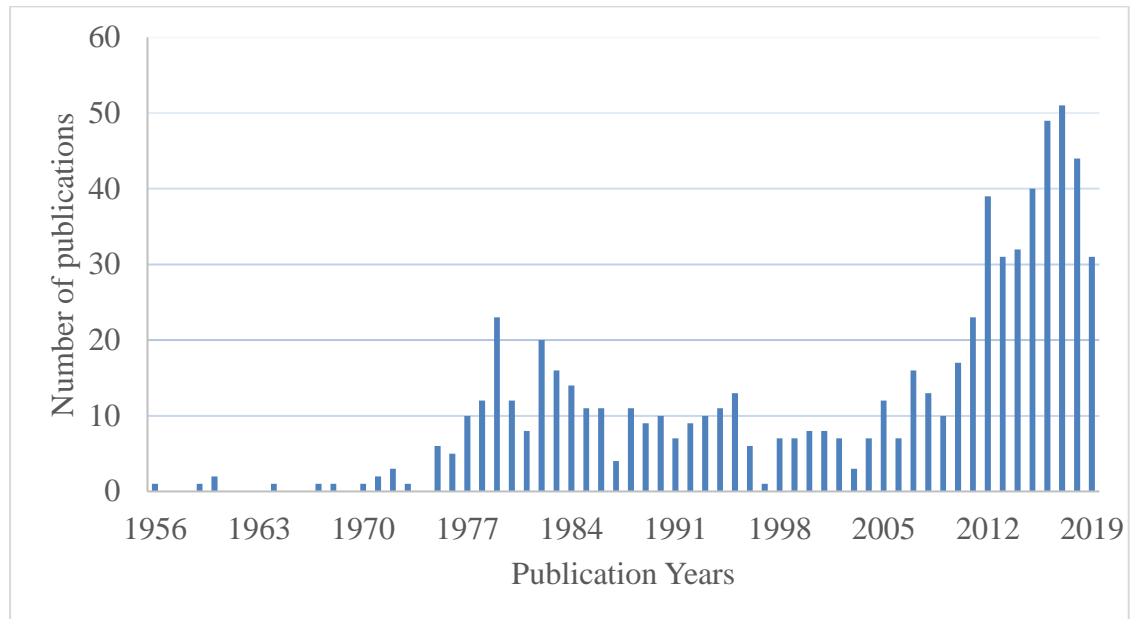
## Results and discussion

The Figure 1 presents the distribution of the collected 715 documents, per year of publication (Fig. 1). The overall increase in the number of publications about vernacular architecture is observable through the years, with a clear rise since the last decade. As shown in Fig. 2, the published research that addressed the different aspects of vernacular architecture was first led by researchers from North America and Europe (UK and Germany essentially) (Fig. 2).

**Table 1.** Summary of the main information of collected Bibliometric data (Source: WoS)

Description	Results
Documents	715
Sources (Journals, Books, etc.)	436
Keywords Plus (ID)	422
Author's Keywords (DE)	1175
Period	1956 – 2019
Average citations per documents	2.81
Authors	1219
Authors of single-authored documents	337
Authors of multi-authored documents	882
Single-authored documents	403
Documents per Author	0.587
Authors per Document	1.7
Co-Authors per Documents	1.97
Collaboration Index	2.83

