Journal of Construction in Developing Countries, 20(2), 115–135, 2015

Nature of the Construction Industry, Its Needs and Its Development: A Review of Four Decades of Research

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Abstract: The construction industry is not well understood. There is no common definition, and there are even arguments about whether it is an industry or a sector that comprises many industries. The contribution of the construction industry to economic growth and long-term national development is widely acknowledged, highlighting its importance, particularly to developing countries. For the benefit of these countries, it is important to investigate the nature, essential characteristics and particular requirements of the construction industry and to use them to develop programmes for its improvement. A research programme that started in 1974 and is still continuing is discussed. The subjects studied in the research programme have included the nature of the construction industry, its importance in development, its needs and its development. Elements of the process of construction industry development that have been studied include ways and means of improving the performance of construction firms, focusing on contractors and technology development. The findings from these early studies influenced the formulation of policies and legislation for establishing construction industry development agencies in a number of countries. Other aspects of the construction industry that are studied in the research programme include the parameters of performance in the industry, such as productivity and environmental performance. An information technology framework for construction was also developed. As the world entered the information age, the implications for the industry were also studied. Finally, the concepts of leadership, ethics and transparency and their importance on construction projects and in the construction industry were also studied. The focus here is on industry development and its application to the delivery of housing. It is suggested that effective methods should be found to reduce the tendency to duplicate studies and to effectively build on relevant findings over time. A research agenda is proposed.

Keywords: Industry development, Technology development, Environmental performance, Leadership

INTRODUCTION

Construction Industry and Its Development

The literature shows that the construction industry is an important sector of the economy and plays a key role in national social and economic development (Turin, 1973; Ofori, 1990; 2012a; Hillebrandt, 2000; Lopes, 2011). The construction industry has peculiar features that need to be understood if it is to be able to perform effectively and efficiently. The author's research programme has been motivated by a desire to make a contribution to both knowledge and practice (in providing the basis for policy formulation and implementation by governments and companies).

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Research Aim and Objectives

The aim is to present a research programme on key aspects of the construction industry, with special reference to the developing countries, that started in 1974 and is still continuing. The focus is on the development of national construction industries to enable them to meet the huge backlog of needs and demand and in light of the peculiar challenges of their operating environments and the resources available to them, to enhance their performance for the benefit of their clients, users and society.

The objectives are:

1. to outline the topics studied in the particular segment of the research programme and the relationships among them,
2. to consider the milestones and influencing factors in that part of the programme,
3. to discuss the main findings from the studies and their theoretical and practical implications,
4. to propose measures to be taken to build sustainability, continuity and organic development in the research on construction in developing countries and
5. to suggest a research agenda.

The research programme started in 1974 with an undergraduate dissertation. The main subjects of the programme have included: construction industry development, industry performance, strategic management, international construction and leadership. The focus in this study is on industry development. Works on housing are used to demonstrate the application to practical issues in the lives of beneficiaries.

THE RESEARCH PROGRAMME

The Origins

The undergraduate dissertation in 1974 studied the ways and means of ensuring effective communication with small contractors on construction projects in Ghana. During internships, the author found that most of the contracting companies were led by persons with no education in construction. Thus, the "good practice" contract documentation and procedures were largely ineffective, if not inapplicable. The questionnaire-based field study of the leaders and members of the main contractors association confirmed this. It was proposed that the extensive standard specifications that mostly remained unused should be replaced with some notes of key points on drawings.

The author's interest and research skills in construction industry development were honed during a master's programme. The philosophy of strategic consideration of the construction industry was pioneered at the Bartlett School of University College London. The late Professor Duccio Turin (1926 to 1976) was the leader of the research. Turin's (1980) inaugural lecture in 1966 was a seminal piece entitled *What Do We Mean by Building?* Groak (1992) took up the

theme and later summarised it in his book *The Idea of Building*. These ideas formed the basis of the academic ethos of the school and formed the author's academic make up. Such strategic, macro-level consideration of construction was in sharp contrast to what other researchers were concerned with – issues at the project level with a focus on tactical matters and tools.

Turin (1973) led studies on the role of the construction industry in national development. The main study covered all countries with a population of at least one million people and used data published by the United Nations and other international organisations. The studies established relationships between construction and the economy that are still being discussed, re-tested and sometimes confirmed today. The relationships included the contribution of value added in construction to the total gross domestic product, the rate of change of this contribution as the economy develops, the proportion of capital formation in construction to the total and the contribution of employment in construction to total employment. Subsequently, the then Building Economics Research Unit (BERU) of the University College Environmental Research Group (UCERG), which included Dr Patricia Hillebrandt (*Economics of the Construction Industry*, the first book on the subject) undertook many studies on the role of the construction industry in economic development and on the improvement of the industries of developing countries for the World Bank and the UK government.

