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Academic research in emerging knowledge-based economies: The case of Sri Lankan construction industry

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The case of Sri Lankan construction industry

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Abstract

Purpose – Knowledge-based economies are popular in the present world. Simultaneously, universities are becoming more responsible for leading economic development through research. As a key contributor to the national economy, it is vital for the construction industry to move beyond outdated practices, and hence, reviewing the role of academic research in empowering the construction industry with knowledge is essential. The purpose of this paper is to focus on how relevant theories conceptualise the expected role of academic research in the innovative development of an industry and the specific location in the Sri Lankan construction industry.

Design/methodology/approach – Following a comprehensive literature review, empirical data were collected from the Sri Lankan context with a mixed approach informed by a pragmatist philosophical stance. The perspective of academia and industry practitioners were deductively obtained through surveys and inductively explored through qualitative interviews.

Findings – This study provides evidence that academic research in Sri Lanka does not contribute effectively to innovative construction management. Due to the absence of industry-focussed knowledge dissemination strategies, the academic–industry relationships are mostly non-research based. The industry lacks in research-informed-decision making, leading to lesser innovations.

Research limitations/implications – The research conclusions are more applicable to the developing country construction industry contexts.

Practical implications – The research urges the need for improved academic–industry research collaborations and strategic knowledge dissemination movements.

Originality/value – The research confirms that academic research is a major integral part of the developing construction industry in a knowledge-based economy. In establishing the expected role of academic research, the research revealed the current practice to be under-located. Hence, the research prescribes the necessary actions; research collaborations in major and subsequent requirements.

Keywords Construction management, Knowledge dissemination, Research collaborations, Academic research, Innovation theories, Knowledge utilization, Knowledge-based economies

Paper type Research paper

Introduction

The construction industry accounts for a sizable proportion of gross domestic product of most countries, ranging from 6 to 8 per cent in average, and considered as a major industry in an economy (Horta *et al.*, 2013). In an increasingly competitive construction industry context, there are growing concerns about knowledge-based innovations (Abu Bakar *et al.*, 2016). Simultaneously, higher education institutes have a growing interest in achieving

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strategic goals through improved research cultures. Considering the complementing mutual interests, a profound relationship between higher education research institutions, i.e. universities, who are the developers of knowledge, and industry organisations, who are the users of knowledge, becomes significant in advancing towards achieving such novel goals (Pucciarelli and Kaplan, 2016). Yet, throughout the time, academic research in construction management is often claimed for not adequately assisting the construction industry development (Abu Bakar *et al.*, 2016; Fairclough, 2002; Latham, 1994). This urges the need for re-defining the research roles of academia and the industry in terms of enabling construction management innovations.

A gap, therefore, exists in the related paradigm explaining the differences between the current nature and the required nature of academic–industry research behaviours in developing construction management practices in a knowledge-based economy. Therefore, this research aims to appraise the research practices of academia and industry, and the respective research dissemination and utilisation behaviours within the domain of construction management. The research first conceptualises the theoretical role of academic research in assisting knowledge-based development of the construction industry. Second, it discusses the current academic and industry perception and practices towards research led-innovations in the construction management context in Sri Lanka. The findings reveal the poor orientation of academic research towards the industry needs and industry's lack of curiosity on academic research. Conclusively, the research portrays the appraised context as lagging innovativeness in moving along with a knowledge-based economy. This piece of research, therefore, is significant as the findings become preliminary in defining the goal-oriented necessities in developing absolute dissemination and utilisation-related behavioural changes for academia and industry.

Literature synthesis

This section reviews the literature pertaining to four knowledge domains as applicable to the research focus: construction industry as an emerging knowledge economy, significance of academic research in leading innovations, merging academia and industry within a knowledge-based economy, and the significance of strategic research knowledge dissemination.

The construction industry as an emerging knowledge economy

According to Abu Bakar *et al.* (2016), effective adoption and diffusion of innovation have the potential to increase the productivity of the construction industry. In response, global trends in construction management innovations are in many directions. Strategic plans and studies in several countries such as the UK (ARCOM, 2017) and Australia (CRIOCM, 2017) identify some main novel trends in building information modelling, equality and diversity, human resources management, big data, research and education, sustainable construction, and building performance. Considering the developments in the construction sector of the Asian region, Andres *et al.* (2014) identified trends, such as urbanisation, developing "megacities", and supply chain management, as priorities of developing countries. Given the widespread areas, changes will be required at all levels of the industry in proposing construction management innovations. In this context, the academic research generated in higher education institutions would be of immense value to an industry, to assist related stakeholders to cope with the industry innovation trends.