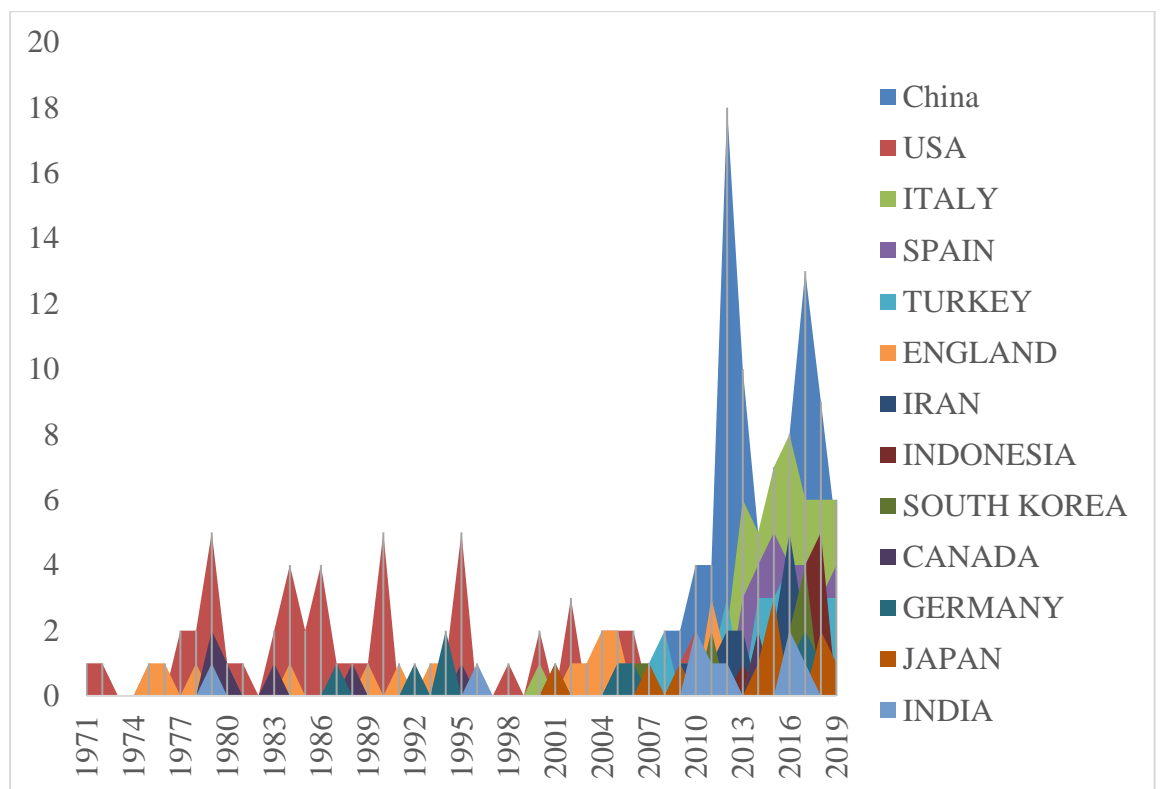




**Fig. 1:** The distribution of the 715 publications per year

Source: Authors based on Data collected from WoS

However, with the turn of the new millennium, the lead was taken by authors from Asian countries such as China, India, Iran, Turkey or South Korea, with the emergence of two European countries: Italy and Spain (Fig. 2). This confirms the observations formulated above in our review of the scientific literature. As shown in Table 2, the Asian countries represent 50% from this worldwide list, and China leads the top ten countries whose authors published the highest number of papers about vernacular architecture.

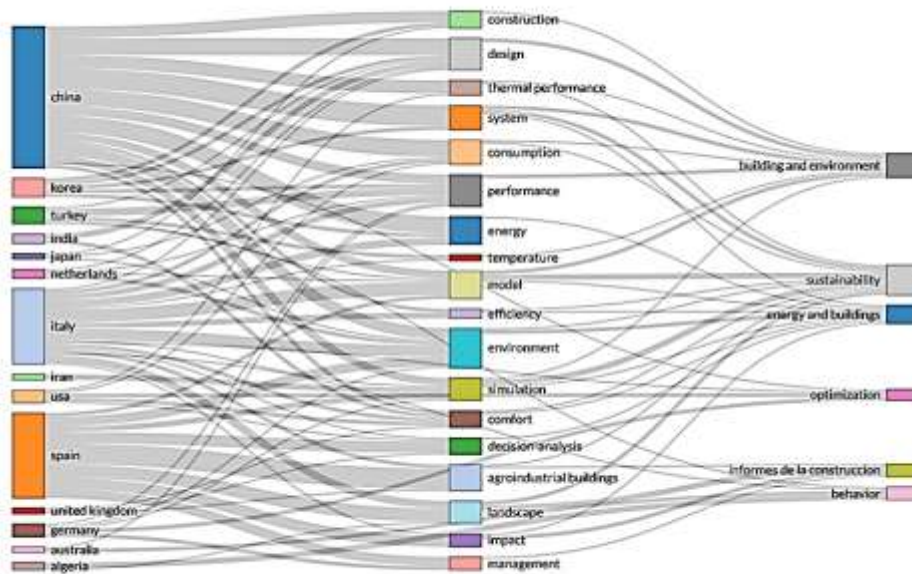


**Fig. 2:** The distribution of the 715 publications per year and per country of their authors

Source: Authors based on Data collected from WoS

**Table 2.** Top 20 countries that produce the most documents in the research area  
Source: Data collected from WoS

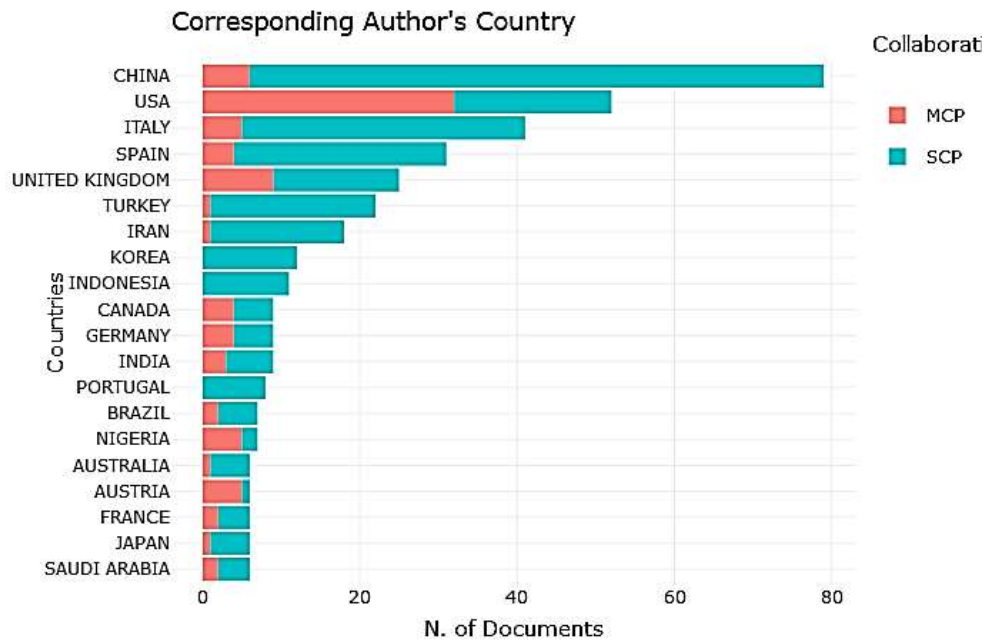
Countries/Regions	Records	% of 715
PEOPLE'S Republic of CHINA	85	11.87
USA	65	9.08
ITALY	51	7.12
SPAIN	33	4.61
TURKEY	25	3.49
ENGLAND	24	3.35
IRAN	19	2.65
INDONESIA	12	1.68
SOUTH KOREA	12	1.68
CANADA	11	1.54
GERMANY	11	1.54



