PERFORMANCE IN CONSTRUCTION: A LITERATURE REVIEW OF RESEARCH IN CONSTRUCTION MANAGEMENT JOURNALS

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Increased competition, customer demands, and higher quality requirements in the global environment have all forced the construction industry to pay much more attention to the concept of "performance" over the last two decades. As a result, there has been a substantial body of literature on performance and performance measurement in the discipline of construction management. This paper analyses the most recent literature on performance and performance measurement published in top-ranked construction management journals to identify the aspects and features of performance studied in different contexts. Peer-reviewed articles published in major construction management journals are included while grey literature has been excluded. The objective of this research was to examine and classify systematically the literature dealing with different facets of the construction performance research domain by using a meta-analysis instrument as methodology. Based on this literature review's findings, the paper maps research trends and identifies gaps in current knowledge for future research.

Keywords: construction industry, meta-analysis, literature review, performance measurement, performance research.

INTRODUCTION

Performance and performance measurement in construction management has been the subject of considerable research, especially over the last two decades with the development of a wide variety of innovative management philosophies, approaches, and techniques such as continuous improvement, just-in-time; improvements in total quality management concept, and quality assurance standards; and automation that has resulted in marginal improvements in construction. There can be little dispute that performance is an area of importance in the field of construction management research. This can be partly explained by the growing trends as mentioned above. In any discipline, academic journals play a vital role because they are the primary context for communicating and exchanging research experience, shaping educational programs and assessing academic careers (Pietroforte and Stefani 2004). Scholarship is a cumulative concept; no matter what is studied or written, researchers are standing on someone else's shoulders and scholars must say something new while connecting it to what has already been said by others. A systematic process was used to classify the

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literature along salient conceptual and research methodological dimensions as part of a doctoral study. The historical analysis of mainstream academic journals' content can show patterns of evolution within a discipline, thus enabling assessment of the impact of contributions, setting more rigorous research efforts, mapping existing areas of research and changes in a discipline, detecting emerging research topics and patterns of collaboration, and controlling research policies at a national and institutional level (Pietroforte and Stefani 2004;Betts and Lansley 1993). Within all fields of study there is a need for knowledge of the ways in which an academic discipline develops and for strategic overview of main dimensions representing the subject matter and classifications of relevant research methods and tools. In many disciplines, studies that address these concerns are termed meta-analysis (Betts and Lansley 1993). In each academic discipline, there are major journals that have high impact scores resulting in them receiving the largest number of submissions and which therefore can be selective in choosing their content. An established refereed academic journal is a repository of good and novel insights gained from data-based research, scholarly enquiry, rigorous analysis of experience and careful logical debate about an issue or phenomenon (Betts and Lansley 1993). As Betts and Lansley (1993) indicated, the analysis of large numbers of papers can reflect important patterns and biases in a discipline. Also, studies of research patterns can be important indicators for understanding researchers' preferences and mainstream themes related with the subject. Performance related research is looming large in the field of construction management discipline, yet there have been few traditional literature reviews only partially addressing performance related issues and which do not address aspects and features of performance studied in different contexts. Lin and Shen (2007) analysed construction management journals between 1998 and 2004 with a specific focus on performance measurement. This investigation considered patterns of published output from peer-reviewed articles in mainstream construction management journals. In this regard, this paper addresses the following three objectives; a) To assess recent performance research in construction management journals. b) To map patterns in the articles that concerned performance against proposed meta-analysis framework constructs. c) To look at some major issues in performance/ performance measurement research literature and present a structured framework for classification and analysis. This paper sets out not to review the performance/performance measurement literature at length per se, but rather to contribute to a systematic classification through the presentation and use of a framework for the categorization of literature linked to the subject of performance.