The significance of academic research in leading innovations

Research is an integral part for the career development of academia (Pucciarelli and Kaplan, 2016), and it accrues to the human, financial, and intellectual resources of the university, which subsequently benefit students and ultimately the relevant industry. The increased

salience of "knowledge in leading economic development" has opened up a new mission for higher education institutes in addition to teaching and research (Fairclough, 2002). Eventually, university research is increasingly serving as an innovation generator (Altbach, 2015). Within the construction sector, the universities are challenged in enhancing prestige and market share, embracing an entrepreneurial mentality, and expanding interactions and value co-creation with key stakeholders with fundamental implications for integrated research and practice (Pucciarelli and Kaplan, 2016).

Merging academia and industry within a knowledge-based economy

Leydesdorff (2010) has identified three sub-dynamics that are necessary in an innovative development of an industry in a knowledge-based economy: wealth generation in the economy, novelty generation through organised science and technology, and governance of the interactions between the first two sub-dynamics by policy-making in the public sphere and management in the private sphere. These should be generated as the results on top of the business cycles, election cycles, and especially, the research paradigm changes (Leydesdorff, 2010).

Inside such varying institutional arrangements of university–industry–state relations, the expected nature of the most acceptable relationship is extensively studied by Etzkowitz and Leydesdorff (2000). The construction industry, therefore, should try to attain some form of triple helix model (THM) as explained by Etzkowitz and Leydesdorff (2000). Tri-lateral initiatives for knowledge-based economic development can be generated through the formation of strategic alliances among construction firms and academic research groups, with the common objective of realising an innovative environment under the proper guidance from the state.

Functioning evidence arises from the developed country contexts. In the example, Construction Industry Institute is a centre, which is actively engaged in developing research relationships between the construction organisations and research academia of USA (Bresnen and Marshall, 2000). Accordingly, the economic and political mechanisms no longer should only control the development of scientific knowledge but must function as feedback mechanisms (Marozau *et al.*, 2016). Further, the state should encourage collaborative research and development (R&D) among firms, universities, and national laboratories to address the issues of national competitiveness (Etzkowitz and Leydesdorff, 2000).

Aforesaid knowledge-based economic development is a three-stage process, where the stages being the creation of "knowledge space", "consensus space", and "innovation space" (Etzkowitz, 2011). The creation of "knowledge space" refers to the concentrations of related R&D activities in a local area. As a consequence, knowledge space creation changes in values among promoters of regional economic development subsidy firms in creating the conditions for knowledge-based economic development (Etzkowitz, 2011). The institutes will, afterwards, lay the foundation to create an "innovation space". Therefore, the three spaces should be created in the construction industry. In fact, partnerships amongst state, construction industry, and research universities should grow considerably, to ensure that new knowledge is linked to development goals (Tijssen and Wong, 2016).

However, at present, the relationships between academia and industry are increasingly intimate and commercial in the construction context, particularly in developing countries. Therefore, the situation urges for scientific investigations in search of ways and means of promoting strategic collaborations in between the academia and the industry.

The significance of strategic research knowledge dissemination

Knowledge dissemination is a crucial part of knowledge management. Dissemination is the interactive process of communicating knowledge to the target audiences; therefore, it becomes a pre-runner for the development of knowledge-based economies.

The dissemination needs to adopt an end-user perspective to facilitate the industry for grasping newly developed knowledge for real-life application. Accordingly, industry will reach higher stages of research utilisation as explained in the chain of knowledge utilisation model (CKUM) developed by Alker (2008) (refer Table I). In parallel to CKUM, Alker (2008) has produced another model called "pipeline model of knowledge dissemination" (PMKD), which explains different stages of practitioners' use of research in response to the researchers' dissemination effort, as presented in Table I.

Move forward in the models; higher the success. However, the low impact of most research is mainly attributable to the absence of a proper dissemination strategy. Hence, it needs to identify the efficient modes of communication to link researchers, practitioners, and research funders (Alker, 2008).

Accordingly, synthesised literature complements the significance of academic research in emerging knowledge-based economies. The development of a space for innovation, therefore, has prerequisites; i.e., knowledge space and consensus space, where academic research has to play a significant role. The creation of such spaces is directly related to knowledge dissemination since in the absence of dissemination there will be no bridge between the academia, industry, and the state. Hence, a research question emerges from the literature synthesis as

RQ1. How and why academic research need to be re-shaped, coupled with appropriate dissemination strategies?

