Qualitative and Quantitative Methods in Libraries (QQML) 11, 1:193-227,2022

A bibliometric review of architecture research in GCC countries: An analysis based on the web of science

Mohammad Sharif Zami[1] & Md Safiqur Rahaman[2]

[1]Department of Architecture, King Fahd University of Petroleum and Minerals, Dhahran 31261
[2]Deanship of Library affairs, King Fahd University of petroleum and Minerals

Abstract
Purpose: A number of studies concluded that the assumption about research established in architecture schools is dominated by myth, and research is not taken to analyze, assess, and evolve a new thought and technology. This mythological assumption significantly affected the research output of the architecture discipline globally. In order to mitigate low research yield from the field of architecture, it is essential to carry out a bibliometric investigation to assess the situation on the ground. This study aims to explore the scientific research (during 1976 – 2020) outcomes in the area of architecture in Gulf Cooperation Council (GCC) countries to explore research productivity and highlight the trends and tendencies besides assessing the gaps to execute future research.
Design/Methodology/Approach: An extensive bibliometric method has been implied in published research of GCC to guide researchers in the field of architecture. The research data were retrieved from the web of science and analyses with the help of bibliometric software such as VOSviewer, Bibexcel, and Biblioshiny.
Findings: The findings show that 6 GCC countries contributed a total of 335 publications and 753 citations. 2019 contributed the highest research in architecture. The UAE was the most driving force with strong academic contribution (TP: 119), while Qatar was the most cited country (TC: 231). The topmost contributing intuition was Qatar University (TP: 41); Salama AM was the most prolific author and most cited author. KSA and Egypt had the most collaborative research work with 18 publications. While writing research papers, the authors of GCC mostly used the keywords such as architecture, sustainability, urban design, housing, urbanism, architectural design, architectural education, culture, heritage, Islamic architecture, urban planning, affordable housing, conservation, education, and energy efficiency.

Received: 29.3.2022 Accepted: 12.4.2022 ISSN 2241-1925

Originality: This is the first comprehensive bibliometric analysis of architecture research produced by GCC countries.

Keywords: Bibliometric, architecture, research culture, Gulf countries

1. Introduction

According to Jenkins (2019), defining research in architecture is a complicated undertaking because it considers epistemological foundations, social and cultural contexts that affect the type of knowledge with the approach of life-changing ideal. Buday (2017) stated that the RIBA (Royal Institute of British Architects and the AIA (American Institute of Architects) both perceive and acknowledge the significance of research and its link with design innovation. Equivalently, the EAAE (European Association for Architectural Education and ACSA (Association of Collegiate Schools of Architecture) agree on the importance of the links between architectural profession-based investigation, architectural education, and theory (Buday, 2017). Architectural education is always related to cognitive research, and it is essential for an architect to be exposed to both professional practice and theory to learn and practice effectively (Rawat et al., 2021). The development of architectural knowledge requires borrowing knowledge from pure and social sciences, arts, and creative enterprise; therefore, an appropriate understanding of science in architecture is required a full spectrum of disciplinary accesses, all embedded in particular explorative practices (Jenkins, 2019). Buday (2017) found out that there is a continuing problem of research escaping from the architectural affair because the architecture discipline assumes it as learned. All of these investigators' findings confirm that the research activities are not well-practiced in the architecture discipline, and therefore, it is assumed that lower practice and engagement of architects in research may influence the quality and quantity of publication in the field of architecture. This manuscript aims to explore the produced scientific research performance (during 1976 – 2020) in the area of architecture in Gulf Cooperation Council (GCC) countries modeling from a bibliometric method, data obtained from the Web of Science. The following section analyzes and presenting the up-to-date literature review of formal research culture in architecture and other bibliometric studies.

2. Lack of formal research culture in architecture

The architecture culture recognizes individual design achievement and contributions rather than the prime exploration and links of novel knowledge in science (Fisher, 2017). Buday (2017) states that architects are uneducated and uninformed of research, and their knowledge is rudimentary. According to a RIBA publication on research-based architectural knowledge (Dye, 2014), *architects dominate "knowing-in-practice" while generating extensive knowledge, predominantly shared informally, and barely summarized into*

supervisory or industry memory. For architects, the network between research and knowledge seems to be fixed in the art of architectural training and study methods and favored delivery styles that are mainly peer-to-peer and perceptive (Buday, 2017). According to Rawat et al. (2021), focusing on research-based education and training is essential in order to train devoted architects. The architecture culture does not have a prosperous practice around research, which leads to research outcomes from projects in architectural offices not much generalized, tested, and shared (Fisher, 2017).

According to Till (2017), there are three myths in architecture that are holding back research culture in architecture. The first myth is to consider "architecture is just architecture," whereby architecture is conceptualized as an exceptional body of knowledge, to which generic rationale of research or procedures may not be practiced. According to the second myth, the scope of architecture encompasses the disciplines of arts to sciences, therefore, subject to the procedures and beliefs of various intellectual areas of research. The third myth abandons rules of research by thinking that designing and producing buildings is pursuing a kind of research and generating authentic knowledge. Till (2017) argued that architectural knowledge should be generated via good research, which is determined by considering originality, importance, and accuracy. To execute this presumption, Till (2017) suggested disregarding the three myths that hold back the progress of investigation in architecture.

Despite the fact that there is a lack of formal research culture in architecture, Hodder and Rich (2014) elucidated architects understanding about research and stated that professional architects might involve in research in various ways, like with research knowledge, processor resources (Figure 1). Research knowledge includes knowing how sustainability principles are integrated or proficiency in using specific material in a particular context. Investigation procedures include the systems of searching information, such as site analysis, visiting a case/precedent study, and study materials. Research resources cover ways to penetrate the science, like a journal manuscript, archived literature, and blogs/websites (Hodder & Rich, 2014).

Figure 1: Possible ways of involving architects in research. Source: Hodder and Rich, 2014

3. Literature review

Elango (2019) studied bibliometric investigation on the state of the art review of engineering studies among BRIC (Brazil, Russia, India, and China) countries. The study was aimed at a comparative inquiry of the experimental yield in the field of engineering amongst the BRIC countries through quantitative investigation, data obtained from the SCImago database. It was found that the trend of international collaboration pattern was varied among the BRIC countries, and China, India, Russia, and Brazil were ranked 1st, 8th, 12th, and 18th respectively in terms of the number of articles in the field of engineering research. Russia's rank was 7th in 1996 and dropped to 10th in 2016, while other countries enhanced their positions. Chinas contribution in high-impact journals was found to be poor even though China's rank is first (Elango, 2017) with a 17% average growth rate per annum. Russia's average growth rate is the lowest per annum, which is only 5%. Regarding the quality of the publication, nearly 50% of China and Russian articles are not cited in the subsequent literature, whereas less than 50% for India and Brazil. This percentage of quality of the

publications is influenced by the fact that most of the researchers cannot read the articles published in Russian and Chinese languages (Elango, 2019). Brazil managed to achieve the highest citation per article (6.62) because the international collaborators co-authored their papers. Chinese articles citation rate was found to be the lowest, followed by the Russian because of their languages. Each country of the BRIC community focused on a distinct field of studies of engineering. Brazil, Russia, India, and China concentrated on Automotive and Industrial Engineering, Computational Mechanics and Aerospace Engineering, Control and Industrial Engineering, and Mechanical Engineering, respectively.

Saka and Chan (2019) studied on Scientometric Review and Metasynthesis of Building Information Modelling (BIM) study aiming to find out its progress in the African architecture, engineering, and construction sector, to analyze the academic growth of BIM, the state of affairs of BIM in the zones, and inhibitors blocking adoption of BIM. The study found different levels of BIM advancement in West, North, and Southern Africa influencing the investigation progress. Central Africa and the East are marginally underdeveloped. Central Africa was found to be underdeveloped in BIM technology and application and exploration among all the African countries. At the same time, North Africa (Egypt) has managed to publish the highest number, followed by the East, West, and South African countries. This study found that the major challenges covering BIM implementation are the process and people-related followed by financing and technology-related inhibitors.

Gomez-Rosselli and Rosselli (2021) conducted a bibliometric study on Colombian engineering publications (2010-2019), data obtained from the Scopus database. According to this study, engineering studies and publications were observed to be developing in Colombia, both in numbers and total national scientific yielding. Colombia is considered as a benchmark of scientific study in Latin America because of this developing trend driven by investment from public and private organizations. Colombia is ranked as fifty-third position in the global benchmark; now led by the USA, China, Japan, UK, and Germany. It is also observed that Universidad Nacional's reduced its contribution to Colombia's total scientific yield which is caused by the growing development of other bodies' scientific yield. However, this university is still leading in the research development of engineering topics.

Ahmad et al.(2021) carried out a bibliometric review of Arab World Research (AWR) output from 1980 to 2020 through InCites tool of Clarivate Analytics. It was the first extensive study analyzing the research achievement of Arab countries and was aimed to present the AWR impact and productivity. The study outcome revealed that there was a compelling escalation in research production in the Arab World in the first two decades of the twenty-first century, which was supported by the drive of the regions to advocate scientific

studies. Egypt and the Kingdom of Saudi Arabia (KSA) were the top research productive countries in the region, and the highest number of citations were found in the Saudi Arabian publications. The highest published research fields were physical sciences, technology, and engineering. Furthermore, the Arab World achieved better than the World in several indicators like average percentile and percentage cited documents, JIF journals, and highly cited manuscripts. A similar type of bibliometric and scientometric study was conducted in other topics/subjects by (Kumar & Rahaman, 2019; Rahaman, Ansari, et al., 2021; Rahaman, Kumar, & Shah, 2021; Rahaman, Kumar, Ansari, et al., 2021). However, the Arab countries were recommended to improve in a number of areas like manuscripts in the top 1 percent, the collaboration between university and practice, rate of publications in Q1 journals, and impact factors compared to the global publications. In this section, having the presentation of the state of the art review of other bibliometric studies, the following section is going to state the research questions of this investigation.