METHODOLOGY

There has been a substantial body of literature on the subject of performance and performance measurement in the discipline of construction management. In view of the large literature on the subject of performance, this study includes the most recent literature on the subject published in top-ranked construction management journals to identify the aspects and features of performance studied in different contexts. In order to obtain the most recent research in the field, the review time frame was limited to a ten year period (1999-2008) of publication. To ensure higher academic standards, peer-reviewed articles published in six major construction management journals are included while grey literature has been excluded. They are analyzed and classified through structured meta-analysis framework constructs.

Meta-Analysis

One of the most-used approaches to integrating the findings of quantitative studies is that of meta-analysis, described by Glass (1976). Glass (1976) uses the term meta-analysis 'to refer to the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings'. The meta-analysis which was carried out in this paper is different from Glass (1976)'s definition and can be defined as a disciplined analysis of published research, in order to identify commonalities and differences in method and/or content, to classify papers within a pre-determined taxonomy, or to abstract a new taxonomy. (Clark, 2000).

Advantages of meta-analysis procedures for reviewing literature include enabling to see the "landscape" of a research domain, and identifying focused research questions while considering statistical significance in perspective. The traditional approach to literature review is to collect together all that can be reached and to summarize, in narrative style, the researches and the key points arising from them. Literature reviews can be more helpful and serve their purpose better if certain procedures are used for minimizing subjectivity in the process of selecting and reporting findings. In this regard, as emphasized by Betts and Lansley (1993), an important methodological issue is in constructing a classification framework for the content and style of papers. The research method and instrument utilized in this meta-analysis was based on multiple independent classifications adopted from Betts and Lansley (1993).

Establishing Search Strategy and Journals Analysed

The keywords for "searching" were designated as "performance (assess/measure/ measuring/evaluation)" in the title section and "performance" in the keyword section of selected journals. These keywords are widely-known for their use in performance related research in order to represent the scope of the study. The procedures for retrieving papers were as follows; the journals were searched with the keywords. There were 320 articles that contained at least one of the keywords in the default areas. A brief review of the abstracts of these papers was conducted to filter out in order to exclude articles that might have contained performance related keywords in the title but essentially have a non-performance focus. For instance, some papers just had a "performance" word in the keywords section but with less related content (e.g. Jeeninga and Kets, 2004) on performance, while other papers were outside the construction context (e.g. Pillai *et al.* 2002) or related with risk issues (e.g.Tah and Car, 2000) and therefore could not be considered as related papers.

Table 1: Journals Analysed and Inclusion Criteria

	Journals	Abbreviation	Inclusion criteria
1	Construction Management and Economics	CME	Harwey *et al.* (2008), Chau (1997), Björk and Bröchner (2007)
2	ASCE Journal of Construction Engineering and Management	JCEM	Chau (1997), Björk and Bröchner (2007)
3	Engineering Construction and Architectural Management	ECAM	Harwey *et al.* (2008), Chau (1997), Björk and Bröchner (2007)
4	ASCE Journal of Management in Engineering	JME	Chau (1997), Björk and Bröchner (2007)
5	International Journal of Project Management	IJPM	Chau (1997), Björk and Bröchner (2007)
6	Building Research and Information	BRI	Chau (1997), Björk and Bröchner (2007)

Additionally, a few papers published in these journals that are very closely related to the subject of performance research were taken into consideration to supplement the literature search unless they were reached by search keywords. (e.g.Costa *et al.* 2006).