**Fig. 3:** Three-Fields Plot on Top Countries  
Source: Authors based on Data collected from WoS

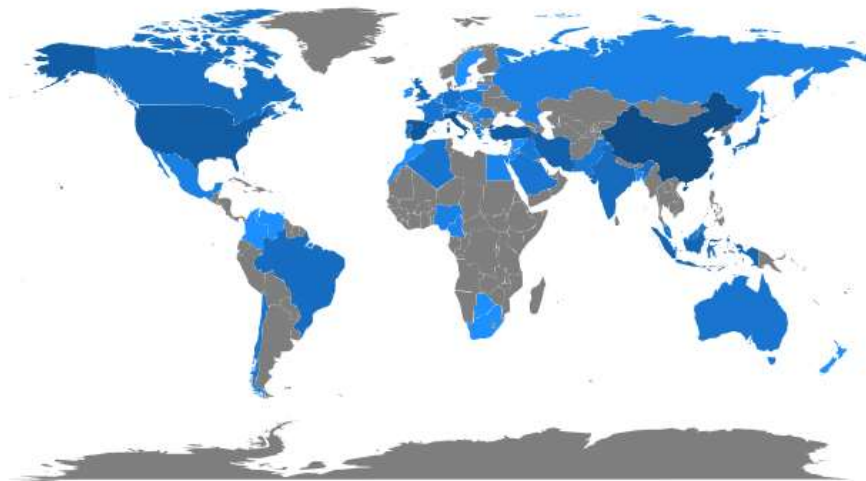
The relationships among *Top Countries*, *Top “Keywords Plus”* and *Top Sources* is presented in (Fig. 3). “*Keyword plus*”, generated by an automatic computer algorithm, are words or phrases that appear frequently in the titles of an article’s references and not necessarily in the title or keywords of that particular article. China then Italy and Spain are the leading countries producing scientific publications related to vernacular architecture studies (Fig. 3). The *Top sources* where this literature is published are “Building and Environment”, “Sustainability” and “Energy and Buildings”. This result goes in line with the findings of previous research about the subject (Vellinga, 2013; Manzano-Agugliaro *et al.*, 2015; Ozorhon and Ozorhon, 2019). This shows that *Osterreichische zeitschrift fur*

*volkskunde* is the first place where “vernacular architecture” researchers have their papers published. Our investigation shows a distribution over three main groups by order of number of articles in each journal. While the group of journals in the bottom is clearly in the field of “hard” sciences and sustainability, the two other groups include different titles specialized in architecture, energy, environment and history of architecture.



**Fig. 4:** Top 20 countries of publication based on corresponding author  
Source: Authors based on Data collected from WoS

## Country Scientific Production



**Fig. 5:** Country Scientific Production  
Source: Authors based on Data collected from WoS

When only the nationality of the corresponding author was considered, China and USA (dark blue Color in Figure 6) were at the top for Single Country Publications (SCP)

and Multiple Country Publications (MCP) respectively. They are followed by Italy and Spain (

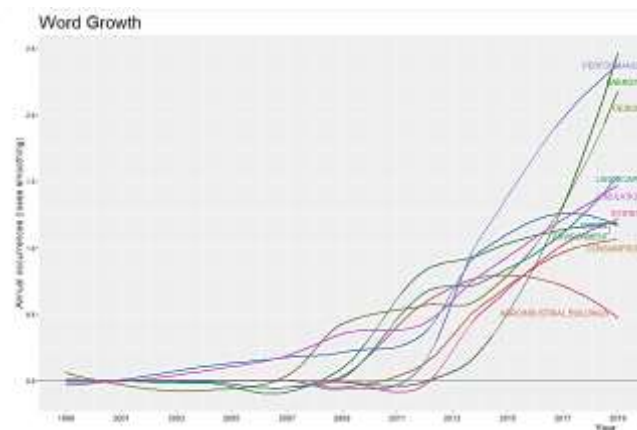
Fig. 4). It is worth noticing that the proportion of SCP to MCP is inverted in USA and China (Fig. 5).



