A Systematic Research Gap Finding Framework: Case Study of Construction Management

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ABSTRACT

Researchers examine theories and crack the problem when they encounter issues in dealing with an area or activities. Nevertheless they refer to the journals to gain broader knowledge and updated insights of the research when they do not face a particular problem. The aim of this study was to examine reputable journals of construction management appearing in Scopus and ISI and to utilize content analysis to extract their major issues and approaches. The study introduced a systematic approach to find new issues as gaps in the field of construction management. This systematic approach can be used in other areas of study. Within this paper, current issues, the boundaries of knowledge and potential fields of study were recognized.

KEYWORDS: Systematic research, Research gap, Research framework, Gap finding, Construction management.

INTRODUCTION

The goal of this research is to point out the gaps in current study. The researcher is going to bridge the gap between academic research and current practice therefore working on original research is required to identify the necessity of research somewhere close to the beginning of the study [1-3]. Because it is imperative to show the reader that existing research is not duplicated, emphasize will be on why and how much the study is significant, interesting or relevant to the field. The surveys shown here are closely related to literature reviews, but shorter and therefore likely to be much less comprehensive. Surveying the current research can show the way ahead with sieves and restricts the limitation of search to achieve the gap and topic [4-7]. When there is no significant problem to study in research, researchers need to search among previous studies to find the broader knowledge. Types and methods of the search and search resources will be determined by the researcher according to his targets of study. If the whole subject and research area is clear, search among related resources and journals to the topic will be done. If in accord with topic levels, it becomes more specialized, search methods and resources will be more specialized and more limited.

A number of journals publish special and reputable papers specific to the research domain, therefore they can be referred to for clear and selective issues in research. In this case we consider the more general state to encompass the various conditions. Only the field of the study is identified and no specific topic is desired. The study is looking to find a new issue as a gap in the field of construction management. Therefore the scope of the study is construction management related journals. Within the study, current issues, the boundaries of knowledge and potential fields of the study are recognized as a systematic approach. This systematic approach can be used in other areas of study.

MATERIALS AND METHODS

The number of books, journals, conferences and work-shops is increasing so a systematic method has become necessary to find the gap of research in area of study [8]. In a systematic research finding relevant documents are analyzed with regard to achieve a particular research gap. This study uses content analysis as its research methodology. This method has been considered as a general method of research [9]. In accord with Dibbern et al [10], this study use a systematic framework to analyze articles that deal with construction management. Generally, frameworks are designed to describe the structure of a set of objects within a given domain and the relationships among those objects [11]. It can be especially practical to obviously outline the domain, organize knowledge and highlight opportunities for more specific research. Figure 1 illustrates the individual steps of our research process. We conducted our five-step systematic framework as follows:

1. **Journals Selection :** Referring the ranking of journals and update classifications to select high quality journal

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2. **Keywords finding and categorizing:** Keywords finding through a pilot study (in limited number of selected journals) and categorization into the main group

3. **Keywords searching:** Searching among the selected journals with the obtained keywords categories

4. **Keywords ranking:** Keywords taxonomy in three major categories of High potential, Medium potential and Low potential

5. **Keywords finalizing:** Recheck high potential keywords in the resources without any time limitation and filtering by research condition such as interest, data accessibility, scope etc

