

Quantitative and Qualitative Content Analysis of Architectural Technology Research Published in Scientific Research Journals during 1979-2019

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ABSTRACT

Scientific-research publications play a key role in representing creativities and scientific findings in a specific scientific field. So far, no comprehensive research has been carried out on this topic in the specialized field of architectural technology. Investigating publications in terms of qualitative content and the number of published articles can be an effective step in helping architecture researchers in this specialized field. The present study aims to show the general trend of architectural technology research published in all domestic scientific research journals, during the years 1979-2019. The present study was carried out in the spring of 2020 and it investigates 225 articles published in 21 domestic scientific research journals. The present study is qualitative-descriptive research. To reach the research goal, first, architectural technology articles are classified into 8 categories through their qualitative content analysis. Next, the relationships between them are analyzed using statistical methods. To this end, ten parameters are considered for further scrutinization, including "research topic of articles", "contribution of institutions", "publishing journals", "scientific ranks of authors", "contribution of scientific-specialized groups", "used references", "publication year", "research method used", "duration of acceptance", and "extractive sources". The results indicate that the subject of "structure technology" was the most widely discussed subject by researchers and the subject of "digital technology" was the least discussed subject. Among the authors, the frequency of graduate students is significant, which can be justified by the fact that the architectural technology sub-field is presented in the master's degree. Articles published during 1990-1995 account for the highest frequency, indicating the researchers' increasing attention to this topic in recent years considering society's need for it.

Keywords: Scientific Research Articles, Architecture, Architectural Technology, Content Analysis.

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1. INTRODUCTION AND PROBLEM STATEMENT

No research is complete unless its findings are presented to the scientific community, and scientific journals are usually the accepted media for communicating research results. In today's world, publications are one of the criteria for socio-cultural development. Today, society is considered developed if education and information, or in other words, the element of information and social knowledge are prominent in it, in addition to economic and demographic indicators such as gross national product, per capita income, steel, and energy production, life expectancy rate, death and birth rates, age-gender composition, etc. (Zaki 2006).

Publications also play a key role in the growth and development of academic disciplines and are considered one of the criteria for evaluating the status of academic disciplines. The quality and quantity of journals published in a country are also considered a basis for planning academic disciplines to promote them. Journals are one of the most important living elements of the scientific sector of any country and are regarded as one of the most important sources of information (Habibollahian 2011, 155).

One of the basic needs of every scientific community is to evaluate the performance of its scientific activities continuously, impartially, and comprehensively, which plays the role of feedback in eliminating barriers to scientific progress. Accordingly, evaluating the performance of scientific publications is an effective and scientific solution to improve the quality of knowledge (Zangi Abadi and Soltani 2009, 177).

Various definitions have been presented for content analysis. It is a research method for the objective, systematic, and quantitative explanation of the explicit content of relations (Motamednejad 1977). Content analysis is a method for identifying and manifesting the axes or main lines of a text, and provides a descriptive analysis leading to knowledge (Saroukhani 1999).

Content analysis is a technique for extracting data from text. It has its specific characteristics. In general, one can say that content analysis, which is also called discourse analysis, is a method based on which the linguistic features of a spoken or written text can be recognized realistically, objectively, and systematically. Content analysis is a method independent of the theoretical framework or perspective (such as contextual theory and phenomenology), but as a method, its origin was quantitative. The qualitative content analysis method is useful in cases where the question "why" is raised in the research, and the quantitative content analysis is used when the question "which" is raised (Boroujerdi Alavi 2009, 31).

Accordingly, to analyze the quantitative and qualitative content of science production in the field

of architectural technology, all the articles published in this field in scientific and research journals from 1979 to 2019 were taken into consideration. After reviewing them, 225 articles were selected and qualitatively and quantitatively analyzed in 10 parameters. The parameters were selected after a detailed study of the articles and considering the information that can be obtained from each article and converted into quantitative tables.

The present research seeks to address the following questions:

1. Considering the importance of technology in the world and its dynamic and growing nature, what is the quantitative and qualitative status of articles published in this field in scientific-research journals in Iran?

2. Is it possible to obtain an acceptable model for drawing and predicting the future of architectural technology by examining and analyzing the quantitative and qualitative content of the articles published in the abovementioned period?

3. What is the contribution of scientific and specialized groups in terms of the number of articles on architectural technology published in scientific research journals?

4. What are the gender composition and scientific rank of the authors of this field?

5. What research method have the researchers in the field of architectural technology used in their research, what is the research method classification, and what is the most widely used research method? What are the strengths and weaknesses of the research method in this field?

Examining the content of scientific-research journals in this field and the contribution of architectural technology topics makes the importance of this field clearer for publishing journals, researchers, and readers. The innovation of the present research is that despite the significance of technology in architecture and also the addition of architectural technology sub-field to academic disciplines in the master's program, no research has investigated the contribution of architectural technology-related topics in scientific-research journals so far and no classification has been presented for the topics discussed in this field. The present study aims to highlight the strengths and weaknesses existing in this field to provide the ground for strengthening strengths and improving weaknesses in the future.

2. RESEARCH BACKGROUND

Undoubtedly, using past studies can be greatly helpful in the present and future research, and many lessons and ideas can be extracted from them. Table 1 represents some research on quantitative and qualitative content analysis and a summary of its results.