**Fig. 6.** Word Cloud of Top Authors' Keywords.  
Source: Authors based on Data collected from WoS

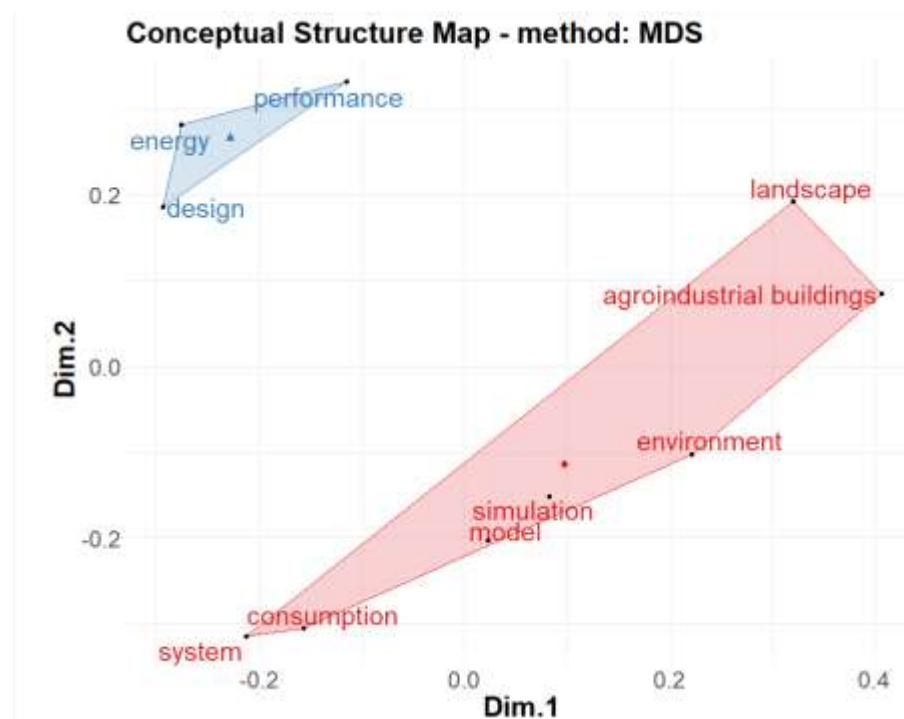
Fig. 6 shows a word cloud of Author's keywords listed in the collected research papers. The general terms highlighted are "rural buildings", "cultural heritage", "vernacular architecture" and "traditional buildings". However, apart from these general terms, some of the attracted keywords are "rural architecture", "conservation", "building materials" and "rural heritage". The cloud depicts that "vernacular architecture" has high potential in these research fields and would mark an increment in the amount of publications about "Vernacular architecture" in the near future.

From Fig. 7 below, it is clear that the top keywords chosen by researchers to publish their papers about vernacular architecture are in "performance", "energy", and then "design". These three places represent a group well above the others. This finding confirms the observations formulated by Meir & Roaf and the trends identified by Manzano-Agugliaro et al. and Ozorhon & Ozorhon in their studies (Meir and Roaf, 2006; Manzano-Agugliaro *et al.*, 2015; Ozorhon and Ozorhon, 2019).



**Fig. 7:** Annual Word Keyword Plus Growth  
Source: Authors based on Data collected from WoS

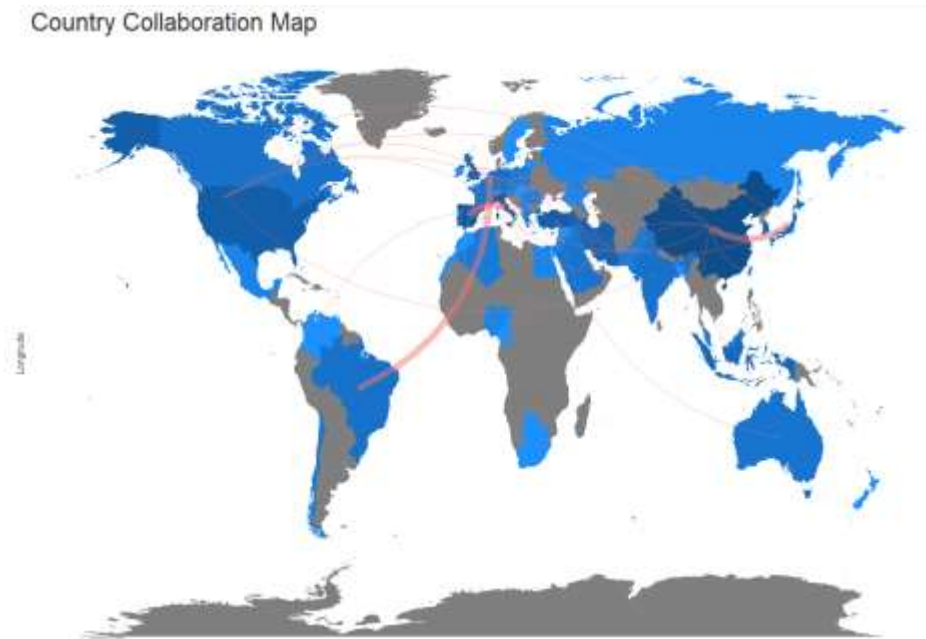
The conceptual structure map of the keywords associated with Vernacular architecture articles included in this study is presented in Fig. 8. This map was obtained through a Multiple Correspondence Analysis (MCA). These data indicate that the articles included in our analysis can be organized into two primary clusters, which represent the intellectual structure of vernacular architecture articles. While a comprehensive review of the contents of these two clusters is beyond the scope of the present study, a few illustrative examples demonstrate the diversity, breadth, and intellectual thrust of the work undertaken in each cluster. While the articles that fell into the Cluster 1 address topics that can be grouped following 3 keywords: “energy”, “performance” and “design”. Cluster 2 is the most comprehensive and the largest identified in our analysis. It gathers articles which “*Keywords Plus*” are close together. This cluster contains 7 separate “*Keywords Plus*”, which are: “landscape”, “agro industrial buildings”, “environment”, “simulation” “model”, “consumption” and “system”. More specifically, the articles grouped in this cluster contain general discussions about Vernacular architecture.



**Fig. 8:** Conceptual structure map of keywords plus clusters  
Source: Authors based on Data collected from WoS

Fig. 10. below shows the country collaboration worldwide. The blue color indicates the existence of collaboration in the concerned country. The dark blue specifies a higher frequency of collaboration with other countries. The nodes in this figure represent the main countries, while the size of nodes is determined by their number of publications. The red lines between nodes signify the co-occurrence relationship between countries. The number and thickness of lines between the nodes reflects the closeness or looseness of the links among different countries. According to the correlation analysis of main countries, the co-occurrence results indicate that the countries that actively collaborate with others are United States, United Kingdom, China, Iran and Turkey. This result demonstrates that

collaborations among countries are key factors in the amount of publications compared to publications in a single country.