1. Journals Selection

Books, journals, conference papers, websites, weblogs etc can be considered as suggestions for the research domain. Among these resources, journals contain the most prestigious and mesentery updated issues that can be placed on stands. There are different ways to find research field related journals, such as referring to the list of prestigious journals in reference sites like Scoops, Elsevier, Springer, ISI Reuters etc. However these sites offer an extended list of journals, therefore to make an easier and faster search, it is better to refer the known ranking of journals in each field of study. Several institutions and websites have produced ranking of top journals in the field. Among the references, as well as the web of knowledge, some of them have presented a list of high impact journals in such fields. However in some research fields and topics there is not an independent and comprehensive journal ranking. Furthermore, at times current rankings are not entered for a number of famous journals.
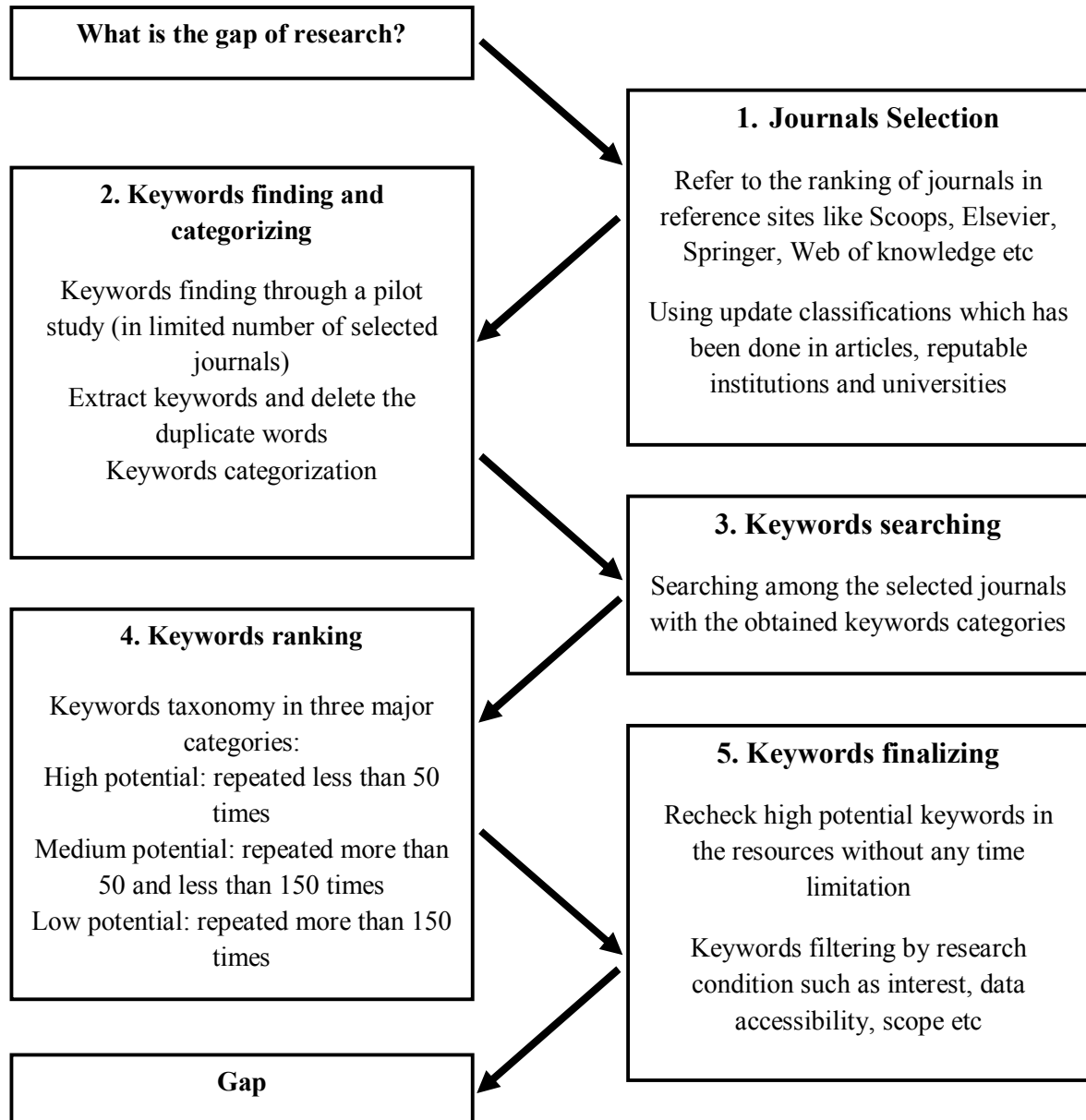
Figure 1: Individual steps of systematic research gap finding framework process