Research methodology

A field study was conducted, combining inductive and deductive approaches informed by a pragmatist philosophical stance. Pragmatism provides freedom for the researchers in selecting appropriate methods according to the requirement of each research question (Powell, 2001). This research posed questions with explanatory and exploratory purposes; therefore, it was answered through a mixed-methods approach. The mixed method focusses

Table I.
Stages of knowledge dissemination and knowledge utilisation

Knowledge dissemination efforts by the academics in stages	Description (Alker, 2008)	Knowledge utilisation efforts by the practitioners in stages
Delivery	Research has been received by a designated individual, after it lands on his/her desk, but the findings may never be read	Awareness
Cognition	Research is read and understood	Acceptance
Mind-set shift	Research changes way of thinking – provokes a shift in an individual's "frame of reference", for example, in terms of defining key problems and priorities	Agreement
Initiation	Research has shaped action: Some effort has been made to get the findings adopted, even if this is ultimately unsuccessful	Application
Adoption	Research has had a direct influence on the actual policy	Action
Implementation	While research may have been used to develop policy, at this stage it has also been translated into practice on the ground	Adaptation
Impact	Utilisation of research, when the implemented policy is successful in producing tangible benefits to the citizens	Adherence

on collecting, analysing, and mixing both quantitative and qualitative approaches, providing a better understanding of the research problem than either of each alone. The survey strategy is discussed by Fowler (2008) as a strategy with the purpose of producing statistics, that is, quantitative descriptions about some aspects of the study population. Surveys formed a part of the method in this study in obtaining perspectives of academia and industry practitioners as Phase I of the data collection. A census was conducted with the construction management academic researchers since the population size was only 49 units. With a response rate of 69 per cent, the academic census comprised entities from top-ranked, state-funded universities operating in a developing country, where the academic research is constrained due to the lack of funds and researching opportunities. An industry survey sample was selected through stratified systematic sampling following the guidance from Sauders *et al.*. The actual sample comprised of 90 professionals including architects, engineers, and quantity surveyors in an equal number of units. The findings of surveys were inductively explored using the expert opinions of three high-profile academics in the same context and ten interviewees from identified three innovative construction organisations, through semi-structured interviews as Phase II of the data collection process.

Quantitative data were collected in Phase I regarding the knowledge dissemination and utilisation efforts by the research academics and industry practitioners related to the models: CKUM, and PMKD) based on a 1–5 Likert scale (i.e. 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). Data were analysed statistically using SPSS software for median and quadrants. Drawn box-plots (refer Figure 1) reveal the actual distribution and the mean value of knowledge dissemination and utilisation efforts of the local research academics and industry practitioners along the above explained 1–5 scale represented by the size and location of the boxes. Consequently, at

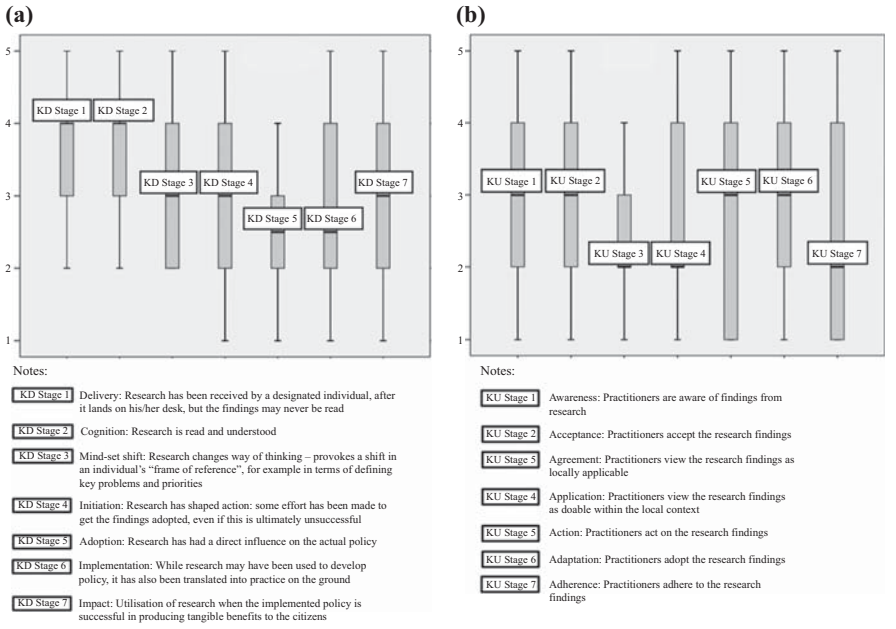

Figure 1.
Performance in (a) knowledge dissemination by academic researchers and in (b) knowledge utilisation by industry practitioners

Notes: (a) Performance of academic researchers in "knowledge dissemination (KD)" at different stages; (b) performance of industry practitioners in "knowledge utilisation (KD)" at different stages

Phase II, qualitative data were collected via semi-structured interviews and analysed for content using NVivo software to capture the current research knowledge dissemination and utilisation behaviours by academia and construction industry. The output of the content analysis is presented as a mind-map (refer Figure 2).