**Fig. 10.** Network map of collaboration (Source: Authors based on Data collected from WoS)

## Conclusions

The purpose of the present study was to measure the progress of the scientific research about vernacular architecture and assess its trends and the areas that need to be further investigated. Through a bibliometric methodology, a systematic analysis of published literature about the subject was performed. Data about more than 700 published articles was collected from the Web of Science (WoS), by using multiple combinations of keywords related to the topic of study. Further computerized analysis was made to investigate different characters of the collected data such as the countries of the most published papers, the themes investigated in this topic and the scientific fields involved in such research since the past 70 years.

The findings of this study revealed a steady increase of the number of scientific papers published about vernacular architecture, especially after the turn of the third millennium. Similarly, after having been led by North America and the UK, research in this field is clearly shifting towards the Asian countries with China as a main source for such studies. It is followed by European countries such as Spain and Italy.

Furthermore, the methodologies involved in this field of research are gradually dominated by quantitative approaches through the calculation and simulation of the thermal comfort and energy performance of vernacular buildings. This had a certain effect on the fact that research papers about vernacular architecture are the most published in “building”, “energy” and “environment” focused journals. This is a clear shift from the research interest and methods used during the previous millennium, and which have employed predominantly qualitative approaches and focused primarily on the exploration and interpretation of the socio-cultural aspects of vernacular architecture. This tendency towards building physics and quantitative approaches is a common trait in the actual evolution of research in architecture in general, probably facilitated by the rapid development of digital technology and efficient simulation software. It can be considered

as an attempt to establish the efficiency and the sustainability of the diverse solutions used in vernacular architecture in addressing the challenges faced by humanity in the 21<sup>st</sup> century. Such a quantitative approach shows, by the numbers, the wisdom embedded in vernacular architecture which was only “felt” and described in the publications of the 19<sup>th</sup> and 20<sup>th</sup> centuries.

One can ponder about the validity and the power bestowed on the language of numbers and simulations to legitimize vernacular architecture as an option worth contemplating for contemporary designs. Isn't this quantitative approach reductive of the wide essence of this architecture? The *Encyclopedia of Vernacular Architecture of the World* by Paul Oliver puts this subject as an option worth exploring to ensure the development of a sustainable architecture. Sustainability here is assumed with its three facets: environmental, cultural and economic (Oliver, 1997). As stated by this author, there isn't a clearly defined discipline that can study vernacular architecture. The present research has proven this statement to be true. It has also confirmed that this field of studies is increasingly globalized and evolving, with its methodologies and mode of action, more trans-disciplinary and inter-disciplinary approaches, as argued by Rapoport (2008).

The present bibliometric analysis of the research production about the vernacular architecture, is the first study to systematically examine the published literature about this topic during the past 70 years. It has revealed some of the important characteristics of this field of research and identified potential areas where research can be further developed. Based on the findings of this research, several parts of the world, apart from China, India, Europe and North America still need to have their vernacular architecture recorded and analyzed. If the question of building performance, energy saving and sustainability are crucial in studying vernacular architecture, they need to be addressed also within the context of the construction materials, design strategies, elements and patterns, in order to employ them with adaptation in the contemporary architecture. Further studies are also needed to explore vernacular architecture from other emerging perspectives, such as the question of adaptive behavior or physical and mental healing. It is expected that such investigations might emphasize the findings of the present research, by casting light on some new aspects in this debate.

## References:

- Abu-Ghazze, T. M. (1997) ‘Vernacular architecture education in the Islamic society of Saudi Arabia: Towards the development of an authentic contemporary built environment’, *Habitat International*, 21(2), pp. 229–253. doi: 10.1016/S0197-3975(96)00056-2.
- Aghaei Chadegani, A. *et al.* (2013) ‘A Comparison between Two Main Academic Literature Collections: Web of Science and Scopus Databases’, *Asian Social Science*, 9(5), pp. 18–26. doi:10.5539/ass.v9n5p18.
- Aguillo, I. F. (2012) ‘Is Google Scholar useful for bibliometrics? A webometric analysis.’, *Scientometrics*, 91(2), pp. 343–351. doi: 10.1007/s11192-011-0582-8.
- Ahmad, B. *et al.* (2017) ‘Seismic risk reduction through indigenous architecture in Kashmir Valley’, *International Journal of Disaster Risk Reduction*, 21(June 2016), pp. 110–117. doi: 10.1016/j.ijdr.2016.11.005.
- Al-Hinai, H., Batty, W. J. and Probert, S. D. (1993) ‘Vernacular architecture of Oman: Features that enhance thermal comfort achieved within buildings’, *Applied Energy*, 44(3), pp. 233–258.