In such cases, using classifications which has been done in articles, reputable institutions and universities can help to find a comprehensive list of top journals. An update classification must be measured and rechecked with potential respondents. In the field of construction management such references, like the web of knowledge, have left specific journals ranking and provided a wider rank in the field such as civil engineering era. These rankings will not accurately fulfill our needed information. Therefore, the study spent its search connecting the existing classifications. Meanwhile some classifications determine the construction management journals ranking specifically including:

1. The Ranking of Construction Management Journals by Chau Kwong Wing [12], table 1
2. Journal Classification by National University of Singapore [13], table 2

Table 1: Summary Statistics of the Respondents' Ranking Scores by Wing (1997)

Journal Title	Average Score (Rank) / Variation Coefficient (Response Rate)
Construction Management and Economics	82.67 (1) / 17.0% (74%)
Journal of Construction Engineering and Management	80.89 (2) / 18.2% (68%)
Engineering, Construction and Architectural Management	73.90 (3) / 19.2% (62%)
Journal of Management in Engineering	73.88 (4) / 22.5% (61%)
Proceedings of Institution of Civil Engineers - Civil Engineering	70.59 (5) / 24.7% (41%)
International Journal of Project Management	70.16 (6) / 22.5% (56%)
International Journal of Construction Information Technology	65.22 (7) / 23.7% (35%)
Transactions of American Association of Cost Engineers	65.05 (8) / 33.4% (30%)
Automation in Construction	64.40 (9) / 30.6% (38%)
Journal of Construction Procurement	61.32 (10) / 23.6% (38%)
Cost Engineering	60.97 (11) / 32.1% (45%)
Building Research and Information	60.72 (12) / 23.7% (33%)
Journal of Real Estate and Construction	59.73 (13) / 35.2% (33%)
Construction Papers	58.09 (14) / 26.8% (33%)
Construction Law Journal	56.88 (15) / 36.4% (24%)
NICMAR Journal of Construction Management	53.57 (16) / 32.0% (21)
Asian Pacific Building and Construction Management Journal	49.30 (17) / 31.0% (30%)
The Building Economist (AIQS Journal)	45.75 (18) / 42.5% (30%)
The Cost Engineer	44.20 (19) / 52.4% (23%)
Construction Manager (Chartered Builder)	32.81 (20) / 69.8% (47%)
Campus Construction	28.13 (21) / 61.7% (23%)
Chartered Surveyor Monthly	24.00 (22) / 72.7% (35%)

Table 2: Journal classification by National University of Singapore (2001)

Premier Journals	7. Australian Surveyor
1. Building and Environment	8. British Corrosion Journal
2. Construction Management and Economics	9. Building Research Journal
3. Energy and Buildings	10. Cement and Concrete Research
4. Journal of Construction Engineering and Management (ASCE)	11. Computers and Structures
Leading Journals	12. Concrete International: Design & Construction
1. Applied Acoustics	13. Corporation Communications
2. Applied Energy	14. Design Studies
3. ASHRAE Transactions	15. Development International
4. Automation in Construction	16. Engineering Structures
5. Building Research and Information	17. Environment Monitoring and Assessment
6. Building Services Engineering Research & Technology	18. European Journal of Purchasing and Supply Management
7. Construction & Building Materials	19. Geotechnical Testing Journal
8. Engineering, Construction & Architectural Management	20. International Journal for Housing Science and Its Applications
9. Fire Safety Journal	21. International Journal of Human Resource Management
10. Habitat International	22. International Journal of Mechanical Sciences
11. Impact Assessment & Project Appraisal	23. International Journal of Space Structures
12. Indoor Air	24. International Journal on Engineering Performance Based Fire Codes
13. International Construction Law Review	25. International Planning Studies
14. International Journal of Lighting Research and Technology	26. Journal of American Ceramic Society
15. International Journal of Project Management	27. Journal of Construction Procurement
16. International Journal of Quality & Reliability Management	28. Journal of Design Computing
Reputable Journals	29. Journal of Managerial Psychology
1. Architectural Science Review	30. Journal of Quality in Maintenance Engineering
2. ASCE Journal of Professional Issues in Engineering Education and Practice	31. Journal of Real Estate and Construction
3. Construction Law Journal	32. Journal of the International Society of the Built Environment
4. Indoor Environment	33. Journal of Wind Engineering and Industrial Aerodynamics
5. International Journal for Construction Marketing	34. Magazine of Concrete Research
6. International Journal of Construction Information Technology	35. Management and Economics
7. International Journal of Energy Research	36. Management Decision
8. International Journal on Architectural Science	37. Managing Service Quality
9. Journal of Applied Fire Science	38. Marketing Intelligence & Planning
10. Journal of Construction Research	39. Noise Control Engineering Journal
11. Journal of the Illuminating Engineering Society	40. Quality Forum
12. Polymer Testing	41. Strain