In a doctoral thesis (Ofori, 1981), the intention was to develop ideas that would be implemented at the broad policy level of the construction industry in Ghana. A review of the state-of-the-art of development economics was followed by an examination of the role of the construction industry in that process. Works on industry development were reviewed and, together with a field study in Ghana, led to the formulation of a comprehensive programme for the development of Ghana's construction industry. It was suggested (and justified) that the proposed programme could be taken to be a template for developing countries. The main argument was that while country specificity is a key watchword in policy formulation and implementation in industry development, the framework could be adapted to suit any context.

Construction Industry Development

Forgotten Developments was a title chosen by the editor of *Building* magazine, a weekly UK trade publication, which published the first paper drawn from the thesis. The title reflected the neglect or ignorance of the need for improving the capacity, capability and performance of the construction industries in developing countries to equip and enable them to play their due role in the long-term progress of the countries.

In the first paper in a refereed journal, Ofori (1984) argued that the problems facing many developing countries at that time posed economic and social problems to their construction industries that existing concepts on their improvement did not consider. After reviewing the current operating environments of the industries in developing countries and the corresponding responses of their participants, Ofori argued that the industries should be "rescued" and enabled to help in the ongoing adjustment of national economies and to develop the capability and resilience to adapt to future changes. Emphasis was put on the role of the industries to help themselves because whereas suggestions for action to

develop the construction industry were usually addressed to governments, the authorities cannot be expected to shield construction from problems confronting the whole economy. These ideas were further reinforced by Ofori (1985b) later in broader proposals for improving the performance of the construction industries in developing countries through effective and systematic management. Citing the experiences of Tanzania and Singapore, Ofori stressed the importance of the formation of a central agency for managing construction industry development. Ofori (1993a) uses the case of Singapore to establish the efficacy of this suggestion.

Ofori (1985a) noted that studies on the construction industries in Africa had, for three decades, advised the countries to reduce their reliance on imported materials and to develop and use local materials. The paper took stock of the national construction materials programme of Ghana since 1950 and drew out lessons that might be learned from it. The main issues highlighted were the factors that are usually forgotten in materials programmes such as socio-cultural and historical factors that hinder the adoption of the materials. These include the non-availability of skills to place the materials, the high cost and poor quality of the materials produced and the lack of effective distribution that have frustrated the development, production, propagation and utilisation of local materials in Ghana. The study infers and crystallises some principles from Ghana's experience for wider application in other developing countries.

Ofori (1988a) noted that the absence of accurate and detailed information on the construction industries in developing countries constitutes an obstacle to the assessment of their strengths and weaknesses to provide a basis for developing programmes for their improvement. The paper considered a scheme for the collection, processing and storage of construction information on a national basis. The proposed central database includes data on enterprises, data on projects and information on construction resources and building stock. Including performance data such as those on safety, cost and quality would also be useful. Establishing such a central database would not be easy, but it was suggested that countries that are able to set one up should do so.

Ofori (1988b) considered that the experience of Singapore in progressing from a typical developing country to a newly industrialising economy in less than one generation would provide the opportunity to test the hypotheses on the relationship between the construction industry and the economy in the course of national socio-economic development. Based on Singapore's development in the period of 1960–1986, the issues considered included the part construction played in the development process and the resulting structural changes that occurred within the industry, government's use of investment in construction to influence the direction of the economy and to facilitate efforts to improve the industry and government's attempts to manage the development of the local construction industry. Singapore's experience was found to confirm the hypotheses of Turin (1973), Strassman (1970) and others on the role of construction in national socio-economic development.

Ofori (1989a) based conclusions on the consideration that a construction industry is necessarily heterogeneous in many respects and reviewed the ways in which construction activities in developing countries are categorised and the merits and weaknesses of each approach. Considering Turin's (1973) matrix for the construction industry, Ofori proposed a matrix that identifies different sectors of the

industry, each with its own determinants of demand and operating constraints. The structure comprises (1) international, (2) conventional – large, (3) conventional – medium or small, (4) self-help, (5) monetary – traditional and (6) subsistence. The relationships among these segments were discussed, and it was suggested that attempts should be made in each country to develop a national matrix. The importance and the potential role of the informal structure and community action were stressed.

Ofori (1991) noted that contractor development schemes are key components of programmes for developing the construction industries of poorer countries. He reviewed such schemes and found that while their results have differed, the overall picture is not positive. Ofori considered the features of small and medium-sized construction firms, focusing on countries in sub-Saharan Africa and Southeast Asia, and identified the ingredients of success. Ofori suggested that the programmes should be country-specific and be based on context-responsive objectives that are achievable and have specific targets, with implementation programmes that should be continually monitored.