- Al-Motawakel, M. K., Probert, S. D. and Norton, B. (1986) 'Thermal Behaviours of vernacular buildings in Yemen Arab Republic', *Applied Energy*, 24(4), pp. 245–276.
- Al-Temeemi, A. A. and Harris, D. J. (2004) 'A guideline for assessing the suitability of earth-sheltered mass-housing in hot-arid climates', *Energy and Buildings*, 36(3), pp. 251–260. doi: 10.1016/j.enbuild.2003.12.005.
- Ale Ebrahim, N. *et al.* (2014) 'Equality of Google Scholar with Web of Science Citations: Case of Malaysian Engineering Highly Cited Papers.', *Modern Applied Science*, 8(5), pp. 63–69. doi: 10.5539/mas.v8n5p63.
- Ale Ebrahim, S. *et al.* (2019) 'Publication Trends in Drug Delivery and Magnetic Nanoparticles.', *Nanoscale Research Letters*, 14(59). doi: 10.1186/s11671-019-2994-y.
- Ali-Toudert, F. *et al.* (2005) 'Outdoor thermal comfort in the old desert city of Beni-Isguen, Algeria', *Climate Research*, 28(3), pp. 243–256. doi: 10.3354/cr028243.
- Alp, A. V. (1989) 'Vernacular climate---control in desert architecture', in Fernandes, E. and Yannas, S. (eds) *Energy and Buildings for Temperate Climates*. Oxford: Pergamon Press, pp. 67–80.
- Alrashed, F., Asif, M. and Burek, S. (2017) 'The Role of Vernacular Construction Techniques and Materials for Developing Zero-Energy Homes in Various Desert Climates', *Buildings*, 7(17), pp. 1–19. doi: 10.3390/buildings7010017.
- Aria, M. and Cuccurullo, C. (2017) 'Analysis., bibliometrix: An R-tool for comprehensive science mapping', *Journal of Informetrics*, 11(4), pp. 959-975. doi: <https://doi.org/10.1016/j.joi.2017.08.007>.
- Asgari, A., Hamid, A. B. A. and Ale Ebrahim, N. (2017) 'Supply Chain Integration: A Review and Bibliometric Analysis.', *International Journal of Economics & Management Sciences*, 6(5 (Articles in Press)), p. 2. doi: 10.4172/2162-6359.1000447.
- Bernot, L. (1979) 'Gwyn I. Merion-Jones, La maison traditionnelle. Bibliographie de l'architecture vernaculaire en France.', *Études rurales*. Éditions de l'École des Hautes Études en Sciences Sociales, 73(1), pp. 156–157.
- Borong, L. *et al.* (2004) 'Study on the thermal performance of the Chinese traditional vernacular dwellings in summer', *Energy and Buildings*, 36, pp. 73–79. doi: doi:10.1016/S0378-7788(03)00090-2.
- Bourdieu, P. (1970) 'La maison kabyle ou le monde renversé', *Echanges et communications, Mélanges offerts à Claude Lévi-Strauss à l'occasion de son 60eme anniversaire*, pp. 739–758.
- Brunskill, R. (1978) *Illustrated handbook of vernacular architecture*. Faber & Fab. London.
- Brunskill, R. (1983) 'Vernacular architecture: a review of recent literature', *JSTOR*. JSTOR, pp. 105–112. Available at: <https://www.jstor.org/stable/1568440> .
- Campbell, J. W. P. (2003) 'The study of bricks and brickwork in England since Nathaniel Lloyd', in *Proceedings of the First International Congress on Construction History (Madrid, 20th-24th January 2003)*. Madrid, pp. 379–389.
- Chandel, S. S., Sharma, V. and Marwah, B. M. (2016) 'Review of energy efficient features in vernacular architecture for improving indoor thermal comfort conditions', *Renewable and Sustainable Energy Reviews*, 65, pp. 459–477. doi: <https://doi.org/10.1016/j.rser.2016.07.038>.



Coch, H. (1998) 'Bioclimatism in vernacular architecture', *Renewable & sustainable energy reviews*, 2(1–2), pp. 67–87. doi: 10.1016/b978-008043004-1/50014-1.

Cuthbert, J. A., Ward, B. and Keeler, M. (1985) *Vernacular Architecture in America: A Selective Bibliography*. GK Hall. Available at: <https://www.worldcat.org/title/vernacular-architecture-in-america-a-selective-bibliography/oclc/11344045>.

Didillon, H. & J.-M. and Donnadiou, C. & P. (1977) *Habiter le désert: les maisons mozabites: recherches sur un type d'architecture traditionnelle pré-saharienne*. Editions M. Brussels.

Dixon, P. G. *et al.* (2015) 'Comparison of the structure and flexural properties of Moso, Guadua and Tre Gai bamboo', *Construction and Building Materials*. Elsevier Ltd, 90, pp. 11–17. doi: 10.1016/j.conbuildmat.2015.04.042.

Ellegaard, O. and Wallin, J. (2015) 'The bibliometric analysis of scholarly production: How great is the impact?', *Scientometrics*, pp. 1–23. doi: 10.1007/s11192-015-1645-z.

Fathy, H. (1973) *Architecture for the Poor: Experiment in Rural Egypt*. The University of Chicago Press.

Fathy, H. (1986) *Natural Energy and Vernacular Architecture. The United, Principles and Examples with Reference to Hot Arid Climates. The United. Chicago, London, Tokyo: The University of Chicago Press.* Available at: <http://archive.unu.edu/unupress/unupbooks/80a01e/80A01E00.htm#Contents>.

Fernandes, J. *et al.* (2019) 'Passive strategies used in Southern Portugal vernacular rammed earth buildings and their influence in thermal performance', *Renewable Energy*, 142, pp. 345–363. doi: 10.1016/j.renene.2019.04.098.

Foruzanmehr, A. and Vellinga, M. (2011) 'Vernacular architecture: Questions of comfort and practicability', *Building Research and Information*, 39(3), pp. 274–285. doi: 10.1080/09613218.2011.562368.