13. Survey Review	42. Structural Survey
14. Tolleys Professional Negligence	
Others	43. The Australian Institute of Quantity Surveyors
1. Architectural Research Quarterly	44. The Learning Organisation: An International Journal
2. Asia Pacific International Journal of Marketing	45. The TQM Magazine
3. Asia Pacific Journal of Marketing & Logistics	46. Thin-walled Structures
4. Australian Dispute Resolution Journal	47. Training for Quality
5. Australian Institute of Building Papers	48. Transactions of the Institution of Engineers, Australia Civil Engineers
6. Australian Journal of Geodesy, photogrammetry and Surveying	49. Work Study

As can be seen from the dates of these two classifications, citing them needs one to update their results. To this end, referring to the list of top journals with high impact factors in the field of civil engineering and review of each journal's subjects, those associated with construction management were selected and added to the above existing lists. A final list was presented to seven academic experts during the interviews. In addition to the journals used for the interviews, six more construction management related journals were selected (table 3).

Table 3: Six related journal of construction management

Journal	Reference	Publisher	ISSN	Issues per year
Automation in Construction	[14]	Elsevier	0926-5805	8
Building and Environment	[15]	Elsevier	0360-1323	12
Construction and Building Materials	[16]	Elsevier	0950-0618	12
Construction Management and Economics	[17]	Taylor & Francis	0144-6193	12
Engineering, Construction and Architectural Management	[18]	Wiley	0969-9988	6
Journal of Construction Engineering and Management	[19]	ASCE	0733-9364	12

2. Keywords finding and categorizing

The content analysis method is one of the most appropriate research methods for finding the components of the study. At first, a text, such as journal paper, will be chosen as a sample. The keywords will be identified and the amount of each keyword will be measured. For the pilot study, consider one of the selected journals, and randomly extract the keywords of a quarter or numbers of issues. An issue of each journal can also be used. The keywords will be extracted and then the duplicated words will be deleted. Finally, the remaining keywords will be categorized. The words that are from similar issues are presented in the same group. For example: information management, information technology, information system, is all presented in a group.

In this case (construction management) eight issues of "Construction Management and Economics" journal and "Journal of Construction Engineering and Management" are randomly selected. The research keywords have been found from keywords that are part of published papers. Same and general keywords (such as construction management, construction industry etc) are removed and the remaining 148 keywords categorized in thirty groups (table 4).

Table 4: Categorizing keywords

No	Keywords	No	Keywords
1	Performance	16	Quality / Quality management / Quality performance
2	Maintenance	17	Productivity
3	Forecast / Forecasting	18	Safety
4	Monitoring	19	Supply Chain
5	Decision making / model	20	Waste / waste management
6	Information management / technology / system	21	Change / change management
7	Risk management / allocation	22	Innovation
8	Cost / Cost estimation	23	Labor
9	Optimization	24	Precast / prefab
10	Planning	25	Building system
11	Scheduling	26	Green / green building
12	Time	27	Sustainable / sustainability
13	Delay	28	Environment / environmental
14	Procurement	29	Social
15	Assessment	30	Economic

3. Keywords searching

At this stage searching among the six selected journals is conducted between the obtained keywords categories. The result for each word is recorded in a table. Table 5 shows the result for searching "Monitoring" as a keyword.