4. Research questions

1) What are the most important countries and institutions in architecture literature among the GCC countries?
2) What are the publishing trends in architecture among the GCC countries from 1976-2020?
3) What are the most relevant journals in journals in the field of architecture?
4) What are the most prolific authors and the pattern of authorship in architecture?
5) What are the global most cited documents?
6) What are the most influential funding agencies in architecture among the GCC countries?
7) What are the most common author keywords in architecture research?
8) What are the most collaborative countries with GCC countries?
9) What the major themes of research in architecture among the GCC countries?

5. Research methodology

The use of statistical techniques to analyze books, papers, and other publications is bibliometrics. Bibliometric methods are widely used in the area of library and information science. The bibliometric approach was applied to explore scientific research performance in architecture among GCC countries. The analysis focused on the field's leading journals, articles, authorships, keywords, collaboration research networks, leading scholars, and a three-factor analysis of leading countries, institutions, and major research themes. Web of science is one of the most extensive peer-reviewed indexing and abstracting databases of

literature(Clarivate Analytics, 2021). The Web of Science database was used for data collection at King Fahd University of petroleum and minerals (KFUPM), Dhahran, KSA, on Feb. 20, 2021. The target data is searched in the advanced search box by selecting field tags (SU=Subject area). The following search query is involved in the Web of Science database:

- SU=Architecture
- Refined By: Countries/Regions: Bahrain or Kuwait or Oman or the United Arab Emirates (UAE) or KSA or Qatar
- Refined by Excluding Document Types: Early Access or Correction or Art Exhibit Review or Meeting Abstract or News Item
- Timespan: All Years (1976-2020).
- Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC

A total of 335 documents indexed in the Web of Science database among 6 GCC countries (KSA, UAE, Qatar, Kuwait, Oman, and Bahrain during 1976-2020. All the research data was downloaded in BibTeX, Tab-Delimited (win), plain text, and MS excel format and analyzed with Microsoft excel and Scientometric and bibliometrics tools, namely Bibexcel (Persson, 2016), RStudio (Biblioshiny) (Aria & Cuccurullo, 2017), and VOSviewer (van Eck & Waltman, 2010).

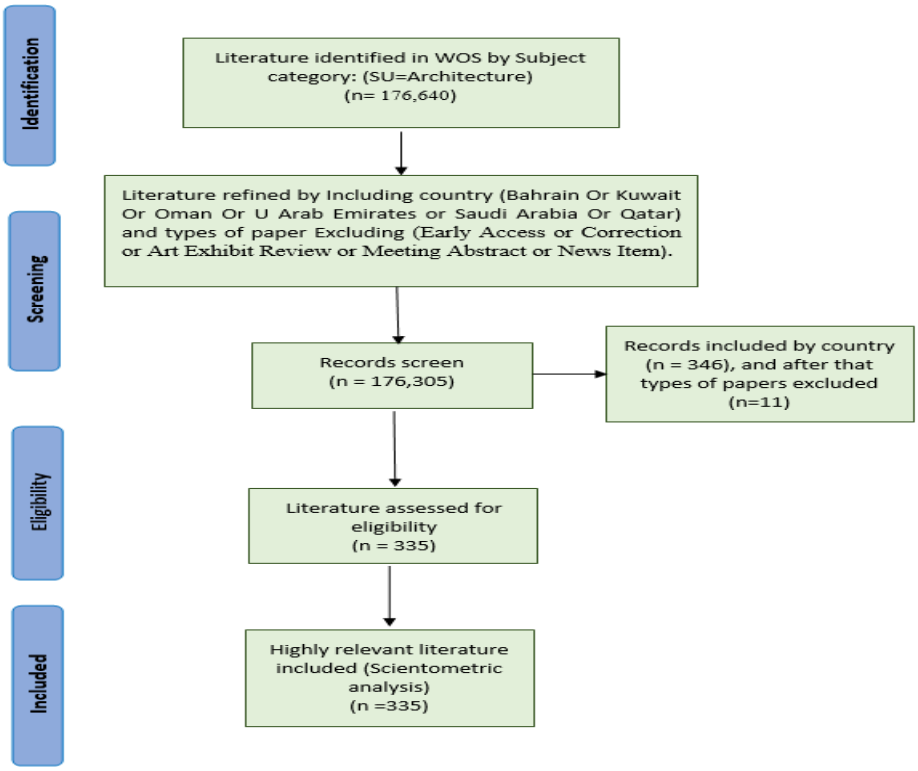


Figure 2: PRISMA flow diagram of data extraction and refining process of architecture literature among the GCC countries during 1976-2020

6. Analysis of results

Table 1 shows the main information of literature published on architecture in GCC countries. Four hundred fifty-nine authors contributed a total of 335 publications and 753 citations, which were published in 92 sources in the field of Architecture among 6 GCC countries between 1976 and 2020. To produce 335 publications, researchers used 205 keywords plus and 1076 author keywords. The analysis also reveals the average citation per publication (2.25), authors of single-authored publication (166), multi-authored publications (169), authors per publication (1.37), and collaboration index (1.98).

Table 1: The primary information of Architecture research in GCC

Particular	Results
Documents	335
Total citation	753
Sources (Journals, Books, etc.)	92
Keywords Plus (ID)	205
Author's Keywords (DE)	1076
Period	1976-2020
Average citations per document	2.25
Authors	459
Author Appearances	627
Authors of single-authored documents	166
Authors of multi-authored documents	169
Documents per Author	0.892
Authors per Document	1.37
Co-Authors per Documents	1.87
Collaboration Index	1.98

6.1 Country-wise research on architecture in GCC

Figure 3 illustrates the architecture research productivity among the 6 GCC countries during 1976 and 2020. The UAE produced most of the research in Architecture with 119 publications, followed by KSA with 100 publications, Qatar with 54 publications, Bahrain with 25 publications, Kuwait with 20 publications, and Oman with 17 publications. As far as the most cited countries among the GCC, Qatar received the highest number of citations (TC: 231), KSA with 180 citations, and the UAE with 167 citations. The average citation per publication (TC/TP) was highest for Qatar with 4.28, followed by Oman with 3.76 TC/TP and Bahrain with 2.84 TC/TP. The analysis indicates that the UAE and KSA are the top two countries in Architecture research but lack average citation per publication compared to other GCC countries (Qatar, Bahrain, Kuwait, and Oman).

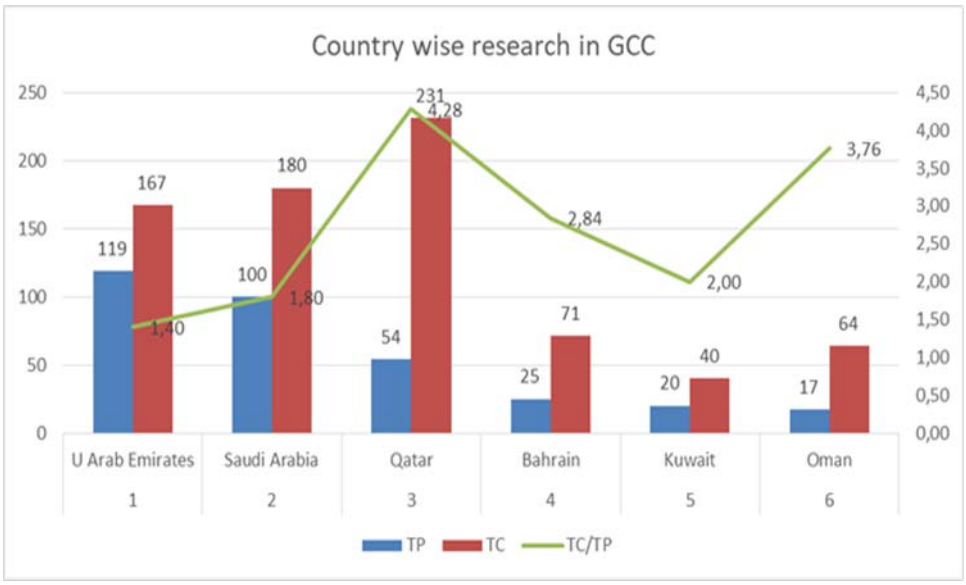


Figure 3: Architecture research productivity in terms of TP, TC, and TC/TP among GCC countries from 1976-2020

6.2 Research trends during 1976-2020 on architecture among GCC countries

Table 2 indicates research trends and citation structure on architecture literature among GCC countries between 1976 and 2020. The first publication in architecture was published in 1976, and the second publication appeared after the gap of 10 years (1987). Unfortunately, both papers of 1976 and 1987 could not receive any citation. The results show that architecture publications in GCC countries have grown exponentially since 1976 (one paper) to 24 papers in 2020. The highest growth was recorded in 2019 with 54 papers, followed by 43 papers in 2015 and 34 in 2018. It was clear from the table that before 2010 yearly research publication was in a single-digit, but from 2010 yearly it becomes double-digit. The table also indicated the growth in the citation. Three hundred thirty-five publications in the field of architecture received a total of 753 citations. The first paper, 1995, received 17 citations. 2016 received the highest number of citations with 120 TC, followed by 92 in 2013, 76 in 2018, and 66 in 2012. The average citation per publication among the GCC countries is 2.25. The highest average total citation per total publication (TC/TP) is 17.00 in 1995, followed by 4.00 in 1998 and 2016. These analyses indicate that architecture publications and citations among GCC countries have risen exponentially since its establishment, with citations growing considerably higher than publication, which is very inspiring. This means that in the recent

decades, research publication has been increased, and expecting more research in the coming decades in the field of architecture among GCC countries.