Gailey, A. (1979) 'MAISON-TRADITIONNELLE-BIBLIOGRAPHY OF FRENCH VERNACULAR ARCHITECTURE-FRENCH-MEIRIONJONES, GI'. ULSTER FOLK TRANSPORT MUSEUM 153 BELFAST RD CULTRA, HOLYWOOD BT18 0EU, NORTH ....

Ghanbari Baghestan, A. *et al.* (2019) 'A Crisis in "Open Access": Should Communication Scholarly Outputs Take 77 Years to Become Open Access?', *SAGE Open*, 9(3). doi: 10.1177/2158244019871044.

Harande, Y. I. (2015) 'Knowledge Diffusion through Islamic Architecture: A Bibliometric Analysis', *Middlebelt Journal of Library and Information Science*, 14.

Hirsch, J. (2007) 'Does the h index have predictive power?', 104, pp. 19193–19198. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2148266/pdf/zpq19193.pdf>.

Jamali, S. M., Md Zain, A. N., Samsudin, M. A. and Ale Ebrahim, N. (2015) 'Publication Trends in Physics Education: A Bibliometric study.', *Journal of Educational Research*, 35(19-36.). doi: 10.5281/zenodo.801889.

Kalantari, A. *et al.* (2017) 'A Bibliometric Approach to Tracking Big Data Research Trends', *Journal of Big Data*, 4(30), pp. 1–18. doi: 10.1186/s40537-017-0088-1.

Lala, S., Gopalakrishnan, N. and Kumar, A. (2017) 'A Comparative Study on the Seismic Performance of the Different Types of Bamboo Stilt Houses of North-East India', *Journal of Environmental Nanotechnology*, 6(2), pp. 59–73. doi: 10.13074/jent.2017.06.172249.

- Li, L. L. *et al.* (2009) 'Global stem cell research trend: Bibliometric analysis as a tool for mapping of trends from 1991 to 2006', *Scientometrics*, 80(1), pp. 39–58. doi: :10.1007/s11192-008-1939-5.
- Manzano-Agugliaro, F. *et al.* (2015) 'Review of bioclimatic architecture strategies for achieving thermal comfort', *Renewable and Sustainable Energy Reviews*, 49, pp. 736-755.
- Martín-Martín, A. *et al.* (2018) 'Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories', *Journal of Informetrics*, 12(4), pp. 1160-1177.
- Meddah, M. S. *et al.* (2020) 'Sarooj mortar: From a traditional building material to an engineered pozzolan -mechanical and thermal properties study', *Journal of Building Engineering*. Elsevier Ltd, 32(June), p. 101754. doi: 10.1016/j.jobee.2020.101754.
- Meddah, M. S., Benkari, N. and Al-Busaidi, M. (2019) 'Potential Use of Locally and Traditionally Produced Bending Construction Material', *iopscience.iop.org*. Institute of Physics Publishing, 471(4). doi: 10.1088/1757-899X/471/4/042008.
- Meir, I. A. and Roaf, S. C. (2006) 'The Future of the Vernacular: Towards New Methodologies for the Understanding and Optimization of the Performance of Vernacular Buildings', in Asquith, L. and Vellinga, M. (eds) *Vernacular Architecture in the 21st Century Theory, Education and Practice*. Taylor & F. London: Taylor & Francis, p. 312. doi: <https://doi.org/10.4324/9780203003862>.
- Meirion-Jones, G. I. (1978) *La maison traditionnelle, bibliographie de l'architecture vernaculaire en France*. Paris.
- Mercer, E. (1975) *English vernacular houses. A study of traditional farmhouses and cottages*. Royal comm. London: Royal commission on historical monuments, London, Her Majesty's Stationary Office.
- Michael, A. *et al.* (2017) 'Lighting performance of urban vernacular architecture in the East-Mediterranean area: Field study and simulation analysis', *Indoor and Built Environment*, 26(4), pp. 471–487. doi: 10.1177/1420326X15621613.
- Minhas, M. R. and Potdar, V. (2020) 'Decision Support Systems in Construction: A Bibliometric Analysis', *Buildings*. Multidisciplinary Digital Publishing Institute, 10(108), p. 26 pages. Available at: <https://www.mdpi.com/2075-5309/10/6/108>.
- Morkūnaitė, Ž., Kalibatas, D. and Kalibatienė, D. (2019) 'A bibliometric data analysis of multi-criteria decision making methods in heritage buildings', *Journal of Civil Engineering and Management*, 25(2), pp. 76–99.
- Nguyen, A. T., Truong, N. S. H., Rockwood, D., Tran Le, A. D., *et al.* (2019) 'ScienceDirect Studies on sustainable features of vernacular architecture in different regions across the world : A comprehensive synthesis and evaluation', *Frontiers of Architectural Research*. Elsevier Ltd, 8(4), pp. 535–548. doi: 10.1016/j.foar.2019.07.006.
- Nguyen, A. T., Truong, N. S. H., Rockwood, D. and Tran Le, A. D. (2019) 'Studies on sustainable features of vernacular architecture in different regions across the world: A comprehensive synthesis and evaluation', *Frontiers of Architectural Research*, 8(4). doi: 10.1016/j.foar.2019.07.006.
- Niroumand, H., Zain, M. F. M. and Jamil, M. (2013) 'Assessing of Critical Parametrs on Earth Architecture and Earth Buildings as a Vernacular and Sustainable Architecture in Various Countries', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 89, pp. 248–260. doi: 10.1016/j.sbspro.2013.08.843.
- Noble, A. (2013) *Vernacular buildings: a global survey*. Bloomsbury. London: I.B. Tauris.