Table 2: The Meta-Analysis Framework

Dimensions	Criteria	Constructs	
Content Oriented Criterions	Level of Analysis*	Construction Operation Activity	Component
		Project	Infrastructure
		Firm	Environment
		Professionals /Individual	Institutional
		National/Industry	Technical Documents
		Firm/ Organisation/Multi Project Organisation	Client
			Project/Firm
			Industry/Firm/ Project
	Research Focus	Building Performance	Performance Measurement
		Component Performance	Performance Modeling
		Construction Performance	Performance of Architects/Engineers
		Consultants Performance	Performance of Joint Ventures
		Contractor Performance	Performance of Projects Managers
		Cost Performance	Performance Prediction
		Cost Schedule Performance	Performance-based Building
		Engineering Performance	Performance-based Contracts
		Environmental Performance	Post-Occupancy Evaluation
		Estimators Performance	Procurement Performance
		Financial Performance	Productivity
		Firm Performance	Project Management Performance
		Forecasting Performance	Project Performance
		Innovation Performance	Quality Performance
		International Construction Performance	Research Performance
		Job Performance	Safety Performance
		Participant Satisfaction	Subcontractor Performance
		Partnering Performance	Sustainability Performance
		Performance Benchmarking	Team Performance
		Performance Evaluation	Technology Performance
		Performance Improvement	Time Performance
		Performance Indicators	Others
Style (Research Process) Oriented Criterions	Sources of Information*	Empirical Data	Reviews
		Case Studies	
	Contribution of Article*	Framework Building	Model Building
		General Insights and Descriptions	System Building
		Model Testing or Fitting	Measurement Instrument Development
Author (s) Oriented Criterions	Author(s) Name		
	Country of Author(s)' Affiliation		

*Adapted from Betts and Lansley (1993)

In this study, six major construction management journals were considered to map the development of the body of literature on performance related research in the discipline of construction management. The selection of journals was based on the studies of Chau (1997), who found that these journals had the highest scores for quality, and Björk and Bröchner (2007), who analysed author attitudes and perceptions of leading journals in construction management and recommendations of the ABS Academic Journal Quality Guide (Harwey *et al.* 2008) (Table 1).

The Meta-Analysis Framework

The assessment of academic and scientific publications is not a new undertaking (Pietroforte and Stefani, 2004). Betts and Lansley (1993) asserted that meta-models are important for the classification and analysis of a discipline inter-relating different areas of study and identifying emerging and neglected themes. The justification for the use of a meta-model grow out of a theoretical understanding that the main determinants of the nature of construction management research come from the multi-disciplinary background, its knowledge bases, the many organisational levels within the industry, the multiple stages through which projects move in their life-cycle, the professional differentiation that exist between parts of the sector, and the distinctions within the types of research process. (Betts and Lansley 1993) The meta-analysis framework has three dimensions, one concerned with content-oriented criterions, the second with style (research process) oriented criterions adapted from Betts and Lansley (2003), and thirdly, author oriented criterions. The use of established methods and tools was a critical design aspect and lends to the credibility of the meta-analysis and its contribution to the body of knowledge. Betts and Lansley (1993) proposed that content and style dimensions are the two principal means of characterizing research.. In the content-oriented dimension, the first criteria concern the research focus, which defines the focus of performance research addressed in the article. The second is the level of analysis, which determines the organizational level where research takes place. In the style (research process) oriented dimension, the first criteria is the source of information which indicates the input type of the research where the constructs are reviews, case studies, and empirical data. The second is the contribution of the article determining the outputs of the research. The third is the author oriented dimension where the articles analysed through the criteria are author name and country of author(s)' affiliation. The country where the research was undertaken can provide indicative insights about the contribution of countries and global distribution of performance related research in construction management. In the move towards developing the meta-analysis framework dimensions, criteria and constructs, some are described within the search and analysis process. The meta-analysis framework, dimensions, criteria and constructs all are given in Table 2.

ANALYSIS AND RESULTS

The results show the analysis of 263 articles published on the performance research domain in the chosen journals. A total of 263 journals were retrieved and analysed in terms of structured meta-analysis framework dimensions. Table 3 provides the number of papers published in each journal according to their publication years. CME, CEM and BRI published the most papers on performance related research. The chronological distribution of articles show that there is a continuous and growing interest in performance research in the mainstream construction management journals The analysis results show that there is a general increase in the number of articles and balanced distribution in years indicating that performance research in construction is a well established research area in construction management.