Table 1. Review of Research Background

No.	Researcher(s)	Title	Summary of Result
1	Bemanian, Mohammadreza, Abafat Yeganeh, Mansour, Naderi, Seyyed Majid (2008)	Quantitative and qualitative evaluation of the HONAR-HA-YE-ZIBA journal during a 12-year interval.	Noticeable quantitative and qualitative progressing changes in 9 parameters: in the case of research topic, articles on architecture, urban planning, and visual arts have the highest frequency, and in the case of the academic rank of authors, the highest frequency is related to assistant professor. The authors are from 25 specialized scientific groups and 40% of the articles have been derived from previous scientific research works.
2	Mozaffar, Farhang, Ahmadi, Feryal, Asadpour, Ali (2012)	Quantitative analysis of restoration articles published in review-specialist journals of Iran during the period from 2001 to 2011	The lowest and highest frequencies are related to articles on restoration and theoretical foundations of restoration, respectively. The shares of the topics of the introduction of works of restoration value in Iran and the world were 38.41% and 5.5%, respectively. Also, it showed the upward trend of authored articles and the downward trend of translated articles in the last 10 years.
3	Dayani Mohammad Hossein, Shirdel Shahla (2000)	Review and comparison of the abstracts of persian articles published in humanities scientific research journals with ISO 214 standard	Most of the abstracts in humanities journals are indicative, which are more compliant with ISO 214 than informative abstracts.
4	Rahnama Mohammad Rahim et al. (2013)	Analysis of factors affecting the acceptance of articles in the Journal of Geography and Regional Development using the Kaplan-Meier model and the Cox regression.	Out of 900 articles received, 136 articles have been published in 14 issues, 51% have been rejected, and 34% are under review.
5	Habibolahian Mahmoud (2011)	Quarter-century of geography of Iran in the mirror of journal of geographical research	The increase of articles with more than 2 authors and the most successful journal in terms of citation and impact factor in the field of geography
6	Noei Maryam (2011)	Considering articles in the Journal of geographical Landscape of Islamic Azad University, Rasht Branch (2006-2010)	60% of the articles were carried out in groups.

3. METHOD

The present study is descriptive-analytical research in which the required data were collected using quantitative content analysis. It aimed to review and analyze architectural technology articles published in scientific-research journals during 1979-2020. The data were collected from 225 articles published in 21 journals in the period from 1979-2020. First, the articles whose titles, keywords, or abstracts included the words architecture and technology were collected. Then, they were reviewed and those irrelevant to the research topic were removed. To ensure the validity and reliability of the research, this was repeated several times by all three researchers until the desired number of articles was collected. Then, a table including ten features of the article was developed. Its rows were including No., author(s), article title, publishing journal, research topic, year of publication,

participation of institutions, the scientific rank of authors, used research method, extractive sources, used references, and the participation of scientific and specialized groups. Next, a table including frequency and cumulative frequency was developed for each of these ten parameters and a histogram graph and a bar graph were obtained for each in Excel software. Then, the findings were formed based on these graphs.

4. OPERATIONAL DEFINITION OF TEN PARAMETERS

To study any social phenomenon, in the sense of social production, including production in any field, the whole phenomenon is considered a system formed by several elements. From this point of view, acquiring knowledge about any phenomenon is first achieved by identifying the constituent elements of that system separately (Berelson 1954, 488). Content analysis is a

systematic and repeatable test of relational symbols. In this technique, numerical values are attributed to the text based on valid measurement rules. Then, using statistical methods, the relationships between those values are analyzed (Boroujerdi Alavi 2009, 86). In the present research, articles published in scientific-research journals during the period from 1979 to 2019 were considered a system whose constituent elements were ten parameters. To select the research parameters, first, previous relevant qualitative and quantitative research was reviewed and 8 parameters were selected. Next, according to all three researchers of the present study, considering the thematic focus of this research on the field of architectural technology, and the absence of such a category in this field, the parameter "thematic categorization" was added to the parameters. To reach this categorization, all the articles published in 21 scientific-research journals in a 40-year period were studied and analyzed, and finally, 225 articles with a thematic focus on architectural technology were separated and 8 thematic categories were extracted. Also, to improve the qualitative content of the present research and enrich it, the parameter "research method used" was selected as another research parameter, and the "abstract" and "research method" sections of 225 selected articles were analyzed quantitatively and qualitatively. In general, the research parameters were selected based on information that can be converted into quantitative content. For example, the scientific rank of the authors can be found in each article, and converting this parameter into quantitative information and graphs makes it possible to assess and analyze the attention of professors of various ranks and students to this field and examine the significance of this field of architecture among the authors. The quantitative and qualitative analyses of the "publishing journal" parameter make it possible to find out which of the scientific research journals have addressed the field of architectural technology more than other journals and can be attracted researchers of this field more than other journals.

The ten parameters investigated in the present study are including:

1. The research topic of the articles: After examining the scientific research journals and the topic and title of the articles published in them, all three authors of the present study divided articles into 8 categories in the research topic as follows:

- a) Construction technology: this category includes topics related to construction technology, construction methods, management of construction methods, details, and construction elements and details.
- b) Structure technology: it includes topics related to building systems, structures, statics, the strength of materials, structural behavior, and earthquakes.
- c) Education of technology: it includes the education of technology in architecture.
- d) Material technology: it includes topics related to

materials in architecture.

e) Digital technology: it includes topics related to digital architecture, digital technology, and applied software in architecture.

f) Restoration technology: it includes topics related to restoration technology, building restoration techniques, and methods.

g) Technology theory: it includes topics related to the basics of technology, the history of technology, the philosophy of technology, and art.

h) New technologies: it includes topics related to recently developed technologies, smartification, and new energy-related debates in architecture.

2. Contribution of institutions: it refers to the contribution of universities and other educational and research institutions in terms of the number of published articles. In this case, the working place of the first author is considered.

3. The scientific rank of the authors: it includes the scientific ranks of professor, associate professor, assistant professor, instructor, etc., respectively.

4. Publication year: it refers to the year in which the article was published in the desired journal.

5. References used: It includes Persian and English references and internet sites used in the articles and their numbers.