Data collection was conducted in Sri Lanka. Hence, the academic perspective of the Sri Lankan university researchers together with the local construction industry perspective was captured through this study. Therefore, the research portraits the state of issues under concern from a developing country perspective.

Data analysis and findings

Phase I of the data collection comprised of the surveys, which obtained the level of knowledge dissemination efforts from construction management-related research academics and the level of knowledge utilisation efforts from construction management-related practitioners, as detailed in the previous section. Semi-structured interviews conducted in Phase II with academic research experts and representatives from innovative construction organisations allowed in-depth discussions on the findings of Phase I.

Phase I – demographic data analysis of the survey respondents

The respondents of the academic survey consisted of professors (3 per cent) and senior lecturers (97 per cent), percentages being parallel to the research population cross-section. In terms of the field of specialisation, respondents belonged to three basic backgrounds in the construction field: design, economics, and engineering. The majority of the respondents (35 per cent of the sample) have more than 40 publications, individually.

As the second step of the data analysis, demographic data of the industry practitioners participated in the industry survey were analysed. Since the sample comprises practitioners belonging to all three major stakeholder groups, a strong base to capture the overall view of the individual practitioners is made available. The findings indicate that 40 per cent of the respondents have more than ten years of work experience, and all respondents were charter qualified.

Demographic data analysis confirms the use of a cohesive sample to represent the academic and industry view.

Phase I – key findings

The stages suggested in CKUM were used to identify the construction management academics' success in disseminating research knowledge. In parallel, the industry practitioners' experiences were examined to determine the individuals' reach of dissemination stages concerning PMKD (refer Figure 1). The respondents rated the seven-stages of models against a 1–5 Likert scale, based on the individual experience. According to Alker (2008), if there are successful dissemination and utilisation effort, the majority of the samples should be reaching the end-level stages of the CKUM and PKMD. However, the results from the studied context deviated from such success as indicated in Figure 1.

The results indicate that 75 per cent of the sample is successfully performing in "delivery" and "cognition" stages. Hence, currently the research knowledge is received by the designated individuals, and recipients understand research according to the stages interpretations by Alker (2008). However, only 50 per cent of the sample reaches "mind-set shift" and "initiation" stages. Hence, only half of the researchers could change the way people think and shape the action. Further, only 25 per cent of the sample is performing at the "adoption" stage. Only 25 per cent of the academics managed to reach the final two stages as per CKUM, "implementation" and "impact". Therefore, the results indicate that

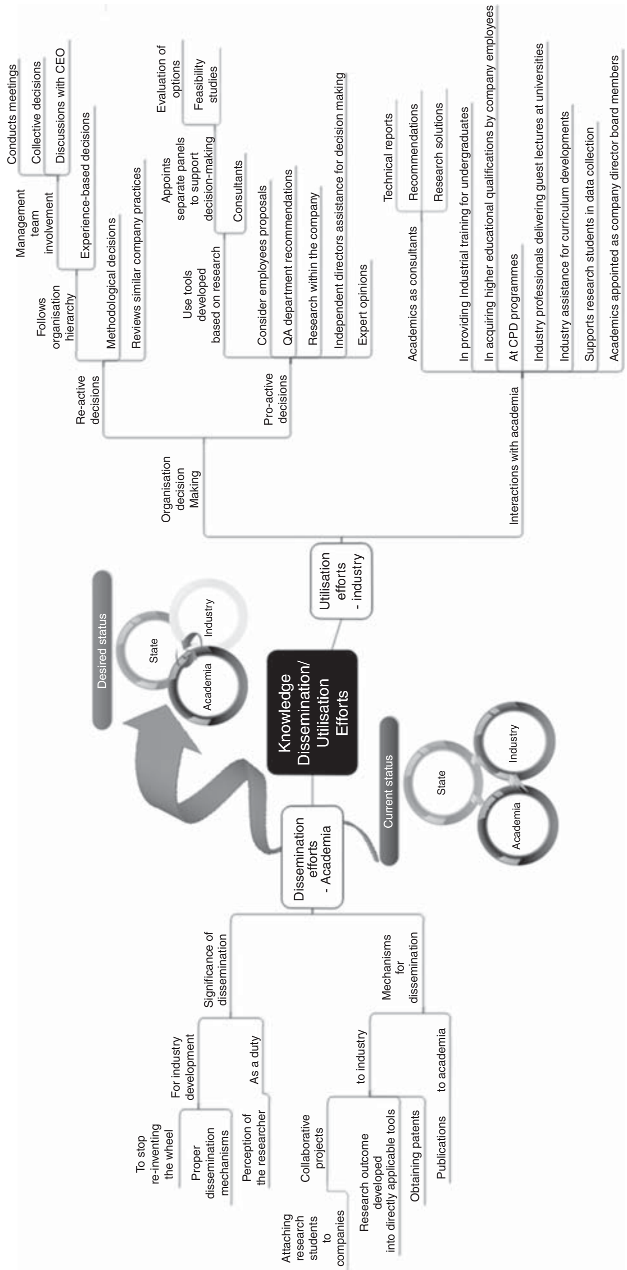

Figure 2.
Research significance and dissemination requirements

researchers have the least experience in directly influencing actual policy/practice, developing policy/practice, and bringing tangible benefits to the industry.