Table 2: Annual research productivity in architecture in terms of TP, TC, TC/TP, Citation sum within h-core and h-index for GCC countries during 1976-2020

Year	TP	TC	TC/TP	Citation sum within h-core	h-index
1976	1	0	0.00	0	0
1987	1	0	0.00	0	0
1995	1	17	17.00	17	1
1997	3	0	0.00	0	0
1998	1	4	4.00	4	1
2001	1	0	0.00	0	0
2002	6	0	0.00	0	0
2006	7	17	2.43	15	3
2007	8	16	2.00	13	3
2008	3	8	2.67	8	2
2009	8	30	3.75	26	4
2010	16	18	1.13	13	2
2011	13	43	3.31	34	3
2012	18	66	3.67	46	4
2013	24	92	3.83	76	6
2014	17	38	2.24	25	4
2015	43	92	2.14	57	5
2016	30	120	4.00	81	6
2017	22	61	2.77	26	4
2018	34	76	2.24	53	5
2019	54	50	0.93	15	3
2020	24	6	0.25	2	1

6.3. Prolific author in GCC in the field of architecture

Table 3 illustrates the top 30 authors of architecture research among GCC countries. Salama A M was singled out as the most prolific author with 21 publications and 104 citations, followed by Wiedmann F with ten publications and 52 citations, Furlan R and Eilouti B with seven publications each, and 44 and 23 citations, respectively. This was followed by Al-Ragam A, El-Kholei AO, and Elkhateeb A A with six publications each and 14, 11, and 14 citations, respectively. As far as the most cited authors among the GCC countries, the first three (Salama A M, Wiedmann F, and Furlan R) productive authors received the highest number of citations with 104, 52, and 44 citations, respectively. Thierstein A received the highest average citation per publication (TC/TP) among the GCC authors with 14.50 TC/TP, followed by Rashid M and Wallner J with 8.00 TC/TP each. Zami M S, Abdelaal M R M, Abdelaal M S, and Abdelfattah H are also listed among the top 30 authors in the table.

Table 3: Top 30 prolific authors in architecture in terms of TP, TC, TC/TP, and h-index for GCC countries from 1976-2020

Rank	Author	Affiliations	TP	TC	TC/TP	H Index
1	Salama AM	University of Strathclyde	21	104	4.95	6
2	Wiedmann F	University of Nottingham	10	52	5.20	3
3	Furlan R	Qatar University	7	44	6.29	5
4	Eilouti B	Prince Sultan University	7	23	3.29	4
5	Al-Ragam A	Kuwait University	6	14	2.80	3
6	El-Kholei AO	Menofia University	6	11	1.83	2
7	Elkhateeb AA	King Abdulaziz University	6	14	2.33	3
8	Mohamed O	Abu Dhabi University	5	8	1.60	1
9	Ahmed KG	United Arab Emirates University (UAEU)	4	2	0.50	1
10	Elsheshtawy Y	UAEU	4	1	0.25	1
11	Gharib RY	Hamad Bin Khalifa University	4	11	2.75	1
12	Ibrahim HG	Qatar University	4	7	1.75	2
13	Khattab R	Abu Dhabi University	4	3	0.75	1
14	Mahgoub Y	Dar Al-Hekma University	4	5	1.25	1

15	Mushtaha E	University of Sharjah	4	3	0.75	1
16	Abu Al Haija A	Taibah University	3	0	0.00	0
17	Rahman MM	kingdom university	3	4	1.33	1
18	Rashid M	University of Sharjah	3	24	8.00	2
19	Tracy K	University of Waterloo	3	0	0.00	0
20	Villanueva Cajide B	Prince Sultan University	3	0	0.00	0
21	Yogiaman C	UAEU	3	0	0.00	0
22	Abdelhameed WA	Singapore University of Technology and Design	2	4	2.00	2
23	Abdelmonem MG	Nottingham Trent University	2	11	5.50	2
24	Soliman AM	Concordia University	2	10	5.00	1
25	Thierstein A	The Technical University of Munich,	2	29	14.50	1
26	Wallner J	Graz University of Technology	2	17	8.50	2
27	Zami MS	KFUPM	2	0	0.00	0
28	Abdelaal MRM	Suez Canal university	1	2	2.00	1
29	Abdelaal MS	Effat University	1	4	4.00	1
30	Abdelfattah H	Helwan University	1	0	0.00	0

6.4 Pattern of authorship

Figure 4 illustrates the pattern of authorship in architecture research among GCC countries between 1976 and 2020. The authorship pattern ranges from 1 to 8th. It is noticed that the pattern of authorship single to three authors papers has more than 50 publications each. Single authorship patterns contributed the highest number of research papers with 166 publications, followed by two authorship, three authorship, and four authorship. The number of publications contributed by 5, 6, 7, and 8 authors have 7, 3, 1, and 8, respectively. The analysis suggests that authors are engaged in collaborative work as well as solo work in architecture research. Regarding the citation impact of the authorship pattern in architecture among GCC countries, single-author papers received the maximum citations (TC=320) for 166 publications, two author papers with 178 citations, and three author papers with 147 four-author papers with 51 citations.

A similar type of authorship pattern has been explored by (Rahaman, Ansari, et al., 2021).

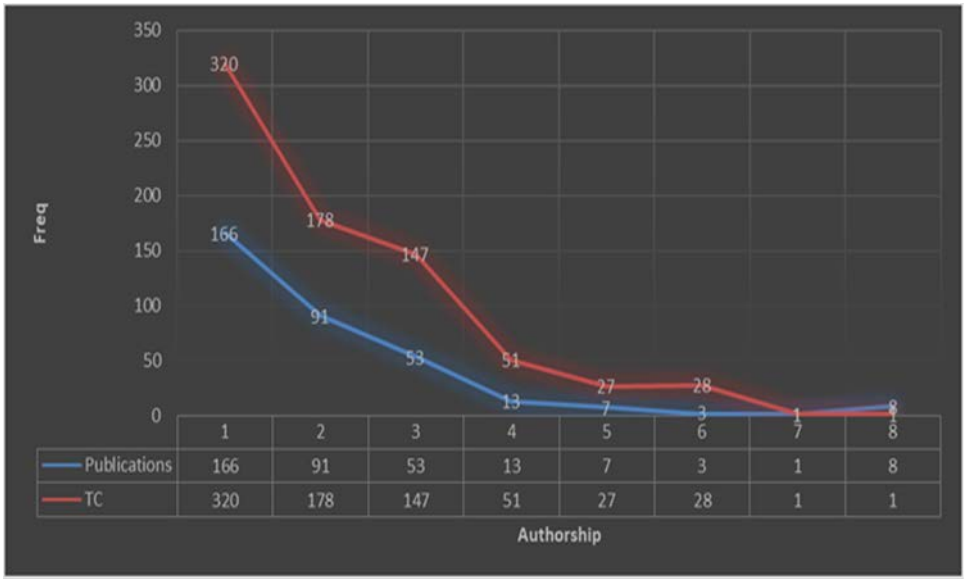


Figure 4: Authorship pattern in the gulf cooperation council region

6.5 Relevant sources in the architecture of GCC countries

Table 4 shows the top ten most prolific sources in the architecture of GCC countries. Open House International (OHI) journal contributed most of the research in architecture with 53 publications and 108 citations, followed by Archnet-IJAR (International Journal of Architectural Research) with 35 publications and 103 citations, Frontiers of Architectural Research (FAR) with 18 publications and 110 citations, 4th world multidisciplinary civil engineering-architecture-urban planning symposium with 13 publication and 4 citations and Architectural Science Review (ASR) with 13 publication and 113 citations. Journal of architecture and urbanism is the least productive among the top ten listed sources with six publications and citations.

ASR is the most cited source in the list with 113 citations for 13 publications, followed by FAR with 110 citations for 18 publications and OHI with 108 citations. As far as the average citation per publication (TC/TP) in the source, ASR received the highest TC/TP (8.69), followed by FAR with 6.11 TC/TP, and Journal of Asian architecture and building engineering with 4.00 TC/TP. Among the top ten sources, most of the sources belong to the UK (4 sources), followed by Prague (2 sources), and one from Qatar, Netherlands, Italy, and the USA. Most of the sources (4) in the list are categories in Quartile 1 (Q1) and

Frontiers of architectural research, and ASR is the most impactful source in the list with 1.35 JIF.

6.6 Type of research and language-wise research in architecture

Table 5 illustrates the type of research papers and language-wise research in architecture between 1976 and 2020. It is observed that most of the researchers favored publishing their work in article format (TP=205), followed by proceeding papers (TP=107), editorial material, and book review with seven papers each. This was followed by a review and letter with four papers each, and a book chapter contributed one paper. As far as the citation impact on the type of research in architecture papers, it was found that research articles received the highest number of citations (TC=612), followed by review (TC=66), proceeding papers (TC=61), and Editorial material (TC=11). The book chapter received the least number of citations with 3 TC only. Interestingly, the 'review' received the highest average citations per publication (TC/TP= 16.50), followed by 'Book chapter' with 3.00 TC/TP and Article with 2.99 TC/TP.

Table 5 also demonstrated language-wise research productivity in architecture among GCC countries. It was clear from the table that architecture researchers among GCC countries favored printing their experiments in the English language with 327 publications with 752 citations, followed by Spanish with 4 publications, and French, Italian, Chinese, and Arabic contributed one paper each.