Ofori (1994a) later applied the business management technique of strategic planning to propose a plan for developing the construction industry in Singapore. In the conceptual framework, the industry is usually analysed from four perspectives: as a production sector that meets national needs, as a creator of fixed capital and infrastructure, as a bona-fide sector of the economy (two roles that lead to national economic growth) and "construction considered separately", with the view towards improving its performance. A review of previous programmes in Singapore and projection of future trends led to a conclusion that there is need for action. At the same time, the following features of Singapore's experience were highlighted: realistic long-term planning for the nation based on specific scenarios, long-term planning of the national economy, medium-term planning for industries including construction, central direction of industry development and efforts to improve the industry's factor and demand conditions with incentive schemes and project opportunities. Ofori suggested that the industry development programme should aim to "utilise positively all the construction-related 'resources' available in the country" (p. 229).

Ofori (1993b) reviews the state of "knowledge concerning the improvement of the construction industries of developing countries" (p. 175) (which he referred to as "construction industry development"). He noted that work on the area was approximately a generation old. There was some progress in its initial stages, and some of the recommendations were adopted in some developing countries. However, the results had been disappointing, and the industries of the countries continued to face severe problems. Moreover, interest in the field had waned. Ofori (1993b) discussed possible reasons for this lack of progress and suggested that there should be changes in approach. He proposed topics for appropriate research and suggested the formation of a global organisation dedicated to the promotion, coordination and dissemination of works on the area.

Subsequently, Ofori (1994b) discussed the state of affairs in the efforts to achieve progress in construction industry development. He considered broad aims and areas of research and action, the impetus behind these, solutions offered and actions taken. The results have not been impressive, and the industry's performance continued to be unsatisfactory. Ofori developed the following inferences: (1) the policies adopted are wrong, as they are based on incorrect

diagnoses and recommendations, (2) while being correct in principle, the policies are inappropriate, considering the nature and operating environment of the construction industries, (3) the policies adopted are correct but are not competently implemented, (4) the policies are not implemented and (5) the policies adopted are correct and are properly implemented but will take time to show results as construction industry development is a long-term task. Ofori examines these inferences and noted that (1) and (2) are correct and that (3), (4) and (5) are also correct with respect to certain aspects of construction. He suggested a fresh perspective in all aspects and that a long-term strategy for construction industry development be developed to guide action at many different levels that should be synchronised, continuously coordinated and continually monitored.

Ofori (1994c) considered the role of technology transfer in enhancing the level of technology in the construction industries in developing countries. He undertakes a fundamental review of the nature of technology and its development. Ofori outlined the differences between construction and other sectors of the economy in this regard and considered the results of efforts in various countries, focusing on Singapore. He found that a country-specific approach to a sound overall policy that should be planned and continually monitored is required, technology transfer should be part of (not the whole of) the technology development programme, technologies to be transferred should be selected with regard to their potential for supporting and promoting technological self-reliance and appropriateness to recipients' needs, the buyer's ability to absorb, adapt, master and integrate the transferred technology into its existing systems, improve upon it and use it to upgrade other technologies is key, the choice of the transfer mode is crucial and the complexity of the technology should be matched with the background of target recipients and training provided if necessary. These ideas were used to propose possible courses of action in using technology transfer to improve the construction industries of developing countries. The proposal is further discussed by Ofori (1994d) considering the need for appropriate policy for construction technology development.

The works considered various vehicles through which construction technology develops. Ofori, Teo and Leong (2001) discussed the effectiveness of joint ventures in the transfer of construction technology in Singapore from foreign contractors to their local counterparts. They found that the latter have benefited from such technology transfer, although the presence of foreign contractors had attracted adverse comments from local practitioners. They suggest that more publicity should be given to successful foreign-local joint ventures, highlighting success factors, possible dangers to avoid and appropriate conflict-resolution mechanisms. To ensure the technological upgrading of the entire industry, local firms that benefit from such transfer should be encouraged and supported to diffuse the upgrades among other local contractors.

Ofori, Hindle and Hugo (1996) at the start of the new political dispensation in South Africa, suggested that the construction industry in that country, which had an illustrious past in completing many complex construction projects, would face different tasks from its previous workload in terms of volume, variety and location. The present strengths and weaknesses of the industry were discussed, the nature of the projects it would undertake in future examined, and a strategic plan for preparing the industry to meet its future challenges outlined. The headings

covered in this plan included (1) institution building – formation of a construction industry board and a housing board, (2) human resource and entrepreneurship development, (3) procurement and enterprise development – procurement procedures, stabilising construction, construction export and competition at home, (4) technologies and research and development (R&D) and (5) community participation including innovative use of linkages among parts of the industry such as the combination of the established formal construction industry and entrepreneurs and informal production units within the communities.