Industry practitioners' experience further indicates low performance in reaching end-level dissemination stages. A 50 per cent of the sample reaches "awareness" and "acceptance" stages, while only 25 per cent reach "agreement" stage. Only 25 per cent reach through the dissemination pipeline to the ultimate stage of "adherence".

The findings are consistent with the extant literature and reveal that current academic research has not contributed much to the innovative development of construction management practice. The reason could be the nature of the construction industry's innovation adoption being commonly incremental or modular as explained by Abu Bakar *et al.* (2016), which is portrayed through poor results regarding the industry knowledge utilisation. The situation dictated the need for further investigations on the possibility of academic research influencing innovative development in construction management practice and the current level of such efforts. Such requirement is served through Phase II.

Phase II – data analysis and findings

Table II presents the background data of the respondents participated in the qualitative interviews conducted in Phase II to capture the perspective of academic research experts.

All respondents were PhD qualified senior lecturers with over ten years of academic experience. The respondents currently supervise PhDs, MPhils, MScs, and undergraduate dissertations, and have received national and international awards for research excellence.

Academic research expert opinions were obtained on two themes: the significance of knowledge dissemination to industry, and the best practical mechanisms of such dissemination.

The significance of knowledge dissemination to the construction industry

According to academic research experts, research dissemination is crucial in leading the "industry development". This argument aligns with the theory behind the THM of Etzkowitz and Leydesdorff (2000). In parallel, R2-CE, the construction engineering research expert interviewee, commented that the knowledge with the capacity to bring positive changes to the industry must be disseminated to the industry, or else it may be a waste of resources by the researchers, and the act would further lead the industry to "re-invent the wheel". R1-CM and R3-CD, the construction management research expert and the construction design research expert interviewee, respectively, stated that they personally believe in the significance of using "proper dissemination mechanisms" to influence industry's development positively. Moreover, R1-CM stated that at least the dissemination should reach the academia through publications. Also, R1-CM and R3-CD indicated the responsibility of dissemination of research outcome, as a "duty of the researcher". R3-CD explained the situation further by stating, "If the researcher only wants to do the publications to create his/her research background, such researchers will not go beyond publications, as a practice". Hence, it was essential to understand the nature of dissemination that the industry would be "willing" and "able" to capture.

Table II.
Interviewee data: expert opinions – academic researchers

Respondent	Expert field	Research interests
R1-CM	Construction management	Construction management, sustainability, waste management, and information technology (IT)
R2-CE	Construction engineering	Construction management, sustainability, structural engineering, and building materials
R3-CD	Construction design	Sustainable construction and design

The mechanisms of knowledge dissemination

Out of the mechanisms currently in practice, "academic–industry research collaborations" claimed to be the most successful in accordance with the research of Daoud *et al.* (2016). However, R1-CM mentioned the practical difficulties in implementing such projects since industry research initiations are rare. Further, "attaching research student into companies" as a researcher or a product developer or to the R&D divisions of the organisations were also practised by R2-CE and R3-CD. The second most practically effective dissemination mechanism according to the experts was to deliver the outcome to a company after processing into "directly applicable tools". In such occasions, obtaining "patents" may create a strong opportunity for disseminating research outcome to the industry safely as suggested by R2-CE, the construction engineering research expert interviewee. Thus, R2-CE stated, "Research output need to be developed into a level, strong enough for applying for a patent by taking the research outcome beyond the raw stage." All three respondents declared "publications" focussed towards the academic community as the notable successful mechanism for disseminating research outcome to the academia. R1-CM and R3-CD, the construction management, and construction design research expert interviewees, respectively, highlighted the necessity of "marketing research outcome to increase the industry awareness," irrespective of the mechanism.

Therefore, the views of the research experts revealed the poor status of research collaborations in the field of construction management at present. Similar to the background in academia, results of Phase I data analysis have evidenced a low success in research knowledge utilisation. Hence, in Phase II, the view of the innovative construction organisations was obtained under two themes: research-informed decision-making practices at the industry, and industry's current linkages with the academia. Table III presents the background data of the interviewees, whose organisations have actively engaged in innovative moves.