6. Publishing journal: It refers to the name of the scientific-research journal in which the article has been published. Here, those journals that have a scientific-research rank at the time of publication of the article are considered.

7. The research method used: It refers to the research methods used in the articles. This parameter was investigated by studying the research method section of the articles, or by studying the entire article if there wasn't any specified "method" section. After reviewing the articles, the three authors of the present study agreed on the following classes: descriptive-analytical, comparative study, interpretive-historical, content analysis, survey, research-applied, empirical-experimental, analytical-exploratory, and computer simulation.

8. Extractive sources: This parameter refers to articles derived from other scientific and research fields such as doctoral thesis, master's thesis, research design, translated sources, class project, and lecture. The "none" option refers to items not derived from any of the abovementioned sources.

9. Duration of acceptance: It refers to the period (in months) from the time of receiving the articles to their acceptance for publication in the journal. Each journal determines a given period.

10. Contribution of scientific-specialized groups: This parameter refers to the scientific and specialized groups contributing to the presentation of the articles. It is examined in terms of the number of articles on architectural technology published in scientific research journals. In this case, the scientific-specialized group of which the first (corresponding)

author of the article is a member is considered.

5. VALIDITY AND RELIABILITY

Reliability: It means that if an experiment is repeated several times, or an analysis is performed several times, the same results will be obtained in all cases. In other words, reliability refers to the achievement of similar results by repeating an action.

To investigate the reliability of the current research, the parameters of each indicator were examined and extracted by each researcher (three researchers), and in each case, differences were examined and revised until a consensus was reached regarding the constituent parameters of each indicator. This process was done in the analysis of both quantitative and qualitative items.

Validity: Validity refers to the degree to which the measurement tool measures what it claims to measure (Saroukhani 2006, 144). According to the nature of this research and the parameters investigated, various types of validity are considered in the research. Due

to the qualitative nature of our research method, face validity is considered. The type of validity refers to the identification of the validity of research indicators by referring to referees (ibid., 140). To examine the face validity of the present study, the ten parameters abovementioned were evaluated by the researchers (three researchers), and their definitions and development were also agreed upon by the researchers.

Validity and reliability are considered the pillars of strengthening and firming scientific credibility and should be considered in all research.

6. FINDINGS

The research topic of the articles: reviewing the articles indicated that they can be categorized into several different categories. After reviewing and classifying them several times, the researchers (three researchers) agreed on the following categories (Table 2).

Table 2. The Research Topic of the Articles

Research Topics	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Building System Technology (Structure Technology)	61	27.11	61	27.11
Technology Theory	59	26.22	120	53.33
New Technologies	49	21.78	169	75.11
Construction Technology	23	10.22	192	85.33
Restoration Technology	10	4.44	202	89.78
Education of Technology	9	4.00	211	93.78
Material Technology	8	3.56	219	97.33
Digital Technology	6	2.67	225	100.00
Total	225	100.00		

Analyzing 225 articles in the field of architecture and technology in the studied period shows that research topics such as structure technology (27.11%) and technology theory (26.22%) have been discussed more than other topics. And topics such as digital architecture (2.67%) and materials (3.56%) have the most minor contributions. According to Table 2, the smaller contribution of digital architecture (n=6) than other topics can be attributed to its novelty in recent years. The importance of introducing new materials

and how to use them in the construction industry is obvious, and its small contribution (n=8) deserves more consideration. The bar graph (Figure.1) displays the thematic contribution of the articles on the topic related to the field of architecture and technology. As seen in Table 2, new technologies account for 21.78% of all the articles. Since they refer to recently developed technologies, they can receive more attention from researchers.

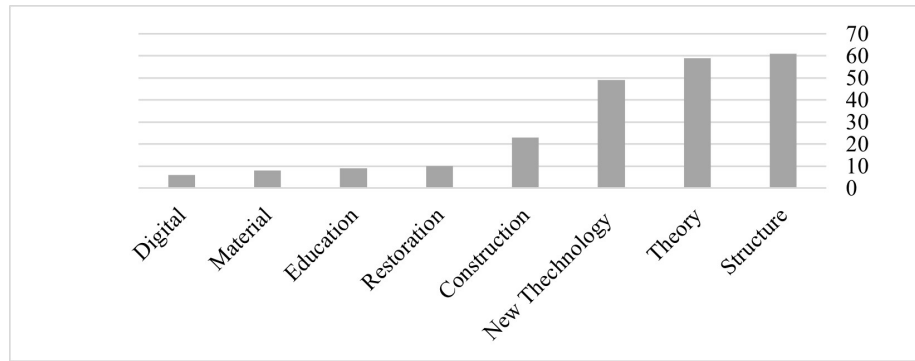


Fig. 1. The Research Topic of the Articles

6.1. Publishing Journals

Table 3 shows the share of each of the scientific-research journals in presenting and publishing the 225 articles published in the field of architecture and technology. As seen in this table, the highest frequency is related to the Journal of SOFFEH (N=31 (13.78%)), followed by the Journal of HONAR-HA-

YE-ZIBA (n=30 (13.33%)), and the lowest frequencies are related to the Journal of Iranian Architecture and Urbanism, the Journal of Architectural Thought, and the Journal of Conservation and Architecture in Iran, each with n=1 (0.44%). This result is justified considering the history of the journals and their prioritization (Fig. 2).