Table 3: Chronological Distribution of Articles on Performance Research

	Years										
Journals	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008 1st Q**	**Total**
CME	1	6	5	6	9	14	6	11	9	7	74
JCEM	2	2		3	7	10	10	11	6	3	54
ECAM	2	4	2	3	2	2	3	3	2	2	25
JME	1	1	2	3	3	3	1	4	7	1	26
IJPM	2	1		1	4	6	1	3	6	3	27
BRI	4	2	11	3	4	4	12	8	9		57
Total	12	16	20	19	29	39	33	40	39	16	263

Content Oriented Criterions

The criteria analysed under content-oriented criterions is the level of analysis and research focus, which is the most diversified. (Figure 1) As the analysis reveals, an important amount of performance research focus is on project (10%) and building performance (10%). The contribution of the vast majority of articles with a project performance focus is general insights and descriptions with the main source of information being empirical data. Performance Improvement, Component Performance, Productivity, Environmental Performance and Performance Measurement also constitute a large portion of the articles and are also discussed in depth. Groupings between constructs of research focus can elicit some valuable insights. For example, the Performance of Projects Managers, Performance of Architects/Engineers, Job Performance, Estimators Performance and Team Performance constructs can be evaluated as human resource performance and this means that articles with a human resources performance focus (8%) follow most in frequency the project and building performance focused articles. Another different group can be regarded as the time-cost-safety-satisfaction quartet that is mostly related to performance oriented concerns. Time Performance, Quality Performance, Safety Performance, Cost Performance, Participant Satisfaction, and Cost Schedule Performance constructs correspond to 33 articles (13% of total papers).This result can be interpreted as their being essential research focuses for performance researches in construction. Forecasting Performance, Innovation Performance, Performance Modeling, Post-Occupancy Evaluation, Procurement Performance, Research Performance, Sustainability Performance and Technology Performance attracted less attention. Low level frequency for this research focus may indicate future research areas. Figure 2 shows the distribution of articles focusing on different levels of analysis. From the level of analysis, we see that the number of articles focusing on project level (46%) is much greater than others as an anticipated result of the project oriented nature of the construction industry. The articles with this research focus involve the evaluation and assessment of different aspects that affect project performance. Following this are firm (19%) national/industry (11%) and professionals/individual (9%) level researches. The high contribution for firm and national level for performance concerns is not surprising. The contribution for the Environment Level and Component Level accounts for 3% and 5% of the papers, respectively. Technical Documents, Activity, Client, Infrastructure and Institutional levels of analysis attracted less attention. The identification of performance related research focuses was one of the most important findings of this paper.