Ofori (2000) commented on a paper by Raftery et al. (1998) on developments in the construction industries in Asia that had implications for the development of the industries. Ofori suggested that several other issues that were relevant to the developing countries had not been considered by Raftery et al. (1998). Thus, Ofori (2000) discussed construction industry development, technology transfer, joint ventures, and the impact of policy reform during that period on the industries in the developing countries in the light of globalisation. He argued that the potential of globalisation to enhance the performance of the construction industries of developing countries should be explored. Ofori suggested that it would be important to institute policies that would offer benefits to both local and foreign firms and that there should be further studies on corporate development through technology transfer.

The relationships between the construction industry and the economy as a nation develops that were established by Strassman (1970) and Turin (1973) have been tested by various authors (see Lopes, 2011). However, some authors argue that the basis of such studies is untenable, as they rely on international cross-sectional data rather than longitudinal data (considering one country at a time). The development of China over a relatively short period provided data that would avoid such a flaw. While there had been considerable economic progress in China, there are significant differences among the provinces. Han and Ofori (2001) examined the geographical distribution of construction in the provinces of China and the relationship between construction and regional economic growth during the period of 1990–1998. They also studied the types of projects, ownership patterns, and levels of technology used. A brief review of the economic growth theories was followed by a discussion of the concepts on the role of construction in development and the construction industry development in China. The regionalisation approach adopted in China was briefly outlined before the data on construction were analysed on a provincial basis. China's experience supported the growth theories that stress the importance of capital accumulation. The construction industry appeared to be a motor of development in some provinces, but "the intensity of the driving force and the consequences of applying it in development programmes are much more dynamic than Turin originally assumed" (p. 203). The regional variations showed that, in large countries, it might not be appropriate to have uniform strategies for the entire construction industry and that there is a need for further understanding of the role of the industry on the economy at the regional level.

Ofori and Han (2003) extended the study on China using data from 1990 to 2000. They noted that the results reinforce the findings of Han and Ofori (2001) and noted that the findings support some of the earlier hypotheses. Most importantly, they showed that construction can be the engine for economic

growth. Ofori and Han (2003) suggested that the study be repeated in another ten years, using the longer series of data that would then be available.

Ofori and Han (2001) considered the factors that have been important in the development of the construction industry in Singapore. The questionnaire-based study of local and foreign contractors, clients and consultants yielded four groups of factors (in order of importance): the contractors' role, government's and institutions' help, practitioners' help and financial support from outside the industry and clients' help. The government's initiatives that ranked at the top were efforts made to improve the operating environment, help given by public clients and incentive schemes. Much vision is needed to monitor and fine-tune such support. Ranked surprisingly low were the role of foreign contractors (despite the Moavenzadeh and Hagopian [1984] model on firm growth through technology transfer), support from contractors' associations, despite such institutions' vision and support from outside the industry. Ofori and Han suggested that local construction firms should do more to help themselves and to take advantage of the country's accumulated industrial, commercial and financial expertise. Ofori and Han (2000) had earlier analysed the paths taken by construction firms in Singapore to grow.

Ofori (2007a) provided a review of the state of knowledge of construction in developing countries in the editorial of a special issue of *Construction Management and Economics* on that subject. The editorial highlighted the critical need for improving the performance of the construction industries of developing countries and noted that researchers in the field have a duty to contribute to efforts to lift over a billion people from poverty, illiteracy, high infant mortality and other manifestations of poor socio-economic development. He noted the urgency for the action but regretted that the pace of research on industries in developing countries had "slowed to almost a halt" (p. 2). The ongoing work does not follow the previous body of knowledge, and the field lacks a deep and solid foundation, as many of the recent works are not profound. New issues that should attract the attention of researchers were suggested, including globalisation, public-private partnerships, global consensus on the need to fight poverty, sustainable development, threats of pandemics and greater cultural sensitivity. Researchers in the area were called upon to ensure that the field does not become marginalised. To this end, the following actions were suggested: (1) formulation of definitions of key terms on construction in the context of developing countries, (2) development of frameworks for analysis, (3) development of continuity in the research on key subjects in the area, (4) coordinated international research on selected topics and (5) a championing effort that brings research and implementation together.

Ofori (2011) discussed the role of construction in the efforts by countries to attain the targets of the Millennium Development Goals (MDGs) by 2015. Arguably the most significant contribution in that work was the suggestion of indicators of good performance on construction projects in developing countries. These indicators were later related in Ofori (2013) to the development of affordable housing, with the suggestion that such projects should be undertaken and completed:

1. *At lowest capital and life-cycle costs* to enable end purchasers to attain value for money. In the case of public provision of housing, effective cost would enable a greater number of units to be provided from the available, usually limited budget. *On*

time to reduce the time that beneficiaries of public housing and potential purchasers of private housing have to wait for their housing units that they need to safeguard their health and/or enhance the quality of their lives.