Table 3. Publishing Journals

Journal	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
SOFFEH	31	13.78	31	13.78
HONAR-HA-YE-ZIBA MEMARI-VA-SHAHRSAZI	30	13.33	61	27.11
HONAR-HA-YE-ZIBA	20	8.89	81	36.00
Naqshejahan	17	7.56	98	43.56
Bagh-e Nazar	14	6.22	112	49.78
Hoviatshahr	14	6.22	126	56.00
Urban Management	13	5.78	139	61.78
Housing and Rural Environment	13	5.78	152	67.56
Iranian Architecture and Urbanism	12	5.33	164	72.89
Armanshahr	12	5.33	176	78.22
Architecture and Urban Planning	9	4.00	185	82.22
Iranian Architecture Studies	8	3.56	193	85.78
Researches in Islamic Architecture	7	3.11	200	88.89
City Development Research	7	3.11	207	92.00
Architecture	5	2.22	212	94.22
Conservation and Architecture in Iran	4	1.78	216	96.00
Iranian Islamic City Studies	4	1.78	220	97.78
Motaleate-e Tatbighi-e Honar	2	0.89	222	98.67
Architectural Thought	1	0.44	223	99.11
Conservation and Architecture in Iran	1	0.44	224	99.56
Iranian Architecture and Urbanism	1	0.44	225	100.00
Total	225	100.00		

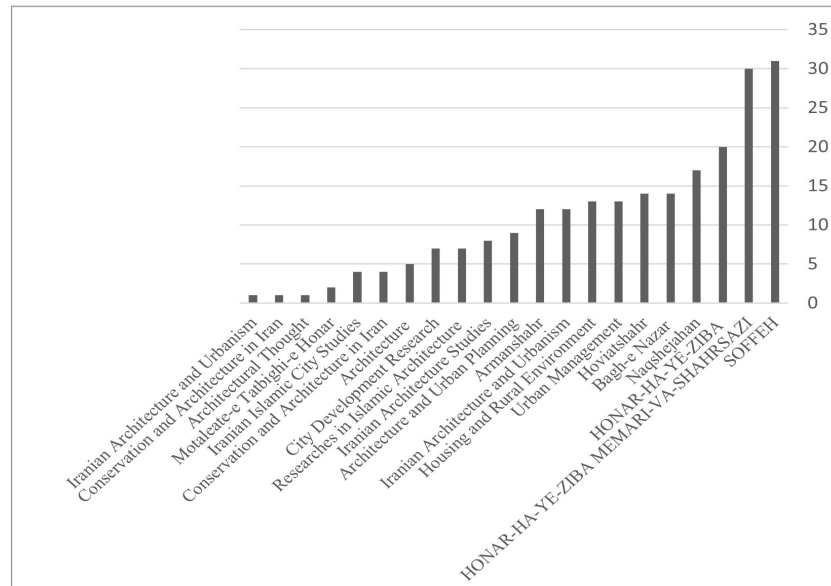


Fig. 2. Publishing Journals

6.2. The Scientific Ranks of Authors

Table 4 shows the scientific rank of the authors (the first authors of the article). According to this table, the highest frequency is related to the authors with the academic rank of assistant professor (20.44%) and the lowest frequency is related to the authors with a doctoral degree (who were not members of the

faculty of any university) and those with the rank of instructor (4.44%). Moreover, it was also found that in general, the participation of the faculty members of institutions and universities is 45.76%, while graduates and postgraduate students account for 54.24% of the participation in the articles reviewed (Fig. 3).

Table 4. The Scientific Rank of the Authors

The Scientific Rank of Authors	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Associate Professor	28	12.44	28	12.44
Assistant Professor	46	20.44	74	32.89
Instructor	10	4.44	84	37.33
Faculty Member	19	8.44	103	45.78
Doctorate	10	4.44	113	50.22
Ph.D. student	35	15.56	148	65.78
Master	41	18.22	189	84.00
Master student	19	8.44	208	92.44
None	17	7.56	225	100.00
Total	225	100.00		
Type of Participation	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Group	148	65.78	148	65.78
Individual	77	34.22	225	100.00
Total	225	100.00		
Gender of Author	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Male	343	73.13	343	73.13
Female	126	26.87	469	100.00
Total	469	100.00		

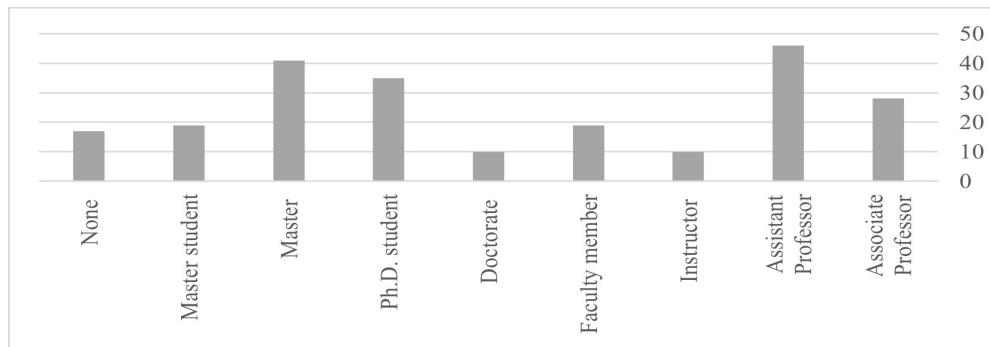


Fig. 3. The Scientific Rank of the Authors

6.3. Contribution of Institutions

As seen in Table 5, state universities had the highest level of contribution (78.22%), followed by Islamic Azad University (16.44%) and non-academic institutions (5.33%), respectively (Fig. 4).

Examining the contribution of scientific institutions to the presentation of articles on technology reveals that various institutions, including state and non-state academic institutions, have contributed to the presentation of the articles reviewed.