Table 5: Result of searching "Monitoring" as a keyword

Monitoring	2005	2006	2007	2008	2009	2010	Total (6 years)
Construction Management and Economics	2	4	1	0	2	0	9
Journal of Construction Engineering and Management	2	2	1	1	1	1	8
Engineering, Construction and Architectural Management	0	0	0	0	0	0	0
Automation in Construction	1	0	2	2	4	3	12
Building and Environment	0	1	4	1	1	3	10
Construction and Building Materials	1	0	5	2	2	3	13
Total (6 Journals)	6	7	13	6	10	10	52

At the end, the entire results are presented in a table. Table 6 states how many times each keyword has been repeated over the past six years and shows the historical attention trend of that word or issue.

Table 6: Result of searching for all 30 keywords

No	Keywords	Year						Total (6 years)
		2005	2006	2007	2008	2009	2010	
1	Performance	31	43	57	60	75	56	322
2	Maintenance	2	8	8	10	13	8	49
3	Forecast / Forecasting	5	8	7	8	11	14	53
4	Monitoring	6	7	13	6	10	10	52
5	Decision making / model	23	28	34	33	25	29	172
6	Information management / technology / system	25	31	25	25	23	51	180
7	Risk management / allocation	31	25	28	29	42	34	189
8	Cost / Cost estimation	57	43	52	46	37	43	278
9	Optimization	19	21	25	22	41	30	158
10	Planning	22	36	26	22	25	25	156
11	Scheduling	27	29	26	27	32	12	153
12	Time	27	21	22	26	30	24	150
13	Delay	5	8	4	11	4	6	38
14	Procurement	12	5	14	6	16	11	64
15	Assessment	20	33	30	42	38	37	200
16	Quality	17	24	28	45	37	34	185
17	Productivity	31	17	24	15	18	19	124
18	Safety	23	20	16	22	36	24	141
19	Supply Chain	4	3	1	1	4	6	19
20	Waste / waste management	3	14	27	16	29	15	104
21	Change / change management	9	9	9	11	13	24	75
22	Innovation	9	12	17	10	8	10	66
23	Labor	11	2	7	7	16	13	56
24	Precast / prefab	3	4	6	8	6	6	33
25	Building system	6	8	13	9	16	18	70
26	Green / green building	4	2	8	3	4	8	29
27	Sustainable / sustainability	17	27	35	31	26	31	167
28	Environment / environmental	21	24	36	23	40	44	188
29	Social	14	8	11	8	14	20	75
30	Economic	13	17	20	10	16	13	89

4. Keywords ranking

As mentioned before, table 6 attempts to demonstrate how many times each keyword has been repeated over the past six years. The keyword's frequency of repetition can determine its potential to be a gap for

research. Based on this potential and according to the nature of this study, the keywords taxonomy was identified in three major categories:

- High potential: Keywords repeated less than 50 times in 6 years
- Medium potential: Keywords repeated more than 50 and less than 150 times in 6 years
- Low potential: Keywords repeated more than 150 times in 6 years

Consequently the keywords which are repeated less than 50 times (High potential) represent the issues with fewer attention during these years. These issues potentially can be the gap of the research. Consistent with the above explanations, Table 7 recognized three keywords taxonomies range from 2005 till 2010.