Research-informed decision-making practices in the industry

"Proactive" decisions with the assistance of research or novelty and traditionally bound "reactive" decisions are made at all the three organisations studied. The organisations are mostly into reactive decision-making following the organisation hierarchy, company methodologies, and imitating similar company practices. In Case 2, project managers can

Organisation	Respondent	Profile of the respondent
Organisation 1	CS1-1	Project manager with over 30 years industrial experience Over ten years' experience with the case organisation in executive level
	CS1-2	Quantity surveyor with over 15 years industrial experience Over five years' experience with the case organisation in executive level
	CS1-3	Quantity surveyor with over 15 years industrial experience Over five years' experience with the case organisation in executive level
	CS1-4	Engineer with over 15 years industrial experience Over five years' experience with the case organisation in executive level
Organisation 2	CS2-1	Deputy director at the case organisation with over 30 years of experience Over ten years' experience with the case organisation in executive level
	CS2-2	Quantity surveyor with over 10 years industrial experience Over five years' experience with the case organisation in executive level
	CS2-3	Engineer with over 10 years industrial experience Over five years' experience with the case organisation in executive
Organisation 3	CS3-1	Deputy director at the case organisation with over 30 years of experience Over ten years' experience with the case organisation in executive level
	CS3-2	Quantity surveyor with over 10 years industrial experience Over five years' experience with the case organisation in executive level

Table III.
Interviewee data of the representatives from innovative construction organisations

make innovative decisions, which are seconded by the chairman, while the management has adequate autonomy to make decisions. In Case 2, development proposals for the organisation also can be presented at monthly meetings. Yet, there are no R&D divisions available in the companies. In addition, all three organisations use tools developed based on research. In Case 2, the company is implementing enterprise resource planning as a resource management tool. Also, Case 1 has provided the example of SAP software implementation for the same purpose. Based on SAP implementation experience CS1-1, the first interviewee from the Case 1 claimed that the local academic solutions were very primitive compared to what the international context offered in that instance. Hence, it proves that the company has obtained research assistance, even from the international context. Auxiliary, Cases 1 and 2 used to appoint separate panels to decide upon innovation adoptions. Moreover, feasibility studies are conducted when introducing new management practices. It was emphasised that employees are encouraged to report on innovation opportunities to QA departments. Case 1 facilitates the research conducted by employees within the company.

In general, research-informed decision making is rare to observe in construction organisation practice. Therefore, the interviewees were questioned about the nature of interactions between the industry organisations and academia at present.

Current academia–industry linkages

All three organisations obtain the academics' service as consultants. Additionally, CS1-3, the third interviewee from Case 1 stated, "The organisation seeks consultancy for the company from academics because we believe academics as the right people to go for when we need advanced advice". This reveals the industry belief upon the academic consultations' inherited value deriving from the profession itself. Besides, Case 1 employees support research students in data collection. Nevertheless, the time spent on such activity does not give a considerable return for the companies, since students very rarely deliver the research results back to the organisations.

Though the industry has many diverse interactions with the universities, still the research-related relationships are weak. The overall findings of Phase II are summarised and displayed by the mind-map in Figure 2, which highlights the significance of research dissemination in support of flourishing industry innovations.

Academic research is argued as a mandatory input for industry development as per literature, and the view of the research samples was also placed inline. Accordingly, research has the power to save a lot of money and effort of the industry through stopping re-inventing the wheel at the industry practice. In disseminating research knowledge to the industry, research collaborations were identified as a strong mechanism. Such practice would expand the methodological options in research designing, promoting rigorous research in construction management. It would be important to disseminate research outcome in a digestible format to the industry to capture the industry interest in starting collaborations.

However, currently, publications are the most commonly used research dissemination mechanism by the academics, which focuses mainly towards the development of the body of knowledge, itself. This suggests the need for considerable re-shaping in dissemination behaviours of the research academia in catering the construction practitioners' sense of taste. However, converting academic researchers from their common dissemination habit of academic community-focussed publications to academic–industry research collaborations would be a challenging 180° turn-around. Therefore, as an initial movement towards non-refereed publications in trade magazines and newspapers would be one good source for reaching industry practitioners (Tripathy *et al.*, 2017).

Attending to industry conferences to present the research is another potential way of influencing thought-provoking in industry, as evident in the health sector (Tripathy *et al.*, 2017). Research publications co-authored with industry partners is an option for joint research that

spans boundaries between academia and the business sector (Tijssen and Wong, 2016). Besides, impacting industry could also be promoted through institutional regulations. "Research impact" is now emerging as one main criterion in international research assessments as opposed to "traditional academic publication outputs" for universities. For example, in the Research Excellence Framework in the UK (Smith *et al.*, 2011), and recently, in Excellence in Research for Australia, a special emphasis was given for research impact assessment (Martin-Sardesai *et al.*, 2017). As per Tripathy *et al.* (2017), such movements from academic affiliations can positively influence the academic–industry research collaborations, yet places substantial threats to the climate of academic freedom.