2. *To the highest level of quality* to enhance the durability and longevity of the completed items for the benefit of the occupants. This would minimise maintenance and repair costs and optimise the utility from the housing unit and hence its contribution to the capital assets of the nation. It also maintains its investment potential and its security over a long period.
3. *With focus on the health of the workers and residents in the environs of the projects* to safeguard the health of the occupants when construction takes place in building other facilities in the vicinity of the housing units.
4. *With attention to the safety of the workers on the construction site, neighbouring residents, passers-by and the occupants and users of the building*. The adoption and implementation of measures to realise these objectives would enhance the wellbeing of the workers and the quality of life of the occupants and users of the building.
5. *With attention to the preservation and safeguarding of the environment*. The considerations in this regard include the conservation of resources (including land, water and energy), reduction of all forms of pollution, reduction of wastage levels and management of the waste that is produced. The adoption of resource-efficient and clean construction methods will reduce costs, increase productivity and relieve the pressure on available land for cultivation.
6. *With due consideration of employment generation*, exploiting the full potential of construction projects to create jobs by selecting appropriate procurement policies and construction technologies. Housing projects can be used to create green and decent jobs.
7. *To the satisfaction of the client* investing directly in the project, respecting the culture and personal or business desires and aspirations of the individual or corporate client and contributing to the competitiveness of the client's firm.
8. *To the satisfaction of the end purchasers and subsequent occupants* (of private housing units) and beneficiaries (in the case of public housing). The end purchasers and beneficiaries should play a role in the key decision-making activities during the design and construction periods of the project.

Revaluing construction and construction in the 21st century

As Singapore approached the new millennium, it launched strategic reviews of the main sectors of its economy. These reports, with titles given the suffix "21", typically considered the current capabilities, future challenges and opportunities of the relevant sector, formulated a vision, highlighted a series of desired

outcomes, and outlined strategic thrusts under which recommendations were set with targets in terms of outputs and dates. Ofori, Ling and Dulaimi (2004) and Dulaimi, Ling and Ofori (2004) reported on a study undertaken on the report of the Construction 21 (C21) Report, produced by a government-appointed C21 Steering Committee (1999). Dulaimi, Ling and Ofori (2004) presented the industry's view of the findings and recommendations in the C21 Report. They considered these areas of construction activities: professional standards, skill levels, buildability, construction safety and internationalisation. They found that the industry clearly supported the C21 recommendations. The industry had greatest preferences for a driving force of the desire to provide an improved service to the customer and, most importantly, developing the business environment in which market forces would demand the desired changes and improvements. In such an environment, safety and buildability would become business priorities for firms without the need for regulations.

Ofori, Ling and Dulaimi (2004) outlined the motivators and enablers of action that the study found in the industry and drew lessons from such a strategic approach to industry development for the developing countries.

Dulaimi et al. (2002) draws from the same study as Ofori (2002) and refers to the C21 study as having "criticised the performance of the construction industry in Singapore and identified fragmentation and segregation of design and construction activities as the main barrier to improved investment and development" (p. 237). The authors focused on how the industry can be motivated and enabled to achieve greater levels of integration and higher volumes of R&D and innovation. The main factor underlying the findings is the need for the creation of business and market conditions that demand further integration and greater innovation to meet customer expectations and demands. Moreover, the industry should do more to help itself.

Singapore is one of the countries that have sought to derive benefit from the application of information and communication technology (ICT). In the late 1980s, the government formulated national policies and strategies, and these were followed by sector-level strategies and programmes. As the so-called "knowledge-age" or "information age" and the "knowledge-based economy" approached, the country formulated plans for preparing the construction industry to exploit the opportunities and address the challenges to improve its work practices and procedures and thereby enhance its performance and cost competitiveness. The objectives of Ofori (2002) were to consider the nature of the knowledge-based economy, to review the strategies for developing a knowledge-based economy for Singapore: to consider the implications of the knowledge-based economy for the construction industry in Singapore, to review current initiatives for preparing Singapore's construction industry for the knowledge-based economy and to propose further necessary action. The focus was on the development of the workforce, training and professionalism as highlighted in the C21 Report. Ofori suggested that construction firms should emphasise learning among their employees and formulate corporate policies for human resource development and ICT implementation. A more effective partnership between government and industry is needed to implement the transition to a competitive, knowledge-based construction industry.

Ofori (2003) asked, "What challenges does the knowledge-based economy pose to the construction industry? How can Singapore develop its

construction industry to meet the demands?". He discussed efforts made to prepare the industry for such an economy, after the publication of the C21 report, focusing on practice improvement, integration of the construction processes and export of services. He suggested that apart from the proposals in the C21 report, a range of other aspects require attention, including corporate development, business networks and procurement arrangements. Moreover, the industry should be more involved in the implementation of the change initiatives.