Table 5. The Contribution of Institutions

Participation of Institutions	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
State -Tehran	127	56.44	127	56.44
State -Other Cities	49	21.78	176	78.22
Azad-Tehran	11	4.89	187	83.11
State-Other Cities	26	11.56	213	94.67
Non-Academic	12	5.33	225	100.00
Total	225	100.00		

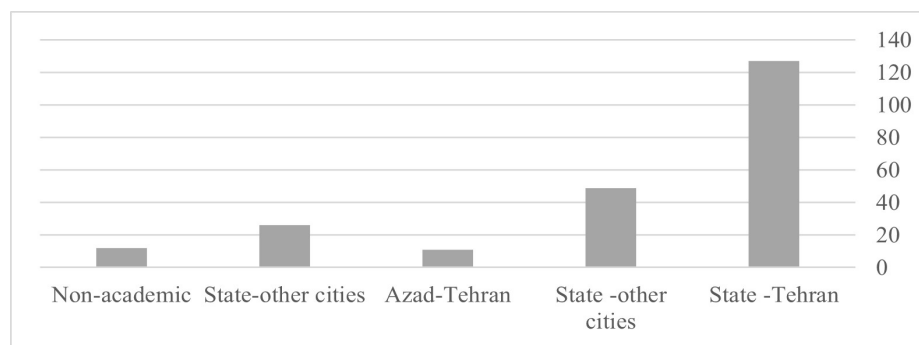


Fig. 4. The Contribution of Institutions

6.4. Contribution of Scientific-Specialized Groups

Table 6 reveals that in the 225 articles reviewed, a wide range of scientific and specialized groups have addressed the issue of architecture and technology, indicating various scientific and specialized groups address this topic. Among these groups, the architecture group pays special attention to it (Fig. 5). According to Table 6, a significant share of the

contribution of scientific-specialist groups belongs to the architecture group (n=127). This result is acceptable since the reviewed articles were selected from scientific-research journals on architecture and urbanism. The small share of the civil engineering group (n=1) implies that there is not much interaction between the two disciplines despite the presence of thematic proximity between them, and this is one of the biggest weaknesses of interdisciplinary knowledge such as architecture.

Table 6. The Contribution of Scientific and Specialized Groups

Scientific Group	Frequency	Percent	Cumulative Frequency	Cumulative percentage
Architecture	127	64.47	127	64.47
Restoration	9	4.57	136	69.04
Energy and Architecture	8	4.06	144	73.10
Energy and Architecture	8	4.06	152	77.16
Structural Engineering	4	2.03	156	79.19
Architectural Technology	3	1.52	159	80.71
Urbanism	3	1.52	162	82.23
Arts	3	1.52	165	83.76
Project Management and Construction	2	1.02	167	84.77
Architectural Studies	2	1.02	169	85.79
Geography	2	1.02	171	86.80
Energy	2	1.02	173	87.82
Architectural Studies	2	1.02	175	88.83
Urban Design	2	1.02	177	89.85
Industrial Design	2	1.02	179	90.86
Architectural Technology	2	1.02	181	91.88
Landscape Architecture	1	0.51	182	92.39
Archaeology	1	0.51	183	92.89
Islamic Architecture	1	0.51	184	93.40
Agricultural Economics	1	0.51	185	93.91
Crisis Management	1	0.51	186	94.42
Information Technology	1	0.51	187	94.92
Sustainable Design	1	0.51	188	95.43
Post-Disaster Reconstruction	1	0.51	189	95.94
Architecture and Energy	1	0.51	190	96.45
Interior Architecture	1	0.51	191	96.95
Building Physics	1	0.51	192	97.46
Environment	1	0.51	193	97.97
Sustainable Architecture	1	0.51	194	98.48
Technology-Bionic Architecture	1	0.51	195	98.98
Civil Engineering	1	0.51	196	99.49
Geotechnics	1	0.51	197	100.00
Total	197	100.00		

Note: 28 articles lack information regarding the participation of scientific groups.

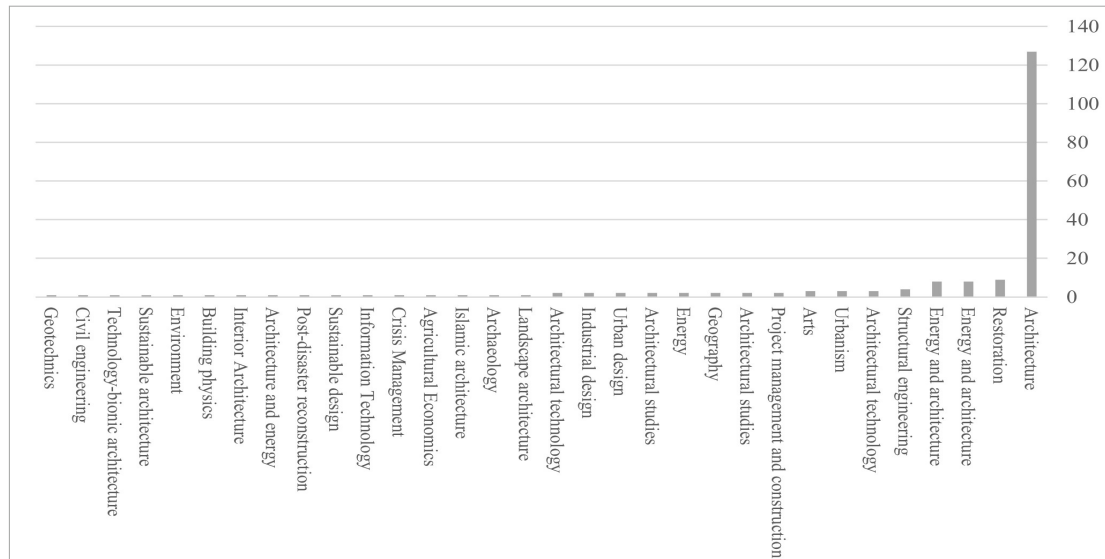


Fig. 5. The Contribution of Scientific and Specialized Groups

6.5. Publication Year

As seen in Table 7, the highest frequency of articles is related to the period of 2010-2015 and the lowest frequency is related to the years before 1995, indicating the significant growth in the publication of scientific and research articles in the field of architectural technology in recent years (Fig. 6).