Hence, as per the discussion, it is essential to derive the means for academic–industry research collaborations, both scientifically and strategically. In the absence of proper thought on future directions in developing such collaborations may create sustainability issues.

Conclusions

The paper reveals the gap between current and expected role and location of academic research in leading construction management innovations within emerging knowledge-based economies relevant to the prevailing theoretical underpinnings and the Sri Lankan construction industry practice.

Academic research as a critical ingredient in industrial development is strongly evident as per many theories in literature. The empirical data confirmed the dissemination of academic research as important to avoid "re-inventing the wheel at practice". Despite the promises, the research academia should need to be appropriately positioned in bringing such advancements to the construction industry. However, managing these interfaces will be both an economic imperative and a political challenge, yet, knowledge-intensive in elaboration as per both literature and empirical data.

The construction industry, therefore, should try to attain some form of THM as explained by Etzkowitz and Leydesdorff (2000). Accordingly, interactions between academia and state should develop the dimension of knowledge infrastructure, while construction industry and state interactions should develop the necessary political economy. However, this knowledge-based economic development is a three-stage process. Academic research has to play a significant role in the development of a space for innovation, which has prerequisites: knowledge space and consensus space.

The creation of such spaces is directly related to knowledge dissemination since the absence of dissemination develops no bridge between the academia, industry, and the state. Accordingly, the stages suggested in CKUM and PMKD helped to identify the construction management academics' success in disseminating research knowledge. Results revealed that the interactions between the academia and the industry are considerably weak at the moment. Currently, the success of researchers is meagre in influencing the actual policy/practice or developing policy/practice directly and bringing tangible benefits to the construction industry. Industry practitioners' experiences further indicate feeble performance in reaching higher level dissemination stages.

As per empirical data, traditionally bound reactive decisions are made at construction organisations in the absence of proper research guidance from the local research academia. There are no R&D divisions available to make decisions for the companies. Current academic–industry interactions are limited to consultancy services, while research-related relationships are weak. Though, the industry believes in the academia's ability in providing advance advices. Hence, there is an urgent need for a change in academic research dissemination behaviours in delivering the significant contributions of research to the innovative development of the construction industry.

The prominent underlying reasons related to academia for such in the studied context is the weak strategic orientation of academic research dissemination efforts and non-alignment

of such with the industry focus. At present, research academics are more interested in publications, where such dissemination mechanisms are hardly in the interest of the industry practitioners. The most productive dissemination mechanism suggested in creating a positive research relationship with industry was academic–industry collaborations, which is rarely visible at the moment. Converting research output into directly applicable tools at the practice will also be critical in obtaining industry interest for research. However, converting current disseminations habits as prescribed will be challenging. Therefore, slight changes such as, publications in commercial magazines, industry conferences, and university regulations to shape academic research dissemination mechanisms, initially will be fruitful as evident in the developed country context. However, developing countries may need policy changes in assisting both academia and the industry for the required changes; therefore, this paper would be important in such future action.

References

Abu Bakar, A.H., Yusof, M.N., Tufail, M.A. and Virgiyanti, W. (2016), "Effect of knowledge management on growth performance in construction industry", *Management Decision*, Vol. 54 No. 3.

Alker, M. (2008), "Guidance note on transferring research knowledge into action, coordinating European water research for poverty reduction.

Altbach, P. (2015), "Higher education and the WTO: globalization run amok", *International Higher Education*, Vol. 23 No. 1, pp. 2-4.

Andres, L., Biller, D. and Dappe, M.H. (2014), "Infrastructure gap in South Asia: infrastructure needs, prioritization, and financing", No. 7032, World Bank Policy Research, available at: http://ssrn.com/abstract=2497232

ARCOM (2017), "Associate researchers in construction management conference", available at: www.arcom.ac.uk/conf-next.php

Bresnen, M. and Marshall, N. (2000), "Building partnerships: case studies of client–contractor collaboration in the UK construction industry", *Construction Management & Economics*, Vol. 18 No. 7, pp. 819-832.

CRIOCM (2017), "Swinburne University of Technology", available at: www.swinburne.edu.au/science-engineering-technology/events/criocm-2017/call-for-papers/

Daoud, A.O., Fayek, A.R. and Fu, Z. (2016), "Framework for assessing the impact of construction research and development on the construction industry and academia", Construction Research Congress, May, pp. 78-87.