Oikonomou, A. and Bougiatioti, F. (2011) 'Architectural structure and environmental performance of the traditional buildings in Florina, NW Greece', *Building and Environment*. Elsevier Ltd, 46(3), pp. 669–689. doi: 10.1016/j.buildenv.2010.09.012.

Oliver, P. (1969) *Shelter and Society*. Barrie and. Edited by P. Oliver. London.

Oliver, P. (1987) *Dwellings: the house across the world*. Phaidon.

Oliver, P. (1997) *Encyclopedia of vernacular architecture of the world*. Cambridge. Edited by P. Oliver. Cambridge.

Ortega, J. *et al.* (2017) 'Traditional earthquake resistant techniques for vernacular architecture and local seismic cultures: A literature review', *Journal of Cultural Heritage*, 27, pp. 181–196. doi: 10.1016/j.culher.2017.02.015.

Ozorhon, G. and Ozorhon, I. F. (2019) 'READING THE RESEARCH: PUBLICATIONS ON VERNACULAR ARCHITECTURE', *Structural Studies, Repairs and Maintenance of Heritage Architecture XVI*, 191, pp. 411–419. doi: 10.2495/STR190351.

Patterson, M. S. and Harris, S. (2009) 'The relationship between reviewers' quality-scores and number of citations for papers published in the journal *Physics in Medicine and Biology* from 2003-2005.', *Scientometrics*, 2. doi: 10.1007/s11192-008-2064-1.

Rapoport, A. (1969) *House Form and culture*. University. Milwaukee. Available at: [https://www.fastonline.org/CD3WD\\_40/JF/433/25-603.pdf](https://www.fastonline.org/CD3WD_40/JF/433/25-603.pdf).

Ratti, C., Raydan, D. and Steemers, K. (2003) 'Building form and environmental performance: Archetypes, analysis and an arid climate', *Energy and Buildings*, 35(1), pp. 49–59. doi: 10.1016/S0378-7788(02)00079-8.

Ravéreau, A., Roche, M. and Fathy, H. (1981) *Le M'Zab, une leçon d'architecture*. Sindbad. Paris.

Ravéreau, A., Roche, M. and Lacheraf, M. (1989) *La Casbah d'Alger, et le site créa la ville*. Sindbad. Paris.

Reddy, B. V. V., Mani, M. and Walker, P. (2019) *Earthen Dwellings and Structures*. doi: 10.1007/978-981-13-5883-8.

Rudofsky, B. (1964) *Architecture Without Architects: A Short Introduction to Non-Pedigreed Architecture*. Academy Ed. London.

Şerefhanoglu Sözen, M. and Gedik, G. Z. (2007) 'Evaluation of traditional architecture in terms of building physics: Old Diyarbakir houses', *Building and Environment*, 42(4), pp. 1810–1816. doi: 10.1016/j.buildenv.2006.01.019.

Singh, M. K. *et al.* (2010) 'Thermal monitoring and indoor temperature modeling in vernacular buildings of North-East India', *Energy and Buildings*. Elsevier B.V., 42(10), pp. 1610–1618. doi: 10.1016/j.enbuild.2010.04.003.

Singh, M. K., Mahapatra, S. and Atreya, S. K. (2009) 'Bioclimatism and vernacular architecture of north-east India', *Building and Environment*. Elsevier Ltd, 44(5), pp. 878–888. doi: 10.1016/j.buildenv.2008.06.008.

Toe, D. H. C. and Kubota, T. (2015) 'Comparative assessment of vernacular passive cooling techniques for improving indoor thermal comfort of modern terraced houses in hot-humid climate of Malaysia', *Solar Energy*. Elsevier Ltd, 114, pp. 229–258. doi: 10.1016/j.solener.2015.01.035.

Tuan, A. *et al.* (2019) 'ScienceDirect Studies on sustainable features of vernacular architecture in different regions across the world: A comprehensive synthesis and evaluation', *Frontiers of Architectural Research*. Elsevier Ltd, 8(4), pp. 535–548. doi: 10.1016/j.foar.2019.07.006.

Upton, D. (1983) 'The power of things: Recent studies in American vernacular architecture', *American Quarterly*. JSTOR, 35(3), pp. 262–279. Available at: <https://www.jstor.org/stable/2712651> .

Upton, D. (1990) 'Outside the Academy: A Century of Vernacular Architecture Studies "1890–1990"', in MacDougall, E. B. (ed.) *The Architectural Historian in America*. National G. Washington.

Vellinga, M. (2013) 'The noble vernacular', *Journal of Architecture*, 18(4), pp. 570–590. doi: 10.1080/13602365.2013.819813.

Vernacular Architecture Group (2016) *Bibliography of the Vernacular Architecture, Archeological Data Service (ADS)*. doi: <https://doi.org/10.5284/1037867>.

Vissilia, A.-M. (2009) 'Evaluation of a sustainable Greek vernacular settlement and its landscape: Architectural typology and building physics', *Building and Environment*. Elsevier Ltd, 44(6), pp. 1095–1106. doi: 10.1016/j.buildenv.2008.05.026.

Zhai, J. and Previtali, J. M. (2010) 'Ancient vernacular architecture: characteristics categorization and energy performance evaluation', *Energy and Buildings*, 42(3), pp. 357–365. doi: 10.1016/j.enbuild.2009.10.002.

de Zouche Hall, R. (1972) *A bibliography on vernacular architecture*. David and Charles. Available at: <https://collections.britishart.yale.edu/catalog/orbis:3682112>.