According to Table 7, one can find that nearly 60%

of the 225 articles reviewed have been published in recent years, including the periods of 2011-2016 and 2016-2020 ($n=84$ and 62 (total $n=146$), respectively). Moreover, the topic of architectural theory ($n=37$) has been the most widely discussed in all the articles published from 2011 to 2016, as the years in which the highest percentage of articles in the field of technology were published, followed by the topic of new technologies ($n=25$).

Table 7. The Publication Year of the Articles

publication Year	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
1995 and earlier	8	3.56	8	3.56
1996-2000	9	4.00	17	7.56
2001-2005	18	8.00	35	15.56
2006-2010	44	19.56	79	35.11
2011-2015	84	37.33	163	72.44
2016-2020	62	27.56	225	100.00
Total	225	100.00		

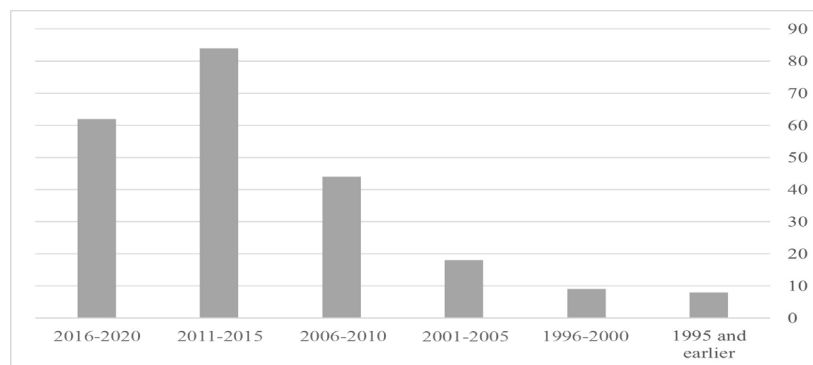


Fig. 6. The Publication Years of the Articles

6.6. The Research Method Used

In the present study, the research method classification includes the following classes: "descriptive-analytical", "comparative study", "interpretive-historical", "content analysis", "survey", "research-applied", "empirical-experimental", "analytical-exploratory", and "computer simulation". According to Table 8, the most used research method in the reviewed articles is descriptive-analytical (n=127 (out of 225) (56.44%)), followed by the empirical-experimental method (10.67%), indicating a great difference between these two methods. Table 8

shows the next ranks. There is an important point here. Considering the nature of architectural technology studies, the experimental and applied methods are expected to be the most used methods but they obtain the second (10.67%) and fourth (5.33%) ranks, respectively. the qualitative investigation of research methods shows that most of the authors didn't want to refer directly to the research method, and this is especially seen in the articles with the qualitative method. In such articles, the researchers use and combine several various research methods to carry out their research (Fig. 7).

Table 8. The Research Methods used in the Articles

Used Methods and Techniques	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Descriptive-Analytical	127	56.44	127	56.44
Empirical-Experimental	24	10.67	151	67.11
Content Analysis	21	9.33	172	76.44
Computer Simulation	16	7.11	188	83.56
Research-Applied	12	5.33	200	88.89
Interpretive-Historical	12	5.33	212	94.22
Comparative Study	10	4.44	222	98.67
Survey	2	0.89	224	99.56
Analytical-Exploratory	1	0.44	225	100.00
Total	225	100.00		