Table 7: keywords taxonomies range from 2005 till 2010

Gap Potential	No	Keywords	Year						Total (6 years)
			2005	2006	2007	2008	2009	2010	
High potential	1	Supply Chain	4	3	1	1	4	6	19
	2	Green / green building	4	2	8	3	4	8	29
	3	Precast / prefab	3	3	6	8	6	6	33
	4	Delay	5	8	4	11	4	6	38
	5	Maintenance	2	8	8	10	13	8	49
Medium potential	6	Monitoring	6	7	13	6	10	10	52
	7	Forecast / forecasting	5	8	7	8	11	14	53
	8	Labor	11	2	7	7	16	13	56
	9	Procurement	12	5	14	6	16	11	64
	10	Innovation	9	12	17	10	8	10	66
	11	Building system	6	8	13	9	16	18	70
	12	Change / change management	9	9	9	11	13	24	75
	13	Social	14	8	11	8	14	20	75
	14	Economic	13	17	20	10	16	13	89
	15	Waste / waste management	3	14	27	16	29	15	104
	16	Productivity	31	17	24	15	18	19	124
	17	Safety	23	20	16	22	36	24	141
	18	Time	27	21	22	26	30	24	150
Low potential	19	Scheduling	27	29	26	27	32	12	153
	20	Planning	22	36	26	22	25	25	156
	21	Optimization	19	21	25	22	41	30	158
	22	Sustainable / sustainability	17	27	35	31	26	31	167
	23	Decision making / model	23	28	34	33	25	29	172
	24	Information management / technology / system	25	31	25	25	23	51	180
	25	Quality	17	24	28	45	37	34	185
	26	Environment / environmental	21	24	36	23	40	44	188
	27	Risk management / allocation	31	25	28	29	42	34	189
	28	Assessment	20	33	30	42	38	37	200
	29	Cost / cost estimation	57	43	52	46	37	43	278
	30	Performance	31	43	57	60	75	56	322

5. Keywords finalizing

Previous steps show the keywords ability to determine a gap in the field of study. Less repetition of the keywords are caused from the following two reasons:

1. The issue was much more studied in the past and its importance is reduced or
2. The issue is new and less paid much attention so can be studied as a gap in the field

Being aware of which of the above two reasons is true about any high potential keywords; recheck them in the resources without any time limitation. Words which have already been repeated a lot, means they have already been talking a lot about them, and the words that are repeated fewer determines the issues that has had less attention in the field. By the review of these five issues, "delay" is the issue which has been studied frequently in the field of construction. Thus in recent, there has been no incentive for research in this area. In fact, in spite of low repetition in recent years, it does not have enough potential to be a significant gap. Table 8 shows keywords; the lowest number of repeats ranged from 2005 till 2010.

Table 8: High potential keywords

No	Keywords	Year						Total (6 years)
		2005	2006	2007	2008	2009	2010	
1	Supply Chain	4	3	1	1	4	6	19
2	Green / green building	4	2	8	3	4	8	29
3	Precast / prefab	3	3	6	8	6	6	33
4	Delay	5	8	4	11	4	6	38
5	Maintenance	2	8	8	10	13	8	49

Now to finalize research topic and achieved the gap, final keywords and their related issues are filtered in terms of novelty, data and information accessibility, university's research era and projects, supervisor's idea and specialty, background and interest of researcher, scope of study and its needs and priorities etc.

RECOMMENDATION

This study uses content analysis as its research methodology. This method has been considered as a general method of research. Moreover, none of these five stages' potential gap finding has been effective particularly in the construction management field. Therefore, the proposed framework is usable for all disciplines such as education, economics, chemistry, information technology etc. The authors suggest that this method is also provided for other scientific disciplines to find broader knowledge, current issues and potential gap in such a field.

CONCLUSION

One of the most reliable sources to find boundaries of knowledge and issues of any discipline, are scientific journals in the field. As aforementioned previously, this systematic framework is provided for finding knowledge boundaries and investigates potential issues in the area of construction management. The operation of this process includes five steps. In the course of this method, six journals were selected by experts from the highly credible and more related journals. Among the investigation of these journals with content analysis, three groups of keywords were obtained to illustrate the potential gap. There is a new attitude toward fast and clean construction in developing countries. Thus, the need of strong research on precast and prefab systems is unavoidable. However the lack of enough study on the area of pre-casted elements and their procurement and maintenance in the construction field is obviously observed. Moreover sustainability is the major issue which construction industry is engaged with it, nowadays. So, the entrance of the aforementioned area with sustainability consideration in the field of construction studied is required for future research. Finally, Supply Chain, Green/green building, Precast/prefab and Maintenance were introduced as high potential issues for future research as major gaps in the construction management field.

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