The International Council for Research and Innovation in Building and Construction (CIB) undertook a major exercise to revalue the construction industry in light of changes in society and the expectations of clients and society. The study had three objectives: generating better understanding of how constructed assets add value to their clients and users, developing a more effective capture of the value generated through the project life cycle in terms of profits and learning and, as a result of these two "revaluations", a revaluation of the image of the industry. The contribution to this exercise (Ofori, 2006) was used to discuss the importance of the construction industries to the developing countries and to develop a research agenda for strategies and actions to improve the performance of the industries. The agenda sought to encourage more research on the industries and to guide the work in appropriate directions to fill gaps, reinforce existing knowledge, and move the field forward.

Applications

Human resource development

Labour subcontracting is an important labour-use strategy in the construction industry in most countries, including some of the developing ones, such as Malaysia. In some cases, such a large proportion of the work is subcontracted that the management of the subcontractors and their workers (skilled, semi-skilled and unskilled) becomes an important performance determinant for the project. This is the case in Singapore, as the main contractors have taken advantage of the convenience, economy and flexibility that subcontracting offers them in their employment practices. Debrah and Ofori (1997) discussed the merits and disadvantages of the construction labour subcontracting system in Singapore from the perspectives of the contractors, the subcontractors and the workers. They suggested that the Japanese model of subcontracting offers lessons for Singapore but would require modifications and adaptations before its application.

Extending the discussion in Debrah and Ofori (1997), Ofori and Debrah (1998) relate the concepts of labour market flexibility in the human resource management literature (where workers are segmented into those in the core and those in the periphery in response to changes and uncertainties in product markets, together with increasing competition) to the construction industry in Singapore. They found that the conditions for the increased use of peripheral workers (owing to a critical shortage of workers) in the industry were different from those considered to be underlying the quest for flexibility in industrialised countries at that time (economic recession, legal restrictions on union action, and global competition). They also found that the practice has many adverse effects despite the benefits derived by the firms. The construction industry in Singapore does not

use labour subcontracting as a short-term solution to create a buffer of peripheral workers, but it has been the traditional basis of the industry.

Debrah and Ofori (2001a) examined the links between construction labour subcontracting involving mainly foreign workers and job safety in Singapore. It had often been argued that the high accident rates in the industry in Singapore were due to labour subcontracting as well as the use of foreign workers who form the bulk of the site workforce. The findings indicate that, under C21, Singapore was about to adopt comprehensive policies to enhance site safety with more stringent requirements and demanding targets that could be a model for developing countries. The researchers suggested that a concerted effort should be made involving government, clients, designers, contractors, subcontractors and the workers. There should be more emphasis on positive reinforcement and promotion of safety consciousness at all levels.

Using an established model formulated from the concept of the Developmental State and points to the dominant role of the state in determining, planning for and providing the skills considered to be necessary, Debrah and Ofori (2001b) examine the links between skill formation and productivity improvement in Singapore's construction industry. They noted how government has used skills formation to enhance competitiveness and show that in Singapore, government's role is not monolithic: different roles have been adopted for various sectors. They used the construction industry in Singapore to make these arguments, suggesting that new ideas of skills formation in the industry are required that rely less on the one-dimensional focus on the number of skilled workers and more on building up the quality of skills.

The development of human resources is crucial for developing countries as human capabilities can make the difference in the performance of the construction industry of any country. However, there is insufficient attention to this topic. The study reported in Debrah and Ofori (2005a; 2005b) considered the post-graduation training of engineering graduates in Tanzania as a consultancy assignment undertaken for the National Construction Council (NCC), funded by the Commonwealth Secretariat. Debrah and Ofori (2005b) found that there was no systematic, integrated industry-wide training of construction professionals in the country: rather, there was an array of fragmented, episodic ad hoc "programmes". The main constraint was lack of sustainable funding. They proposed an industry-specific training levy but warned against the possible influence of the other constraints of lack of political will, bureaucracy and corruption.

Leadership

Ofori and Toor (2012) considered leadership to be the missing ingredient in the recipe for industry development, owing to the nature of these countries, construction industries and their operating environments. The features of the construction industry, process and project make leadership even more essential. The industry includes many stakeholders with often conflicting objectives. The projects are expensive, technically demanding and take a long time to complete: the project teams are large and diverse. The process is long and involves many discrete and interrelated tasks. In developing countries, given the influence of construction products on long-term socio-economic development, poor

performance on projects can have severe implications for the nation and its citizens. Thus, effective leadership is critical in construction.