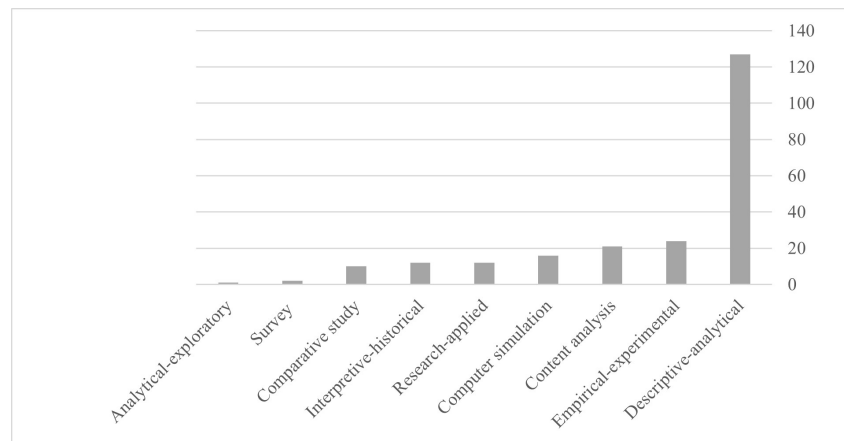


Fig. 7. The Research Method used in the Articles

6.7. Duration of Acceptance

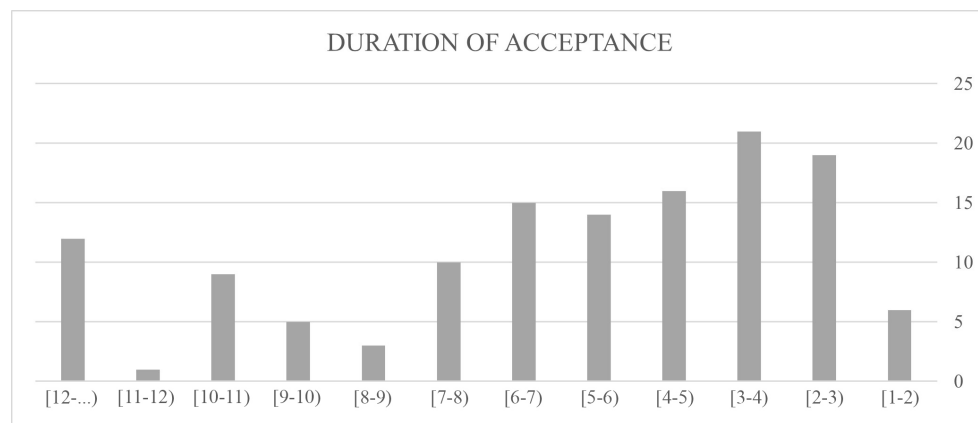
In these articles, the duration of acceptance can indicate the author's expectation for the publication of his/her article and the journal's review speed, which is one of the important indicators in the evaluation

of a scientific-research journal and plays an effective role in applicants' satisfaction with publication in the journal (Movahed and Izadi 2009). Out of 225 reviewed articles, 94 articles lacked information about the duration of acceptance (Fig. 8).

Table 8. The Duration of Acceptance of Articles

Duration of Acceptance (Month)	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
(1-2)	6	4.58	6	4.58
(2-3)	19	14.50	25	19.08
(3-4)	21	16.03	46	35.11
(4-5)	16	12.21	62	47.33
(5-6)	14	10.69	76	58.02
(6-7)	15	11.45	91	69.47
(7-8)	10	7.63	101	77.10
(8-9)	3	2.29	104	79.39
(9-10)	5	3.82	109	83.21
(10-11)	9	6.87	118	90.08
(11-12)	1	0.76	119	90.84
(12-...)	12	9.16	131	100.00
Total	131	100.00		

Note: 94 articles lack information about the duration of acceptance.

**Fig. 8. The Duration of Acceptance of Articles**

6.8. Extractive Sources

Among the ten parameters abovementioned, this parameter refers to the sources from which the published article is extracted. Table 9 shows extractive sources and their frequencies. It should be noted that the "none" option is considered for articles that were not extracted from any sources (Figure 9). The highest frequency is related to the Master's thesis. This result is predictable considering the provision of

the architectural technology sub-field in the master's program. The small share of translated articles ($n=2$) shows that researchers pay little attention to the translation of articles focusing on technology and technology in architecture. Another important point from Table 9 is that only 30% of the articles were extracted from the previous references and 70% of the articles were not extracted from any references.

Table 9. Extractive Sources

Extractive Sources	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
None	158	70.22	158	70.22
Master's Thesis	34	15.11	192	85.33
Dissertation	21	9.33	213	94.67
Research Design	9	4.00	222	98.67
Translated Source	2	0.89	224	99.56
Lecture	1	0.44	225	100.00
Total	225	100.00		

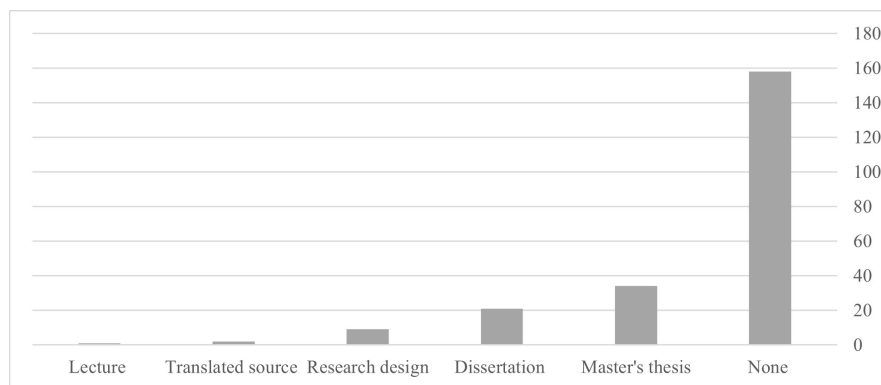


Fig. 9. Extractive Sources

6.9. References Used

The references used in the articles include Persian, English, and Arabic articles, and websites. In total, 225 published articles in the field of architectural

technology, have used 4333 references. According to Table 10, the highest frequency is related to English articles (51.47%), followed by Persian articles (45.51%), websites (3%), and Arabic articles (0.02%), respectively (Fig. 10).

Table 10. References used in Articles

References	Frequency	Percent	Cumulative Frequency	Cumulative Percentage
Persian Articles	1972	45.51	1972	45.51
English Articles	2230	51.47	4202	96.98
Arabic Articles	1	0.02	4203	97.00
Websites	130	3.00	4333	100.00
Total	4333	100.00		