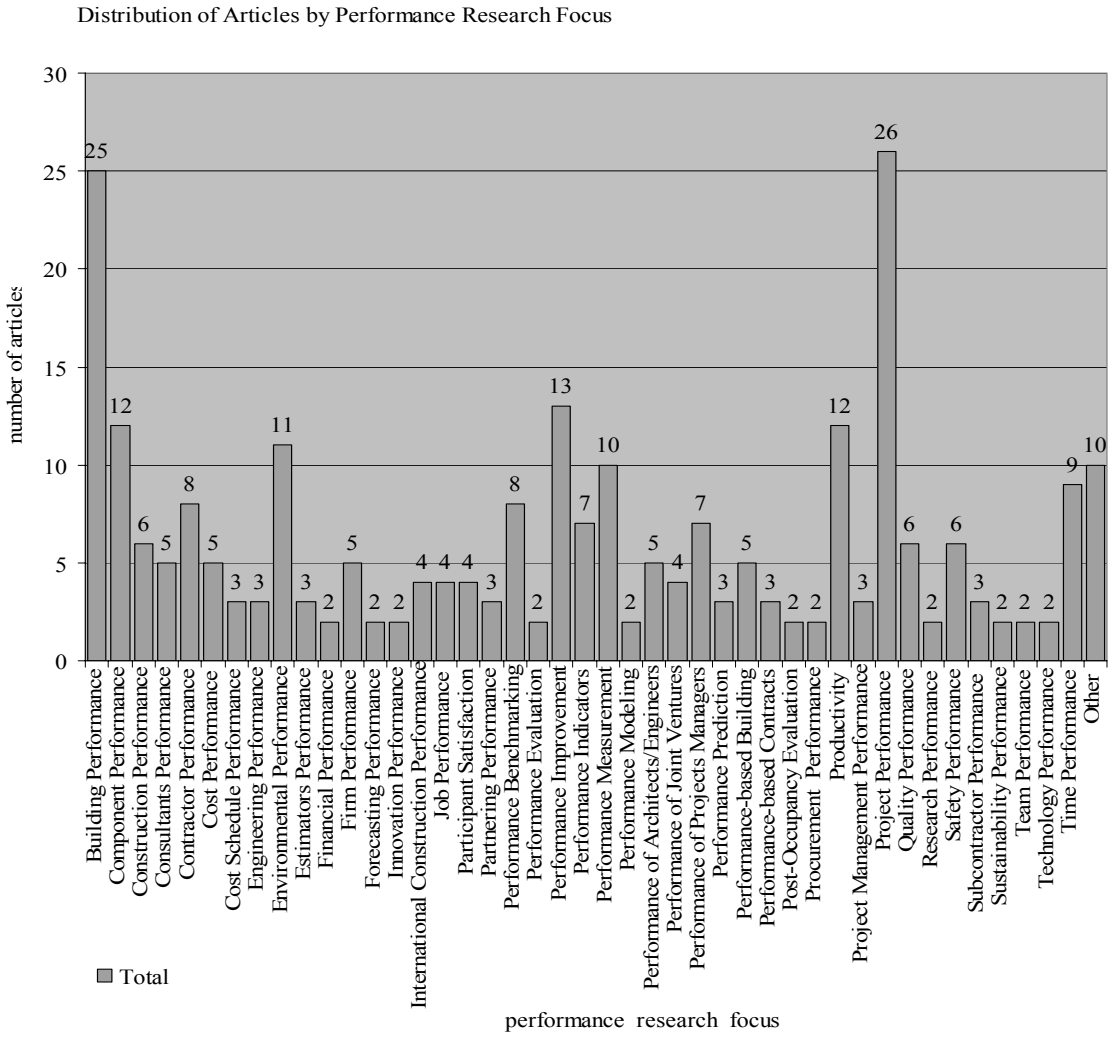

Figure 1: Distribution of Articles by Performance Research Focus

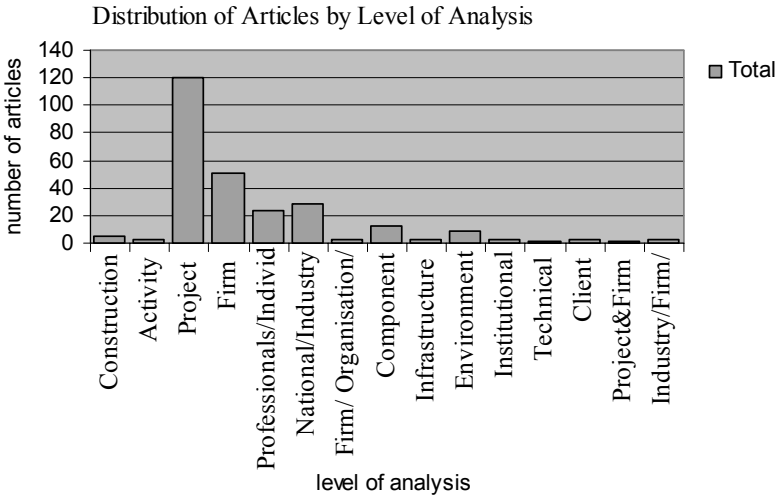

Figure 2: Distribution of articles by level of analysis.