Table 4: Top 10 most relevant sources in architecture among GCC countries

Rank	Source	Publisher	Country	TP	TC	TC/ TP	JIF	Q	H Index
1	OHI	Open House International Association	UK	53	108	2.04	0.18	Q4	5
2	Archnet-IJAR	Emerald Group	Qatar	35	103	2.94	1.17	Q1	5
3	Frontiers of architectural research	Elsevier BV	Netherland	18	110	6.11	1.35	Q1	5
4	4th world multidisciplinary civil engineering-architecture-urban planning symposium	WMCAUS	Prague	13	4	0.31	NA	NA	1
5	ASR	Taylor & Francis	UK	13	113	8.69	1.35	Q1	5
6	Nexus network journal	Kim Williams	Italy	12	41	3.42	0.33	Q4	4
7	Architectural design	Wiley-Blackwell	USA	11	12	1.09	0.12	Q2	3
8	Journal of Asian architecture and building engineering	Taylor & Francis	UK	8	32	4.00	0.38	Q4	4
9	3rd world multidisciplinary civil engineering, architecture, urban planning symposium	WMCAUS	Prague	7	8	1.14	NA	NA	1
10	Journal of architecture and urbanism	Taylor & Francis	UK	6	7	1.17	0.37	Q1	2

Table 5: Types of research and language-wise research in architecture in terms of TP, TC, TC/TP, Citation sum within h-core and h-index among GCC countries from 1976-2020

Rank	Type of research	TP	TC	TC/TP	Citation sum within h-core	h-index	Rank	Language	TP	TC	TC/TP	Citation sum within h-core	h-index
1	Article	205	612	2.99	185	11	1	English	327	752	2.30	228	11
2	Proceedings Paper	107	61	0.57	30	4	2	Spanish	4	0	0.00	0	0
3	Editorial Material	7	11	1.57	9	2	3	French	1	1	1.00	1	1
3	Book Review	7	0	0.00	0	0	3	Italian	1	1	1.00	1	1
4	Review	4	66	16.50	65	2	3	Chinese	1	0	0.00	0	0
4	Letter	4	0	0.00	0	0	3	Arabic	1	0	0.00	0	0
5	Book Chapter	1	3	3.00	3	1							

6.7 Productive organization

Table 6 analyzed the top 10 most contributing institutions among GCC countries between 1976 and 2020. Among the top 10, eight institutions have more than 15 publications. Qatar University has a greater number of papers (TP=41) with 214 citations, followed by UAEU with 24 publications and 45 citations, UAEU with 20 publications and 43 citations, Amer University Sharjah with 19 publications with 16 citations, and KFUPM with 17 publications and 29 citations. The University of Bahrain and Sultan Qaboos University was the least productive institution among the listed top ten, with 13 publications each. Qatar University also secured 1st ranked in terms of total citation (TC: 214) and average citations per publications (TC/TP: 5.22), followed by Sultan Qaboos University (TC: 49, TC/TP: 3.77), and the University of Bahrain (TC: 45, TC/TP: 3.46). It's also worth mentioning that the top contributing institutions are Qatar, UAE, and KSA.

Table (6): productive organization in terms of TP, TC, TC/TP, Citation sum within h-core and h-index for GCC countries from 1976-2020

Rank	Organization	Country	TP	TC	TC/TP	Citation sum within h-core	h-index
1	Qatar University	Qatar	41	214	5.22	138	9
2	UAEU	UAE	24	45	1.88	30	4
3	University of Sharjah	UAE	20	43	2.15	27	3
4	Amer University Sharjah	UAE	19	16	0.84	11	3
5	KFUPM	KSA	17	29	1.71	23	4
6	Abu Dhabi University	UAE	16	13	0.81	8	2
7	King Abdelaziz University	KSA	15	19	1.27	12	3
8	Kuwait University	Kuwait	15	19	1.27	14	3
9	University of Bahrain	Bahrain	13	45	3.46	28	4
10	Sultan Qaboos University	Qatar	13	49	3.77	42	3

6.8 Mapping co-appearance of author keywords

Figure 5 presents the study of co-appearance of author keywords in architecture research among GCC countries. VOSviewer software has been used to generate the map. Three minimum appearances of author keywords were considered for the analysis. Out of the the1030 author keywords,55 met the thresholds. For each of the 55 keywords, the total tenacity of the co-appearance networks with the other keywords was calculated. The keywords with the largest total network tenacity were also calculated. A total of 29 keywords were grouped in 6 clusters with 64 links and 76 total link strengths. The node size indicates the strength of the keywords network, and color represents a distinct cluster in Figure 5.

- Cluster # 1 consists of 8 author keywords: Globalization, Housing, Innovation, Modernity, Tradition, Urban History, Urban Planning, and Urbanism.

- Cluster # 2 includes five keywords: Conservation, Green Building, Heritage, Planning, and Sustainability.
- Cluster # 3 comprises Affordable Housing, Community, Socio-Cultural, and Urban.
- Cluster # 4 represent Architectural Design, Education, Geometry, and Landscape.
- Cluster # 5 includes Culture, Fractals, Muslim Cities, and Urban Design.
- Cluster #6 consists of Architecture, Energy Efficiency, Le Corbusier, and Thermal Comfort.

The top ten most occurred keywords in the Figure 5 are architecture (n:15), sustainability (n:15), urban design (n:8), housing (n:7), urbanism (n:6), architectural design (n:5), architectural education (n:5), culture (n:5), heritage (n:5), Islamic architecture (n:5), urban planning (n:5), affordable housing (n:4), conservation (n::4), education (n:4) and energy efficiency (n:4).

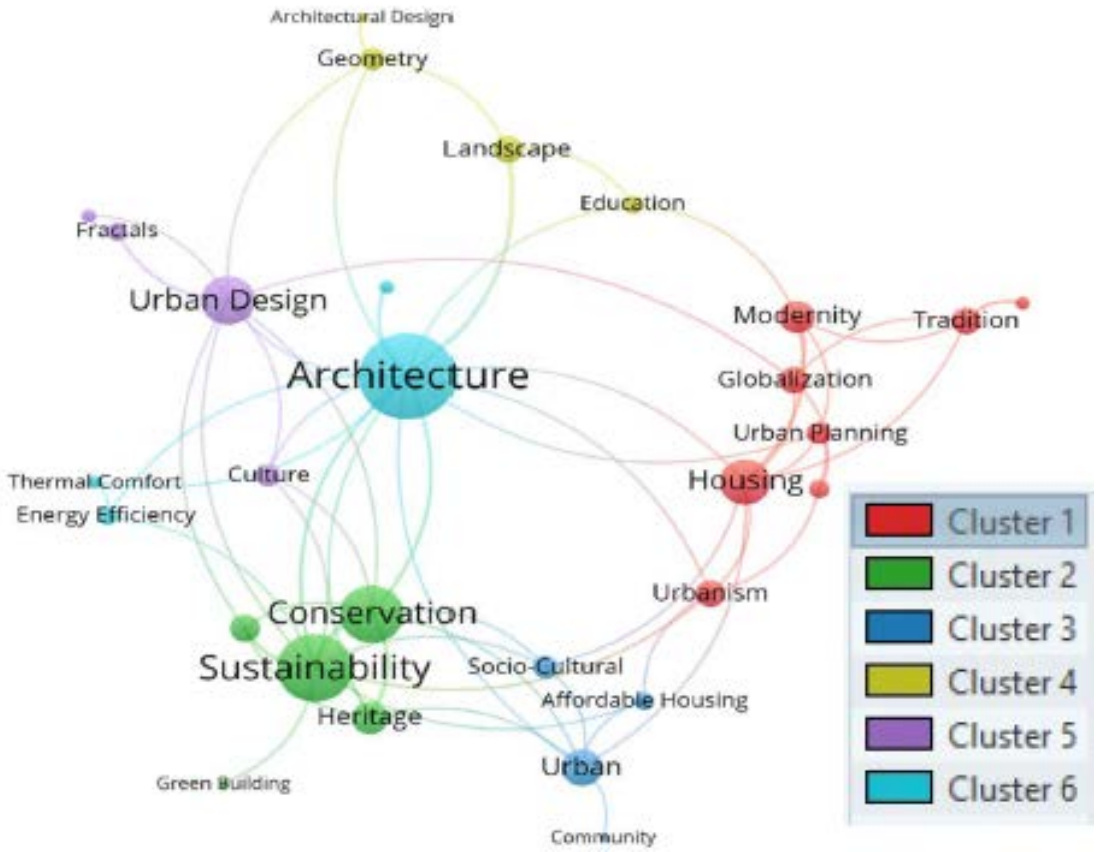


Figure 5: most highly used author keywords in architecture research in the gulf cooperation council

6.9 Most cited research papers in architecture among GCC countries

Table 7 analyzes the most cited research paper in architecture among GCC countries between 1976 and 2020. Among the top 10 most cited papers, the First five have received more than 20 citations since their publication. Among the top 10 most cited publications, the total number of citations ranges (TC) between 12 to 37. The first article entitled 'Urban livability across disciplinary and professional boundaries' by Kashef M (2016) (in Table 7) has received the highest total citation (TC:37), followed by 'A numerical investigation into the feasibility of integrating green building technologies into row houses in the Middle East' by Calautit JK (2013) with 30 citations, 'Sick building syndrome: are we doing enough?' by Ghaffarianhoseini A (2018) and 'Urban evolution of the city of Doha: an investigation into the impact of economic transformations on urban structures' by Wiedmann F(2012) with 28 citations each respectively. This was followed by 'Modernity in tradition: Reflections on building design and technology in the Asian vernacular' by Rashid M (2015), with 20 citations. The article 'Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage' by Boussaa D (2014) was the least cited among the top ten cited publications with 12 citations. The article entitled 'Sick building syndrome: are we doing enough?' by Ghaffarianhoseini A (2018) used maximum times since 180 days (13 times), 31 times since 2013, and same time article received the highest total citation per year (7). This was followed by the article 'Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage' by Boussaa D (2014), used 28 times since 2013.