Ofori and Toor (2012) addressed the following questions: What is leadership? How important is it in construction? How relevant is leadership to construction in developing countries? How has research on leadership developed over the years? What is the current status of research on leadership in construction? How can the situation be improved, especially with respect to the leadership needs of developing countries? What are the relevant issues to study in the field of leadership in construction in developing countries? The subject of leadership was then related to construction industry development. After establishing a relevance of the former for the latter, the relationship between the two was discussed. An agenda for research on leadership in construction in the context of the developing countries was presented. Ofori and Toor (2012) also argued that authentic leadership was the most suitable for these countries and this particular purpose. Table 1 from that study considers the components of construction industry development and the relevance and merits of leadership in realising each of them. Ofori and Toor (2012) concluded that it is important to develop authentic leaders and followers to set the vision for improving the performance of the construction industry by enhancing its capacity and capability in the context of each country concerned. These leaders and followers would tackle the task of realising this vision with heart, tenacity, a sense of hope, and self-transcendence.

Table 1. Leadership and Components of Construction Industry Development

Component	**Potential of Leadership Necessary Action**	**Leadership Tasks**
Technology development	Appropriate research and development to develop locally suitable technologies and foster innovation, transfer and diffusion of technology	Strategy formulation (including identification of need), monitoring, feedback and review
Corporate development	Fostering the continuous growth and prosperity of contracting and consulting firms in the construction industry, formulating and implementing programmes for developing construction enterprises	Effective corporate leadership, including strategy formulation and implementation, continuous business development, formulation and implementation of national policies, monitoring and feedback
Institution building	Building of professional institutions and trade associations, creating umbrellas of these entities to provide a common voice for the construction industry and establishment of a dedicated industry development agency	Leading the institutions to be a force for progress, engendering ethics and professionalism, strategy and policy formulation for and collective championing of, industry development

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Table 1: (*continued*)

Component	Potential of Leadership Necessary Action	Leadership Tasks
Materials development	Development of appropriate materials and components with regard to economic, environmental, social and technical sustainability	Similar to, and to be coordinated with, technology development
Human resource development	Visionary identification of human resource needs in relevant areas and expertise levels and coordination of programmes to realise the requirements	Effective coordination of the involvement of government, industry and academic institutions, engendering a spirit of excellence
Documentation, procedures and practices	Formulation of appropriate contract documentation with fair and equitable terms, adoption of procedures based on good practice rather than history	Collective leadership to develop appropriate documents and procedures for mutual benefit
Operating environment	Development of a conducive operating environment for the construction industry that facilitates the performance of firms and individuals, fosters corporate growth and enables the construction industry to play its role in national development	Collective leadership to influence the development of a facilitating environment including education of other sectors about the construction industry and its needs

Toor, Ogunlana and Ofori (2012) consider these questions: What does leadership mean where the construction industries in the developing countries are concerned? How important is leadership to these industries? If construction is important in that context, then what should be done about it? The researchers suggested that leadership could be the missing ingredient that accounts for the failure to make progress in industry development. To this end, efforts should be made to develop leaders in these countries to enable them to lead at the corporate, project and industry levels.

Housing

One of the applications of the studies on industry development was the resolution of the housing problems facing developing countries. Ofori (1989b) considered the success factors of Singapore's housing programme that had enabled the country to effectively break the back of its housing problem by the 1980s and offered proposals for developing countries. Among these was the presence of a central executive housing agency, which was highlighted by Ofori (1989c). This paper used the experience of Ghana since the 1950s and suggested that the absence of a broad-based and well-staffed national housing agency accounts in large measure for the lack of successful efforts to provide satisfactory housing for the people. Such an agency should be executive in nature, able to tailor programmes to meet the needs of specific targets of the population, predict, assess and react to changes in its operating environment, have access to relevant resources and be able to set rental levels and selling prices.

Field and Ofori (1989) considered the role of the state in housing, using Singapore's experience since 1960. They noted that state provision is only one of a range of viable options for housing and that Singapore is unique in terms of size and population growth. They highlighted elements of success worth emulating despite this uniqueness: firm government commitment; attention paid to housing in overall economic management, a well-organised planning system, a strong and effective implementation agency, appropriate policies firmly enforced and, especially, sound resource management and development of construction firms.

Ofori (2007b) noted that housing is a basic human need and that most governments are committed to ensuring that all of their citizens have decent standards of housing. There are gaps between needs and provisions in almost all countries; the shortfall is greatest in developing nations. Whereas the adverse effect of construction activity on the world's environment has been highlighted in the literature, large volumes of resources will be required if these housing gaps are to be filled. There will also be other environmental impacts from such levels of building activity. Ofori (2007b) asked, "How can all humans be provided with satisfactory housing units with minimal impact on the physical environment?". He discussed developments in sustainable construction, focusing on housing and concentrating on the role of the client. He reviewed national policies on housing and the practices of larger clients of housing developments in Singapore and inferred impacts for other countries. He suggested that further education of the client is necessary. Moreover, there is the potential for end purchasers to be similarly educated to form them as a market force for change.