Style (Research Process) Oriented Criterions

In the style dimension, the articles were firstly analysed for their source of information. The constructs for this criterion were determined as case studies, empirical data and reviews. 198 articles (75% of the total) used empirical data as their source of information. A wide variety of techniques were used to collect the data including field surveys, interviews, secondary data analysis, expert panels, focus groups, field experiments and multi methods. 15 of the articles (5% of total papers) were classified as case studies and 50 articles (20% of total papers) were based on reviews. The analysis of articles by sources of information revealed that most of the research is empirical data based This result was an indication of the integral nature of performance and measurement. Few of the empirical studies attempt to model testing or fitting. The second style oriented construct is the contribution of articles analyzed by means of their output to the research process (Figure 3). It should be noted that multiple research methods are also adopted in articles demonstrating the potential complexity in this area. Contributions related to general insights and descriptions account for 59% of total papers (154 articles) most of which were empirical data (65%) sourced. Various cross-classifications of the papers reveal other significant associations For example, papers pitched at national/industry level are most often based on reviews rather than other sources while those at firm level and project level are most often based on empirical data. The relationship between the source of information and contribution is strong. Reviews tend to provide general insights and descriptions (98%). Empirical data contribute most often to model building, general insights and descriptions, and measurement instrument development, whereas 51 articles (19% of papers) offered model building, mostly arising from empirical data used. One remarkable result is that there were only 4 system building contributions and only 6 model testing or fitting contributions among the articles analyzed. 35 articles (13%) were concerned with Measurement Instrument Development based on empirical data and 13 articles (5%) with framework building.

Author Oriented Criterions

The last dimension of the meta-analysis framework proposed is author oriented criterions. This analysis generates one of the most remarkable results, showing that the research on performance in construction is mostly dominated by particular countries. North America, Europe and Asia Pacific are in the leading position of studies in this area. Within the Asia Pacific region, more studies were identified from Hong Kong and Singapore; and in Europe, the UK is far ahead of all others. From the geographical distribution of the articles (Figure 4) in terms of the location of the authors' affiliation for the 263 selected papers, it can be seen that performance research is the focus of global academicians. It may reflect the fact that performance is a global phenomenon. The 263 articles analysed involved 470 authors from 41 countries. Research on the subject has been dominated by authors from the UK, USA, Hong Kong, Singapore and Australia. Findings also show that contributions were made by countries fairly evenly, with the exception of the UK, USA, Hong Kong, Singapore and Australia. Of the 263 papers, 46 were written by single authors, 104 by two authors, 73 by three authors, 36 by four authors and 4 by five authors. In addition, analysis of the data reveals that of 263 articles, there are 57 articles (22%) that include collaboration in authorship between authors from different countries. It is clear that more collaboration between authors from different countries would bring different perspectives and contribute to the improvement of research in the field. Only 46 papers (20% of the total) were found to have single author. This result shows that

most of the research is done in collaboration. Collaboration in research is an essential element for developing a related research area and also for deepening and widening research area dimensions and domain. On the other hand, in the context of the "performance" phenomenon unique to itself, benchmarking the practices and lessons learnt from different applications can provide very gainful insights.