Table 7: top ten most cited papers in the gulf cooperation council

Rank	Title	Author	year	Journal	TC	TC PY	U1	U2
1	Urban livability across disciplinary and professional boundaries (Kashef, 2016)	Kashef M	2016	Frontiers of Architectural Research	37	6.1667	4	26
2	A numerical investigation into the feasibility of integrating green building technologies into row houses in the Middle East(Calautit et al., 2013)	Calautit JK	2013	ASR	30	3.3333	0	26
3	Sick building syndrome: are we doing enough?(Ghaffarianhoseini et al., 2018)	Ghaffarian hoseini A	2018	ASR	28	7	13	31
4	Urban evolution of the city of Doha: an investigation into the impact of economic transformations on urban structures(Wiedmann et al., 2012)	Wiedmann F	2012	Metu Journal of The Faculty of Architecture	28	2.8	2	13
5	Modernity in tradition: Reflections on building design and technology in the Asian vernacular(Rashid & Ara, 2015)	Rashid M	2015	Frontiers of Architectural Research	20	2.8571	1	11
6	Omar Khayyam, Mathematicians, and "Conversation" with Artisans(Ozdural A, 1995)	Ozdural A	1995	Journal of the Society of Architectural Historians	17	0.6296	0	0
7	Privacy and Gendered Spaces in Arab Gulf Homes(Sobh & Belk, 2011)	Sobh R	2011	Home Cultures	15	1.3636	0	2
8	Trans-disciplinary knowledge for affordable housing(A. M. Salama, 2011)	Salama AM	2011	OHI	15	1.3636	2	6
9	Drivers and barriers to occupant adaptation in offices in India(Indraganti et al., 2015)	Indraganti M	2015	ASR	14	2	0	4

10	Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage(Boussaa, 2014)	Boussaa D	2014	Journal of Architectural Conservation	12	1.5	2	28

6.10 Analysis of three-field plot of sources, author, and country

Figure 6 shows GCC countries' top ten sources, authors, and countries on architecture literature. The size of the blocks indicates the relationship between each plot. The top five sources (OHI, Archnet-IJAR, Frontiers of architectural research, 4th world multidisciplinary civil engineering-architecture-urban planning symposium and Nexus network journal) have a strong association with the top 10 authors (Salama A M, Wiedmann F, Furlan R, Eilouti B, Al-Ragam A, El-Kholei AO, Elkhateeb A A, Mohamed O, Ahmed KG, and Elsheshtawy Y). These sources and authors have a strong link with the top eight countries (Qatar, UAE, KSA, Bahrain, Kuwait, Egypt, UK, and the USA).

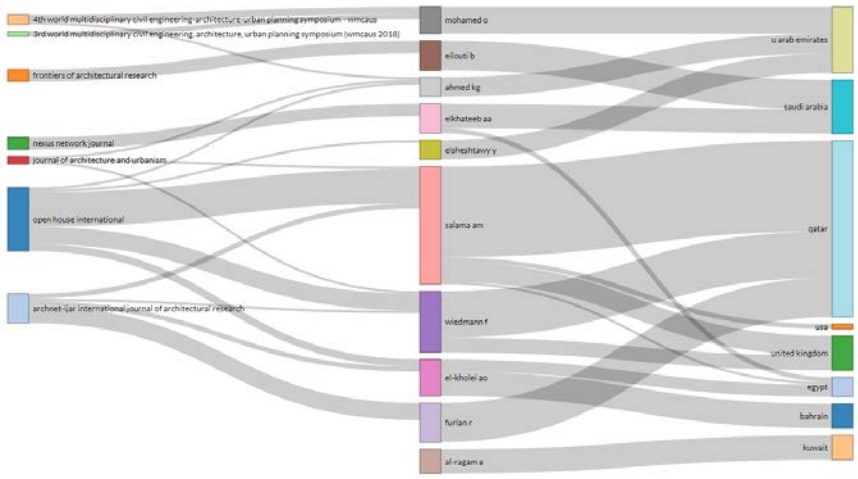
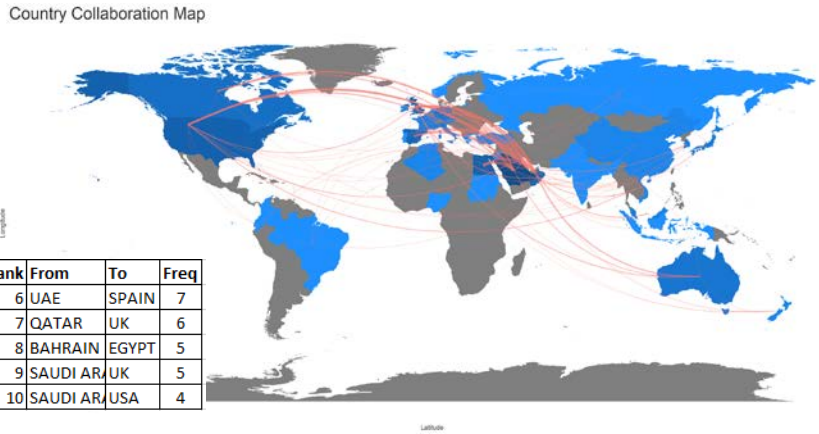


Figure 6: Three-factor analysis of architecture research in GCC countries by the Source (Left), Authors (Middle), and country (Right)

6.11 Country collaboration map

Figure 7 depicts the top ten international collaborations in producing architecture research among GCC countries. This map indicates that the most frequent research collaboration has been between KSA and UAE with other countries. This is not surprising as the majority of the research contributed by these two countries. Among the top ten list, the collaboration ranged between 4

and 18 publications. Most of the collaboration was found between KSA and Egypt with18 publications, followed by (UAE and UK) and (UAE and USA) with nine publications each, Qatar and USA with eight publications, (KSA and Spain) and (UAE and Sprain) with seven publications each. Among the top ten, KSA and the USA were the least collaborated with four publications. This implies that researchers of GCC countries in the field of architecture collaborated both within and outside GCC countries.



Rank	From	To	Freq	Rank	From	To	Freq
1	SAUDI ARABIA	EGYPT	18	6	UAE	SPAIN	7
2	UAE	UK	9	7	QATAR	UK	6
3	UAE	USA	9	8	BAHRAIN	EGYPT	5
4	QATAR	USA	8	9	SAUDI AR	UK	5
5	SAUDI ARABIA	SPAIN	7	10	SAUDI AR	USA	4

Figure 7: Top ten most collaborative countries with GCC

6.12 Top ten highly active funding agencies in architecture among GCC counties

Table 8 reveals the top ten most influential funding agencies in architecture among GCC countries. Qatar University is recognized as the most influential funding agency with six publications, followed by UAEU with four publications. Centre on Sustainable Built Environment at Abu Dhabi University, College of Engineering at Sultan Qaboos University, National Priorities Research Program Qnrf Qatar National Research Fund Entitled Investigating Housing Typologies in Multicultural Societies of The Gulf Region, Department of Architecture at KFUPM Office of Research and Sponsored Programs Orsp At Abu Dhabi University, Prince Sultan University in Riyadh, Qatar National Research Fund and Abu Dhabi Department of Education and Knowledge have funded two publication each.

Table 8: Top ten most influential funding agencies in GCC

Rank	Funding Agencies	TP	%
1	Qatar University	6	1.194
2	UAEU	4	0.896
3	Centre on Sustainable Built Environment at Abu Dhabi University	2	0.597
4	College of Engineering at Sultan Qaboos University	2	0.597
5	National Priorities Research Program Qnrf Qatar National Research Fund Entitled Investigating Housing Typologies in Multicultural Societies of The Gulf Region	2	0.597
6	Department of Architecture at KFUPM	2	0.597
7	Office of Research and Sponsored Programs Orsp At Abu Dhabi University	2	0.597
8	Prince Sultan University in Riyadh, KSA	2	0.597
9	Qatar National Research Fund	2	0.597
10	Abu Dhabi Department of Education and Knowledge	2	0.299

6.13 Bibliographic coupling: Theme analysis

Bibliographic coupling is employed to disclose the major themes of the research produced by GCC countries in architecture papers. The method is based on the assumption that papers sharing the same references are related to the content. This is the most notable characteristic of bibliometric studies to identify trending research fronts by analyzing cited references. VOSviewer bibliographic software was used to generate bibliographic coupling of 335 papers. Out of 335 papers, it resulted in 168 clusters, wherein ten major clusters comprise more than ten publications each while the other 158 clusters contain below ten publications. In the below section, only top 10 major cluster (themes) is explained depending on the total number of papers and citations. Cluster # 1 have the largest number of architecture papers with 22 publications, followed by cluster,2,3,4 and 5. In terms of total citation, cluster # 1 received the highest number of citations (TC:105), followed by cluster #8 (TC:81), clusters #3 and 4 with 54 citations each, and cluster # 4 (TC:53). The summary of the top 10 major themes is represented in table 9. Cluster # 1: Urban Planning and Design: This cluster contain 22 research papers that have been cited 105 times. The most cited research paper in this cluster #1 is entitled “Urban evolution of the city of Doha: an investigation into the impact of economic transformations on urban structures’ by Wiedmann (Wiedmann et al., 2012) as shown in table (9). This was followed by Cluster # 2: Islamic Vernacular Architecture (TP in cluster:16;TC in cluster:9), Cluster # 3: Architectural Education and Housing (TP in cluster:16; TC in cluster:54), Cluster # 4: Quality of Urban Open Space

and Architecture (TP in cluster:12, TC in cluster:53) and Cluster # 5: Architectural Design (TP in cluster:11, TC in cluster:28).