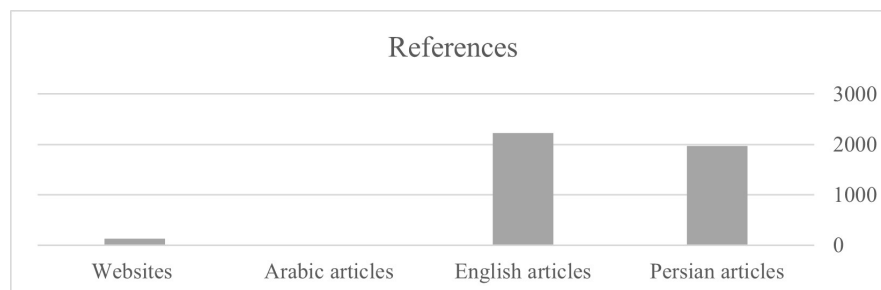


Fig. 10. References used in Articles

7. CONCLUSION

Scientific-research journals are considered one of the centers for producing and connecting sciences. They are published at regular intervals and within a certain period. The present study qualitatively and quantitatively analyzed articles published in the field of architectural technology in scientific research journals from 1979-2019 in terms of 10 parameters. Out of all the articles published in scientific research journals, 225 articles were in the field of architectural technology. They were divided into eight general categories in the research topic. The results indicate a very small share of articles on the subject of "digital technology" (2%), which was predictable due to the novelty of this field in architecture, showing the need for researchers to address this issue more than ever. The "structure technology" (27%) was the most widely discussed subject in the published articles. Also, among the publishing scientific-research journals, the largest number of articles has been published by the journals of SOFFEH and HONAR-HA-YE-ZIBA. This result can be justified considering the two factors of history and prioritization of the magazine. Regarding the scientific ranks of the authors, the highest and lowest frequencies were related to assistant professors and instructors, respectively. It was found that there is a tendency to work in groups, and most of the authors were males. However, the frequency of master's students is significant, which can be justified considering the provision of the sub-field of architecture and technology at the master's degree. More than 78% of the articles have been supported by state universities and 16% by Islamic Azad universities, the contribution of Tehran universities (state and Azad) is very significant. They accounted for more than 60%, and the significance of the spread of this field throughout the country emphasizes the need for more attention of the universities in other cities to this issue to avoid its concentration in the capital enter. The results indicated the participation of 32 specialized scientific groups in these articles, among which the architecture group has contributed the most. However, there is a remarkable point: the spread of this field among scientific-specialist groups. This result is justified considering the nature of technology. The most and least used research methods were descriptive-analytical (56%) and analytical-exploratory (16.3%) research methods, respectively. The duration of acceptance of 3-4 months has the highest frequency (16.3%) and articles with a duration of acceptance of above one year (9.16%) also show a significant frequency and it is hoped that it will be examined by experts. Most of the articles were derived from the master's thesis (15%) and the lowest frequency was related to the lectures (0.44%). Regarding references

used, the highest frequency was related to English references (51%), followed by Persian references (46%), and websites (3%), respectively, indicating the necessity of using reliable Internet sources and how to recognize their credibility.

Since the present study is descriptive and analytical research, its results are presented in the form of suggestions as well as practical solutions in Table 11 for educational planners, researchers, professors, and students in the field of architectural technology to improve the quantitative and qualitative states of scientific research articles in the field of architectural technology and enhance their scientific level as follows:

1. Considering the dispersion of articles in the field of architectural technology in various scientific research journals, the non-significant share of articles in this field among the articles published in journals, the addition of the "architecture and technology" sub-field at the master's degree, and the growth of students of this sub-field in recent years, it seems critical to established specialized academic or state publications in this field.
2. Since the research method was not accurately clear in many articles, especially in qualitative research, where many authors did not mention their research method or carried out their research using mixed research methods or several research methods. Since not having a suitable and reliable research method can sometimes lead to wrong results in the research, scientific research journals are suggested to pay more attention to the research methodology and ask the researchers and authors of the articles to clearly explain and mention their research methods.
3. Considering the small share of articles with the empirical research method, it seems that one of the obstacles facing researchers is the lack of a suitable platform for conducting such research. Considering the nature of architectural technology in some subjects such as materials and structural systems that require experimental simulations and accurate measurement, it is necessary to provide a suitable platform for this type of research in universities.
4. Since many scientific findings have a specific consumption time, journals are recommended to pay more attention to a reasonable duration of acceptance. The duration of acceptance of above one year may cause serious damage to the obtained results.
5. Considering the novelty of topics such as digital architecture and topics related to new technologies, scientific research journals are recommended to ask the authors to refer to some new and reliable English references (at least 4 references) (2019-2020), preferably ISI articles, to make the global issues in this field known and studied.

Table 11. Practical Solutions

Group	Presentation of Practical Solutions
1. Architectural Technology Researchers	<p>1. Among scientific research journals, 10 journals of SOFFEH, HONAR-HA-YE-ZIBA MEMARI-VA-SHAHRSAZI, Armanshahr, HONAR-HA-YE-ZIBA, Naqshejahan, Bagh-e Nazar, Hoviatshahr, Urban Management, Housing and Rural Environment, Iranian Architecture and Urbanism, have more addressed architectural technology than other journals and the researchers of this field can use them more than other journals in their research.</p> <p>2. Considering the abundance of articles published on architectural technology topics between the years 2011-2020 (148 articles out of a total of 225 articles), the researchers can refer to the articles published within the abovementioned 10-year period.</p> <p>3. Although topics such as digital architecture and material technology are among the topics least addressed by the researchers, they can be considered by researchers due to being new.</p>
2. Publishers of Scientific Research Journals	<p>1. Considering the relatively small share of architectural technology articles and the importance of addressing this topic due to its growing nature in the world, it is recommended to allocate a certain part of the articles published in scientific research journals to this field of architecture.</p> <p>2. Considering the quantitative and qualitative review of the research methods used in the articles and the weakness of the researchers in presenting and using the appropriate research methods for most of the reviewed articles, publishers are recommended to announce the correct research methods they accept for the initial acceptance of the articles.</p> <p>3. According to the results of the present research and the introduction and classification of the shortcomings and challenges facing this field of architecture, there seems a need for a scientific-research journal focusing on architectural technology topics.</p>
3. Educational Institutions and Universities	<p>Many architectural technology studies, due to the scientific and experimental nature of this field, require workshops and laboratories to conduct scientific research. Universities and educational institutions are recommended to provide more laboratory and workshop facilities for "architectural technology", and "energy, and architecture" sub-fields, especially at the master's degree.</p>

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