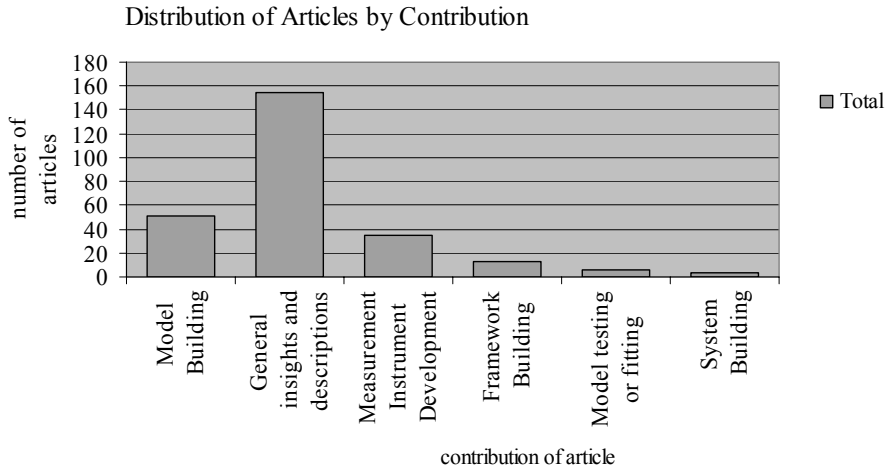

Figure 3: Distribution of articles by contribution

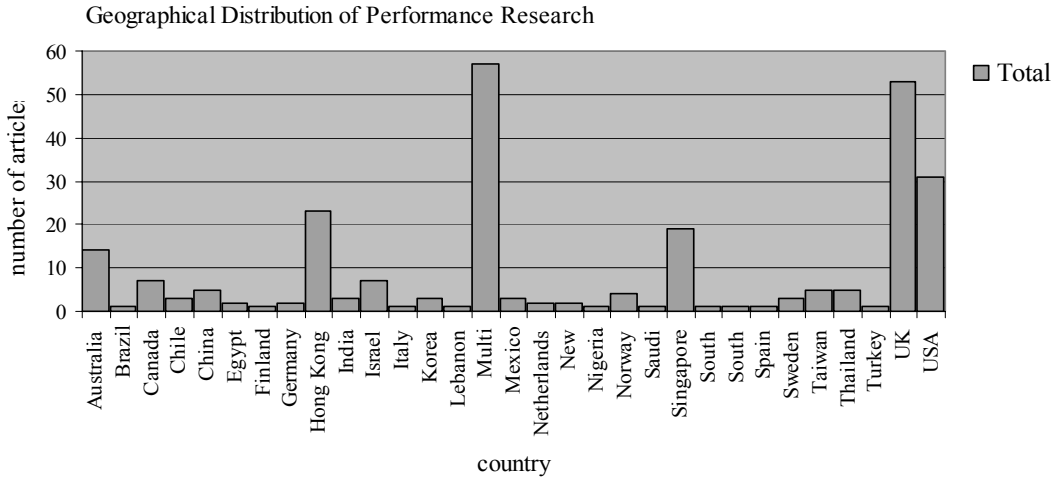

Figure 4: Geographical Distribution of Performance Research

CONCLUSION

Regarding the meta-analysis framework dimensions, remarkable findings were reached in order to identify the trends, research approaches and primary research objectives focused upon. This research was also an attempt to design a preliminary taxonomy for performance research in the construction management discipline. As a result of analysing the content of the articles, it is apparent that some aspects of performance are examined more than others. To enhance and extend the performance related research knowledge base, future research must consider different aspects of performance in the construction management discipline. Analysis of the research focus in the articles indicated a dearth of published work on the topics of Forecasting Performance, Innovation Performance, Performance Modeling, Procurement Performance, Research Performance, Sustainability Performance, and Technology

Performance, which are very limited. Complimenting the large amount of research carried out at the project, firm and national/industry levels of analysis, the seldom-investigated activity, client, infrastructure, institutional and construction operation levels of analysis are open to investigation in a broad manner. The review reveals that performance related research is mostly empirical-descriptive in nature. Survey research was the dominant method employed and almost all of the research approaches employed in the empirical articles included in the study can be characterized as traditional approaches reflecting a positivist orientation tradition within construction management. This analysis generates one of the most remarkable results, showing that the research on performance in construction is mostly dominated by authors from the UK, USA, Hong Kong, Singapore and Australia. The identified shortcomings include a lack of research focused on some specific area of performance, as indicated in the analysis section, notably, the lack of articles contributing to system building, framework building and model testing or fitting, and the absence of articles relating to technical documents, activity, client, infrastructure and institutional levels of analysis. Future research directions are suggested in order to address the identified shortcomings. Analysis essentially provides both academics and practitioners with a map of existing research trends and also points out opportunities for future research.

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