Table 9: Top 10 significant themes/clusters architecture research among GCC countries

Cluster: theme	**TP in Cluster**	**TC in Cluster**	**Most cited publication in Cluster**			
			TC	***Title***	***Year***	***Author***
Cluster # 1: **Urban Planning and Design**	22	105	28	Urban evolution of the city of Doha: an investigation into the impact of economic transformations on urban structures (Wiedmann et al., 2012)	2012	Wiedmann
			12	Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage(Boussaa, 2014)	2014	Boussaa
Cluster # 2: **Islamic Vernacular Architecture**	16	9	2	Metamorphosis of mosque semiotics from sacred to secular power metaphorism - the case of state mosques(Allahham, 2019)	2014	Allahham
			2	The classification of prayer halls in modern Saudi masjids: with special reference to the city of Jeddah(A. Elkhateeb et al., 2018)	2018	Elkhateeb
Cluster # 3: **Architectural Education and Housing**	16	54	15	Trans-disciplinary knowledge for affordable housing(A. M. Salama, 2011)	2011	Salama
			7	Committed educators are reshaping studio pedagogy(A. Salama, 2006)	2006	Salama
Cluster # 4: **Quality of Urban Open Space and**	12	53	37	Urban livability across disciplinary and professional boundaries(Kashef, 2016)	2016	Kashef

Architecture			7	The destruction of modernist heritage the myth of Al-Sawaber(Al-Ragam, 2013)	2013	Al-Ragam
Cluster # 5: **Architectural Design**	11	28	7	Concept evolution in architectural design: an octonary framework(Eilouti, 2018a)	2018	Eilouti
			5	Scenario-based design: new applications in metamorphic architecture(Eilouti, 2018b)	2018	Eilouti
Cluster # 6: **Revitalization of Traditional Urban Space**	11	27	9	A perceptual approach for investigating urban space diversity in the city of Doha(A. M. Salama & Gharib, 2012)	2012	Salama
			4	Remarks on the surface area and equality conditions in regular forms. part i: triangular prisms(A. A. Elkhateeb, 2014)	2014	Elkhateeb
Cluster # 7: **Conservation of Traditional Urban Architecture**	11	19	4	Conservation of historic waterfront to improve the quality of life in old Dhaka(Rahman & Imon, 2017)	2017	Rahman
			4	Complexity of urban fabric in traditional muslim cities: importing old wisdom to present cities(Ben-Hamouche, 2009)	2009	Ben-Hamouche
Cluster # 8: **Sustainability and Green Architecture**	11	81	30	A numerical investigation into the feasibility of integrating green building technologies into row houses in the middle east(Calautit et al., 2013)	2013	Calautit
			12	Field survey of air conditioner temperature settings in hot, humid climates, part 1: questionnaire results on	2013	Ekasiwi

				use of air conditioners in houses during sleep(Ekasiwi et al., 2013)		
Cluster # 9: **Architectural Design Theory**	10	35	28	Sick building syndrome: are we doing enough?(Ghaffarianhoseini et al., 2018)	2018	Ghaffarianhoseini
			4	Biophilia and salutogenesis as restorative design approaches in healthcare architecture(Abdelaal & Soebarto, 2019)	2019	Abdelaal
Cluster # 10: **Culture Influencing Architectural Form**	10	54	20	Modernity in tradition: reflections on building design and technology in the Asian vernacular(Rashid & Ara, 2015)	2015	Rashid
			8	Cultural traditions and architectural form of Italian transnational houses in Australia(Furlan, 2015)	2015	Furlan

7. Discussion

The aim of this study is to review architecture research productivity among the GCC countries between 1976 and 2020. The analysis indicated that architecture publication in GCC countries has continuously increased since 1976 single to 54 papers in 2019 and 24 additional papers in 2020. During the last decade, architecture researchers from GCC countries contributed 83% of publications whereas only 17% between 1976 and 2010. Three hundred thirty-five publications in the field of architecture received a total of 753 citations. 2016 received the highest number of citations with 120 TC, followed by 92 in 2013. The GCC countries have an average of 2.25 citations per article. In 1995, the average total citation per total publication (TC/TP) was 17.00, followed by 4.00 in 1998 and 2016. As far as the research productivity of GCC countries, the UAE dominated research in Architecture with 119 publications, followed by KSA with 100, Qatar with 54, Bahrain with 25, Kuwait with 20, and Oman with 17 publications. Qatar (TC: 231), KSA (TC: 180), and UAE (TC: 167) are the most cited countries among the GCC countries.

The analysis revealed the top contributed authors in the field of architecture among the GCC countries are Salama A M, Wiedmann F, Furlan R, Eilouti B, Al-Ragam A, El-Kholei A O, Elkhateeb A A, Mohamed O, Ahmed K G, Elsheshtawy Y, Gharib R Y, Ibrahim H G, Khattab R, Mahgoub Y, Mushtaha E, Abu Al Haija A, Rahman M M, Rashid M, Tracy K, Villanueva Cajide B, Yogiaman C, Abdelhameed W A, Abdelmonem M G, Soliman A M, Thierstein A, Wallner J, Zami M S, Abdelaal M R M, Abdelaal M S, and Abdelfattah H. Among the top 30 authors, Salama A M was the most prolific author with 21 publications and 104 citations. As far as the most cited authors among the GCC countries, the first three (Salama A M, Wiedmann F, and Furlan R) productive authors received the highest number of citations with 104, 52, and 44 citations respectively. Thierstein A received the highest average citation per publication (TC/TP) among the GCC authors, with 14.50 TC/TP.

It was observed that the authorship pattern of single to three authorship works has more than 50 publications each. With 166 publications, single authorship provided the most research papers, followed by two, three, and four authorships. Regarding the citation impact of the authorship pattern in architecture across GCC countries, single-author papers got the most citations (TC=320), two author papers with 178 citations, three author papers with 147, and four author papers with 51 citations. The analysis indicated that the most relevant and productive top five sources in the field, where authors of GCC countries publish their scientific research are OHI, Archnet-IJAR, FAR, 4th world multidisciplinary civil engineering-architecture-urban planning symposium, and ASR whereby with 113 citations from 13 publications ASR became the most cited source. As far as the average citation per publication in the source, ASR received the highest TC/TP (8.69).

It was found that most researchers preferred to publish their work in 'articles' (TP=205), followed by proceeding papers (TP=107). Their publications were mostly published in English with 327 publications with 752 citations, followed by Spanish with 4 publications, and French, Italian, Chinese, and Arabic contributed one paper each. The top five productive organizations in architecture among the GCC countries are Qatar University, UAEU, University of Sharjah, Amer University Sharjah, and KFUPM. Qatar University was identified as the most productive in terms of total publication (TP: 41), total citation (TC: 214), and average citations per publication (TC/TP: 5.22). The GCC researchers used the author's keywords: architecture, sustainability, urban design, housing, urbanism, architectural design, architectural education, culture, heritage, Islamic architecture, urban planning, affordable housing, conservation, education, and energy efficiency while writing a research paper.

This study concluded that the most common research collaboration has been taken place between the KSA and UAE with other nations. With 18 publications, KSA and Egypt had the most collaborative research work, followed by (UAE and UK) and (UAE and USA) with nine publications each.

Qatar and USA with eight publications, (KSA and Spain) and (UAE and Sprain) with seven publications each. Qatar University is the most important fund provider with six publications, followed by UAEU with four publications. The major top ten research themes in architecture among the GCC countries are: Urban Planning and Design, Islamic Vernacular Architecture, Architectural Education and Housing, Quality of Urban Open Space and Architecture, Architectural Design, Revitalization of Traditional Urban Space, Conservation of Traditional Urban Architecture, Sustainability and Green Architecture, Architectural Design Theory, and Culture Influencing Architectural Form.

8. Conclusions

This study appeared to be the first overall inquiry of architectural research output and performance among the GCC countries. The study found out that there was a significant increase in scientific production in architecture research during last ten years compared to earlier thirty-four years (between 1976 and 2010). UAE and KSA are the most prolific countries in architecture research publication among all the GCC countries, while Qatar emerged as the most impactful country in term total citations in their architecture publications. The authors of GCC countries performed better than earlier in terms of total publication, citation, average citation per publication, and publication in quartile (Q1) journals. This study indicates that GCC researchers in the field of architecture collaborated with other GCC nations and other international countries. However, GCC authors need be engaged in more collaborative research projects to increase the rate of author collaboration, country collaboration and institution collaboration. According to this study, number of architectural publications and citations have grown in GCC countries. UAE and KSA are the top two countries in architecture research but lacking average citation per publication compared to other GCC countries. It was noted that citations are increasing considerably faster than the number of publications, which is very promising. More research output is expected in the coming decade from the GCC to improve the formal research culture in the field of architecture.