Etzkowitz, H. (2011), "The triple helix of university–industry–government: implications for policy and evaluation", working paper, Science Policy Institute, Stockholm.

Etzkowitz, H. and Leydesdorff, L. (2000), "The dynamics of innovation: from national systems and 'mode 2' to a triple helix of university–industry–government relations", *Research Policy*, Vol. 29 No. 2, pp. 109-123.

Fairclough, J. (2002), *Rethinking Construction Innovation and Research. A Review of Government R&D Policies and Practices*, Department for Transport and Local Government Regions (DTLR), London.

Fowler, J.W. (2008), *Survey Research Method (Apply Social Research Methods)*, 4th ed., SAGE Publications, CA.

Horta, I.M., Camanho, A.S., Johnes, J. and Johnes, G. (2013), "Performance trends in the construction industry worldwide: an overview of the turn of the century", *Journal of Productivity Analysis*, Vol. 39 No. 1, pp. 89-99.

Latham, M. (1994), *Constructing the Team – Joint Review of Procurement and Contractual Arrangements in the United Kingdom Construction Industry*, HMSO, London.

Leydesdorff, L. (2010), "The knowledge-based economy and the triple helix model", *Annual Review of Information Science and Technology*, Vol. 44 No. 1, pp. 365-417.

Marozau, R., Guerrero, M. and Urbano, D. (2016), "Impacts of universities in different stages of economic development", *Journal of the Knowledge Economy*, Vol. 7, pp. 1-21.

Martin-Sardesai, A., Irvine, H., Tooley, S. and Guthrie, J. (2017), "Organizational change in an Australian university: responses to a research assessment exercise", *The British Accounting Review*, Vol. 49 No. 4, pp. 399-412.

Powell, T.C. (2001), "Competitive advantage: logical and philosophical considerations", *Strategic Management Journal*, Vol. 22 No. 9, pp. 875-888.

Pucciarelli, F. and Kaplan, A. (2016), "Competition and strategy in higher education: managing complexity and uncertainty", *Business Horizons*, Vol. 59 No. 3, pp. 311-320.

Smith, S., Ward, V. and House, A. (2011), "Impact' in the proposals for the UK's Research Excellence Framework: shifting the boundaries of academic autonomy", *Research Policy*, Vol. 40 No. 10, pp. 1369-1379.

Tijssen, R.J. and Wong, P.K. (2016), "Unraveling complexities of university–industry research interactions: the analytical power of case studies", *Research Evaluation*, Vol. 25 No. 2, pp. 119-120.

Tripathy, J.P., Bhatnagar, A., Shewade, H.D., Kumar, A.M.V., Zachariah, R. and Harries, A.D. (2017), "Ten tips to improve the visibility and dissemination of research for policy makers and practitioners", *Public Health Action*, Vol. 7 No. 1, pp. 10-14.

Appendix 1. Excerpt of survey instruments used in data collection – Phase I

Questionnaire Survey: Academia's Perspective

Please indicate the EXTENT of following knowledge utilization levels as you have achieved in transferring construction management research outcome as an academic researcher (1 being the highly negative end and 5 being the highly positive end)

1.	**Delivery**: Reaches recipient's desks but the findings might never get read (I try disseminating my research outcome)	1	2	3	4	5
2.	**Cognition**: My research get read and understood by people	1	2	3	4	5
3.	**Mind-set Shift**: Research changes the way of thinking (People refers to my research)	1	2	3	4	5
4.	**Initiation**: Research has shaped action (People act as my research outcome)	1	2	3	4	5
5.	**Adoption**: Research has had a direct influence on the actual policy (My research outcome influenced on existing policies)	1	2	3	4	5
6.	**Implementation**: Research may use to develop policy and also been translated into practice (My research used for policy development)	1	2	3	4	5
7.	**Impact**: Utilisation of research when the implemented policy is successful in producing tangible benefits to the citizens (My research outcome has produced tangible benefits to people)	1	2	3	4	5

Questionnaire Survey: Industry Perspective

Please indicate the EXTENT of following knowledge dissemination levels as you have experienced in receiving construction management research outcome to the industry as an industry practitioner (1 being the highly negative end and 5 being the highly positive end)

1.	**Awareness**: Aware of findings from research	1	2	3	4	5
2.	**Acceptance**: Accepted research findings	1	2	3	4	5
3.	**Agreement**: Seen as locally applicable	1	2	3	4	5
4.	**Application**: Seen as doable within the local context	1	2	3	4	5
5.	**Action**: Acted based on research findings	1	2	3	4	5
6.	**Adaptation**: Adopted research findings	1	2	3	4	5
7.	**Adherence**: Adhered to research findings	1	2	3	4	5

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