9. Reference

Abdelaal, M. S., & Soebarto, V. (2019). Biophilia and Salutogenesis as restorative design approaches in healthcare architecture. *Architectural Science Review*, *62*(3), 195–205. https://doi.org/10.1080/00038628.2019.1604313

Ahmad, S., Ur Rehman, S., & Ashiq, M. (2021). A Bibliometric Review of Arab World Research from 1980-2020. *Science & Technology Libraries*, *40*(2), 133–153. https://doi.org/10.1080/0194262X.2020.1855615

Al-Ragam, A. (2013). The Destruction of Modernist Heritage: The Myth of Al-Sawaber. *Journal of Architectural Education*, *67*(2), 243–252. https://doi.org/10.1080/10464883.2013.817167

Allahham, A. (2019). Metamorphosis of mosque semiotics. *Archnet-IJAR: International Journal of Architectural Research*, *13*(1), 204–217. https://doi.org/10.1108/ARCH-11-2018-0001

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Ben-Hamouche, M. (2009). Complexity of urban fabric in traditional Muslim cities: Importing old wisdom to present cities. *URBAN DESIGN International*, *14*(1), 22–35. https://doi.org/10.1057/udi.2009.7

Boussaa, D. (2014). Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage. *Journal of Architectural Conservation*, *20*(1), 2–15. https://doi.org/10.1080/13556207.2014.888815

Buday, R. (2017). *The Confused and Impoverished State of Architectural Research*. Common\Edge Website. https://commonedge.org/the-confused-and-impoverished-state-of-architectural-research/

Calautit, J. K., Hughes, B. R., & Ghani, S. A. (2013). A numerical investigation into the feasibility of integrating green building technologies into row houses in the Middle East. *Architectural Science Review*, *56*(4), 279–296. https://doi.org/10.1080/00038628.2012.686433

Clarivate Analytics. (2021). *Web of Science*. Https://Clarivate.Com/Webofsciencegroup/Solutions/Web-of-Science/. https://clarivate.com/webofsciencegroup/solutions/web-of-science/

Dye, A. (2014). Architects and research-based knowledge : a literature review. *Architects, Royal Institute of British Architects*, *February*. file:///C:/Users/mdsafiqur/Downloads/Architectsandresearchbasedknowledgeliteraturereviewpdf (1).pdf

Eilouti, B. (2018a). Concept evolution in architectural design: an octonary framework. *Frontiers of Architectural Research*, *7*(2), 180–196. https://doi.org/https://doi.org/10.1016/j.foar.2018.01.003

Eilouti, B. (2018b). Scenario-based design: New applications in metamorphic architecture. *Frontiers of Architectural Research*, *7*(4), 530–543. https://doi.org/https://doi.org/10.1016/j.foar.2018.07.003

Ekasiwi, S. N. N., Majid, N. H. A., Hokoi, S., Oka, D., Takagi, N., & Uno, T. (2013). Field Survey of Air Conditioner Temperature Settings in Hot, Humid Climates, Part 1: Questionnaire Results on Use of Air Conditioners in Houses During Sleep. *Journal of Asian Architecture and Building Engineering*, *12*(1), 141–148. https://doi.org/10.3130/jaabe.12.141

Elango, B. (2019). A bibliometric analysis of literature on engineering research among BRIC countries. *Collection and Curation*, *38*(1), 9–14. https://doi.org/10.1108/CC-05-2017-0017

Elkhateeb, A. A. (2014). Remarks on the Surface Area and Equality Conditions in Regular Forms. Part I: Triangular Prisms. *Nexus Network Journal*, *16*(1), 219–232. https://doi.org/10.1007/s00004-014-0178-8

Elkhateeb, A., Attia, M., Balila, Y., & Adas, A. (2018). THE CLASSIFICATION OF PRAYER HALLS IN MODERN SAUDI MASJIDS: WITH SPECIAL REFERENCE TO THE CITY OF JEDDAH. *ArchNet-IJAR : International Journal of Architectural Research*, *12*(2), 246. https://doi.org/http://dx.doi.org/10.26687/archnet-ijar.v12i2.1411

Fisher, T. (2017). Research and Architecture's Knowledge Loop. *Technology|Architecture + Design*, *1*(2), 131–134. https://doi.org/10.1080/24751448.2017.1354601

Furlan, R. (2015). CULTURAL TRADITIONS AND ARCHITECTURAL FORM OF ITALIAN TRANSNATIONAL HOUSES IN AUSTRALIA. *ArchNet-IJAR : International Journal of Architectural Research*, *9*(2), 45–64.

https://www.proquest.com/scholarly-journals/cultural-traditions-architectural-form-italian/docview/1700276270/se-2?accountid=27795

Ghaffarianhoseini, A., AlWaer, H., Omrany, H., Ghaffarianhoseini, A., Alalouch, C., Clements-Croome, D., & Tookey, J. (2018). Sick building syndrome: are we doing enough? *Architectural Science Review*, *61*(3), 99–121. https://doi.org/10.1080/00038628.2018.1461060

Gomez-Rosselli, S., & Rosselli, D. (2021). Bibliometric analysis of engineering publications in colombia 2010-2019: A scopus analysis•. *DYNA (Colombia)*, *88*(216), 9–14. https://doi.org/10.15446/dyna.v88n216.89837

Hodder, S. R., & Rich, H. (2014). How architects use research. In *RIBA, Architecture.com* (p. 64). RIBA. file:///C:/Users/mdsafiqur/Downloads/HowArchitectsUseResearch2014pdf.pdf

Indraganti, M., Ooka, R., Rijal, H. B., & Brager, G. S. (2015). Drivers and barriers to occupant adaptation in offices in India. *Architectural Science Review*, *58*(1), 77–86. https://doi.org/10.1080/00038628.2014.976539

Jenkins, P. (2019). Research and knowledge development in architecture: reflections on academic, professional and wider social approaches. *ARCC Conference Repository*, *1*(1). https://www.arcc-journal.org/index.php/repository/article/view/882

Jeremy Till. (2017). *Architectural Research: Three Myths and One Model*. ArchDaily. https://www.archdaily.com/802766/architectural-research-three-myths-and-one-model

Kashef, M. (2016). Urban livability across disciplinary and professional boundaries. *Frontiers of Architectural Research*, *5*(2), 239–253. https://doi.org/https://doi.org/10.1016/j.foar.2016.03.003

Kumar, S., & Rahaman, M. S. (2019). Research Performance in the field of big data in India : A Scientometric analysis based on Scopus database. *Library Philosophy and Practice*, 1–24. https://digitalcommons.unl.edu/libphilprac/3736/

Ozdural A. (1995). Omar Khayyam, Mathematicians, and "Conversazioni" with Artisans. *Journal of the Society of Architectural Historians*, *54*(1), 54–71. https://doi.org/10.2307/991025

Persson, O. (2016). Bibexcel is a versatile bibliometric toolbox developed. *Inflibnet*, *23*(4).

Rahaman, M. S., Ansari, K. M. N., Kumar, H., & Shah, K. (2021). Mapping and Visualizing Research Output on Global Solid Waste Management : A Bibliometric Review of Literature. *Science & Technology Libraries*, *00*(00), 1–29. https://doi.org/10.1080/0194262X.2021.1960943

Rahaman, M. S., Kumar, S., Ansari, K. M. N., & Rahman, M. R. (2021). Twenty-five years of global research publications trends of novel coronavirus: A scientometrics assessment. *Library Philosophy and Practice*, 1–17. https://digitalcommons.unl.edu/libphilprac/4294/

Rahaman, M. S., Kumar, S., & Shah, K. (2021). A scientometric assessment of global research productivity in traditional knowledge:Evidence from scopus database. *Kelpro Bulletin*, *25*(June), 15–29.

Rahman, M. M., & Imon, S. S. (2017). CONSERVATION OF HISTORIC WATERFRONT TO IMPROVE THE QUALITY OF LIFE IN OLD DHAKA. *International Journal of Architectural Research: Archnet-IJAR*, *11*, 83–100.

Rashid, M., & Ara, D. R. (2015). Modernity in tradition: Reflections on building design and technology in the Asian vernacular. *Frontiers of Architectural Research*, *4*(1), 46–55. https://doi.org/https://doi.org/10.1016/j.foar.2014.11.001

Rawat, U., Karmakar, V., & Sawan Kumar Sharma. (2021). Importance of Research in Architecture. *INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY*, *10*(01), 156–161. https://doi.org/10.2139/ssrn.3703560

Saka, A. B., & Chan, D. W. M. (2019). A Scientometric Review and Metasynthesis of Building Information Modelling (BIM) Research in Africa. *Buildings*, *9*(4). https://doi.org/10.3390/buildings9040085

Salama, A. (2006). Editorial: Committed Educators are Reshaping Studio Pedagogy. *Open House International*, *31*(3), 4–9. https://doi.org/10.1108/OHI-03-2006-B0001

Salama, A. M. (2011). Trans-Disciplinary Knowledge for Affordable Housing. *Open House International*, *36*(3), 7–15. https://doi.org/10.1108/OHI-03-2011-B0002

Salama, A. M., & Gharib, R. Y. (2012). A Perceptual Approach for Investigating Urban Space Diversity in the City of Doha. *Open House International*, *37*(2), 24–32. https://doi.org/10.1108/OHI-02-2012-B0004

Sobh, R., & Belk, R. W. (2011). Privacy and Gendered Spaces in Arab Gulf Homes. *Home Cultures*, *8*(3), 317–340. https://doi.org/10.2752/175174211X13099693358870

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Wiedmann, F., Salama, A. M., & Thierstein, A. (2012). Urban evolution of the city of Doha: An investigation into the impact of economic transformations on urban structures. *Metu Journal of the Faculty of Architecture*, *29*(2), 35–61. https://doi.org/10.4305/METU.JFA.2012.2.2

Abdelaal, M. S., & Soebarto, V. (2019). Biophilia and Salutogenesis as restorative design approaches in healthcare architecture. *Architectural Science Review*, *62*(3), 195–205. https://doi.org/10.1080/00038628.2019.1604313

Ahmad, S., Ur Rehman, S., & Ashiq, M. (2021). A Bibliometric Review of Arab World Research from 1980-2020. *Science & Technology Libraries*, *40*(2), 133–153. https://doi.org/10.1080/0194262X.2020.1855615

Al-Ragam, A. (2013). The Destruction of Modernist Heritage: The Myth of Al-Sawaber. *Journal of Architectural Education*, *67*(2), 243–252. https://doi.org/10.1080/10464883.2013.817167

Allahham, A. (2019). Metamorphosis of mosque semiotics. *Archnet-IJAR: International Journal of Architectural Research*, *13*(1), 204–217. https://doi.org/10.1108/ARCH-11-2018-0001

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Ben-Hamouche, M. (2009). Complexity of urban fabric in traditional Muslim cities: Importing old wisdom to present cities. *URBAN DESIGN International*, *14*(1), 22–35. https://doi.org/10.1057/udi.2009.7

Boussaa, D. (2014). Al Asmakh historic district in Doha, Qatar: from an urban slum to living heritage. *Journal of Architectural Conservation*, *20*(1), 2–15. https://doi.org/10.1080/13556207.2014.888815

Buday, R. (2017). *The Confused and Impoverished State of Architectural Research*. Common\Edge Website. https://commonedge.org/the-confused-and-impoverished-state-of-architectural-research/

Calautit, J. K., Hughes, B. R., & Ghani, S. A. (2013). A numerical investigation into the feasibility of integrating green building technologies into row houses in the Middle East. *Architectural Science Review*, *56*(4), 279–296.

https://doi.org/10.1080/00038628.2012.686433

Clarivate Analytics. (2021). *Web of Science*. Https://Clarivate.Com/Webofsciencegroup/Solutions/Web-of-Science/. https://clarivate.com/webofsciencegroup/solutions/web-of-science/

Dye, A. (2014). Architects and research-based knowledge : a literature review. *Architects, Royal Institute of British Architects, February*. file:///C:/Users/mdsafiqur/Downloads/Architectsandresearchbasedknowledgeliteraturereviewpdf (1).pdf

Eilouti, B. (2018a). Concept evolution in architectural design: an octonary framework. *Frontiers of Architectural Research*, *7*(2), 180–196. https://doi.org/https://doi.org/10.1016/j.foar.2018.01.003

Eilouti, B. (2018b). Scenario-based design: New applications in metamorphic architecture. *Frontiers of Architectural Research*, *7*(4), 530–543. https://doi.org/https://doi.org/10.1016/j.foar.2018.07.003

Ekasiwi, S. N. N., Majid, N. H. A., Hokoi, S., Oka, D., Takagi, N., & Uno, T. (2013). Field Survey of Air Conditioner Temperature Settings in Hot, Humid Climates, Part 1: Questionnaire Results on Use of Air Conditioners in Houses During Sleep. *Journal of Asian Architecture and Building Engineering*, *12*(1), 141–148. https://doi.org/10.3130/jaabe.12.141

Elango, B. (2019). A bibliometric analysis of literature on engineering research among BRIC countries. *Collection and Curation*, *38*(1), 9–14. https://doi.org/10.1108/CC-05-2017-0017

Elkhateeb, A. A. (2014). Remarks on the Surface Area and Equality Conditions in Regular Forms. Part I: Triangular Prisms. *Nexus Network Journal*, *16*(1), 219–232. https://doi.org/10.1007/s00004-014-0178-8

Elkhateeb, A., Attia, M., Balila, Y., & Adas, A. (2018). THE CLASSIFICATION OF PRAYER HALLS IN MODERN SAUDI MASJIDS: WITH SPECIAL REFERENCE TO THE CITY OF JEDDAH. *ArchNet-IJAR : International Journal of Architectural Research*, *12*(2), 246. https://doi.org/http://dx.doi.org/10.26687/archnet-ijar.v12i2.1411

Fisher, T. (2017). Research and Architecture's Knowledge Loop. *Technology|Architecture + Design*, *1*(2), 131–134. https://doi.org/10.1080/24751448.2017.1354601

Furlan, R. (2015). CULTURAL TRADITIONS AND ARCHITECTURAL FORM OF ITALIAN TRANSNATIONAL HOUSES IN AUSTRALIA. *ArchNet-IJAR : International Journal of Architectural Research*, *9*(2), 45–64. https://www.proquest.com/scholarly-journals/cultural-traditions-architectural-form-italian/docview/1700276270/se-2?accountid=27795

Ghaffarianhoseini, A., AlWaer, H., Omrany, H., Ghaffarianhoseini, A., Alalouch, C., Clements-Croome, D., & Tookey, J. (2018). Sick building syndrome: are we doing enough? *Architectural Science Review*, *61*(3), 99–121. https://doi.org/10.1080/00038628.2018.1461060

Gomez-Rosselli, S., & Rosselli, D. (2021). Bibliometric analysis of engineering publications in colombia 2010-2019: A scopus analysis•. *DYNA (Colombia)*, *88*(216), 9–14. https://doi.org/10.15446/dyna.v88n216.89837

Hodder, S. R., & Rich, H. (2014). How architects use research. In *RIBA, Architecture.com* (p. 64). RIBA. file:///C:/Users/mdsafiqur/Downloads/HowArchitectsUseResearch2014pdf.pdf

Indraganti, M., Ooka, R., Rijal, H. B., & Brager, G. S. (2015). Drivers and barriers to occupant adaptation in offices in India. *Architectural Science Review*, *58*(1), 77–

86. https://doi.org/10.1080/00038628.2014.976539

Jenkins, P. (2019). Research and knowledge development in architecture: reflections on academic, professional and wider social approaches. *ARCC Conference Repository*, *1*(1). https://www.arcc-journal.org/index.php/repository/article/view/882

Jeremy Till. (2017). *Architectural Research: Three Myths and One Model*. ArchDaily. https://www.archdaily.com/802766/architectural-research-three-myths-and-one-model

Kashef, M. (2016). Urban livability across disciplinary and professional boundaries. *Frontiers of Architectural Research*, *5*(2), 239–253. https://doi.org/https://doi.org/10.1016/j.foar.2016.03.003

Kumar, S., & Rahaman, M. S. (2019). Research Performance in the field of big data in India : A Scientometric analysis based on Scopus database. *Library Philosophy and Practice*, 1–24. https://digitalcommons.unl.edu/libphilprac/3736/

Ozdural A. (1995). Omar Khayyam, Mathematicians, and "Conversazioni" with Artisans. *Journal of the Society of Architectural Historians*, *54*(1), 54–71. https://doi.org/10.2307/991025

Persson, O. (2016). Bibexcel is a versatile bibliometric toolbox developed. *Inflibnet*, *23*(4).

Rahaman, M. S., Ansari, K. M. N., Kumar, H., & Shah, K. (2021). Mapping and Visualizing Research Output on Global Solid Waste Management : A Bibliometric Review of Literature. *Science & Technology Libraries*, *00*(00), 1–29. https://doi.org/10.1080/0194262X.2021.1960943

Rahaman, M. S., Kumar, S., Ansari, K. M. N., & Rahman, M. R. (2021). Twenty-five years of global research publications trends of novel coronavirus: A scientometrics assessment. *Library Philosophy and Practice*, 1–17. https://digitalcommons.unl.edu/libphilprac/4294/

Rahaman, M. S., Kumar, S., & Shah, K. (2021). A scientometric assessment of global research productivity in traditional knowledge:Evidence from scopus database. *Kelpro Bulletin*, *25*(June), 15–29.

Rahman, M. M., & Imon, S. S. (2017). CONSERVATION OF HISTORIC WATERFRONT TO IMPROVE THE QUALITY OF LIFE IN OLD DHAKA. *International Journal of Architectural Research: Archnet-IJAR*, *11*, 83–100.

Rashid, M., & Ara, D. R. (2015). Modernity in tradition: Reflections on building design and technology in the Asian vernacular. *Frontiers of Architectural Research*, *4*(1), 46–55. https://doi.org/https://doi.org/10.1016/j.foar.2014.11.001

Rawat, U., Karmakar, V., & Sawan Kumar Sharma. (2021). Importance of Research in Architecture. *INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY*, *10*(01), 156–161. https://doi.org/10.2139/ssrn.3703560

Saka, A. B., & Chan, D. W. M. (2019). A Scientometric Review and Metasynthesis of Building Information Modelling (BIM) Research in Africa. *Buildings*, *9*(4). https://doi.org/10.3390/buildings9040085

Salama, A. (2006). Editorial: Committed Educators are Reshaping Studio Pedagogy. *Open House International*, *31*(3), 4–9. https://doi.org/10.1108/OHI-03-2006-B0001

Salama, A. M. (2011). Trans-Disciplinary Knowledge for Affordable Housing. *Open House International*, *36*(3), 7–15. https://doi.org/10.1108/OHI-03-2011-B0002

Salama, A. M., & Gharib, R. Y. (2012). A Perceptual Approach for Investigating Urban Space Diversity in the City of Doha. *Open House International*, *37*(2), 24–32. https://doi.org/10.1108/OHI-02-2012-B0004

Sobh, R., & Belk, R. W. (2011). Privacy and Gendered Spaces in Arab Gulf Homes.

Home Cultures, *8*(3), 317–340. https://doi.org/10.2752/175174211X13099693358870

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Wiedmann, F., Salama, A. M., & Thierstein, A. (2012). Urban evolution of the city of Doha: An investigation into the impact of economic transformations on urban structures. *Metu Journal of the Faculty of Architecture*, *29*(2), 35–61. https://doi.org/10.4305/METU.JFA.2012.2.2