Reports for United Nations agencies

The present author played an active role in the Construction Management Programme for Africa, which was formulated and administered by the International Labour Organisation (ILO) and originally led by Professor John Andrews of the UCERG. This provided the author with the opportunity to study aspects of the construction industries of a number of countries. An example is Ofori (1980), who discussed the construction industry in Ghana.

The author was engaged as a consultant to undertake a series of studies for the then United Nations Centre for Human Settlements (UNHabitat): two may be highlighted. The first major study (1992) was on technology development in human settlements in general, and in the construction industry in particular. The study considered the nature of technology; the process of technology development, including R&D and innovation, technology transfer and proposals for developing technology in human settlements. This study was one of the earliest works to cover environmental issues in construction. The report later led to the development of papers such as Ofori (1994c; 1994d). The second study (UNCHS, 1996) was on the development of small contractors that covered entrepreneurship, the nature, features and needs of small- and medium-scale enterprises around the world, examples of programmes for small contractor development around the world and a template of a programme for the development of small contractors. Papers that flowed from this work included Ofori (1991).

In one of the few works on foreign construction workers that are available, Ofori (1997) analysed data on such workers in Singapore as one of a number of

studies undertaken for the International Labour Office. The coverage included government policies on foreign workers, employers' recruitment, deployment and management practices and data on numbers, skills distribution, wages and working conditions. Many countries around the world, including all of those in the Middle East as well as Malaysia and Singapore, rely on foreign workers. There are many subjects worth studying in relation to the implications for the development of the industries themselves, including productivity, cost, competitiveness and the welfare of the workers.

Contribution to academic community and society

The author was the founding coordinator of the CIB Task Group 29 (TG29) in construction in developing countries. One of the accomplishments of the group under his leadership was the series of definitions it formulated. For example, TG29 (1998) defined construction industry development as follows:

> Construction industry development is a deliberate and managed process to improve the capacity and effectiveness of the construction industry to meet the national economic demand for building and civil engineering products and to support sustained national economic and social development objectives.
>
> Construction industry development promotes (1) increased value for money to industry clients as well as environmental responsibility in the delivery process, (2) the viability and competitiveness of domestic construction enterprises and (3) optimisation of the role of all participants and stakeholders through process, technological, and institutional enhancement and through appropriate human resource development.

This definition has been referred to and used by some governments, such as that of South Africa (in the formulation of the enabling legislation for the Construction Industry Development Board [CIDB]).

Ofori (2012b) discussed work on transparency in construction. Studies show that corruption and mismanagement are responsible for the loss of between 10% and 30% of the investments in construction projects made by governments. Ofori (2012b) considered the pernicious and corrosive nature of corruption in construction and its causes. The efforts being made at various levels around the world were outlined, including laws such as the Bribery Act in the UK and the Sarbanes-Oxley Act in the United States. At the international level, there are initiatives such as the United Nations Global Compact. At the national level, countries have set up anti-corruption and fair-trading organisations. At the industry level, professional institutions have their codes of practice, and corporations have their codes. The Construction Transparency Initiative (CoST) was discussed in detail. CoST was launched in 2008 and is a multi-stakeholder initiative with the simple concept that disclosing key information on public projects at relevant stages would reduce corruption and mismanagement on projects. CoST was piloted in eight countries: Ethiopia, Guatemala, Malawi, the Philippines, Tanzania, United Kingdom, Vietnam and Zambia. The institutional arrangement is that a multi-stakeholder group (MSG) comprising representatives of government, private

sector (industry) and civil society is formed. The MSG is based in a host organisation that appoints a national coordinator. The international secretariat, based in the UK, provides technical assistance when necessary. The procedure is that the information is disclosed by the procuring entities. This information is subjected to scrutiny and review by an independent "assurance team" that highlights issues of concern that it finds. The report of the assurance team is published by the MSG, and the relevant authorities can take action if necessary. CoST has made a significant impact, including tangible cost savings on projects where malpractice was found early, changes in procedures and institutional redesign.

CONCLUSION

The findings of the research programme have been translated into regulations, policies and initiatives for industry development in some countries. The programme has led to a higher doctorate degree and an academy fellowship and has spawned a CIB working commission (W107 on construction in developing countries, formed in 1997). The work has enabled the researcher to be a consultant and adviser to many governments.

One might ask, "Was the sequence of research projects deliberate?". For the author's own papers, the sequence of research subjects was specifically chosen. However, this was not the case for other papers such as those by the author's graduate students and those involving collaboration with others. Another question would be, "What have been the enablers?". The enablers have included (1) supportive professors – these were John Andrews and Patricia Hillebrandt, (2) opportunities to work for international agencies, especially International Labour Office and United Nations Human Settlements Programme (UNHSP), (3) research ethos and overall atmosphere at the National University of Singapore (NUS) and some good collaborators and graduate students. A final question would be, "What have been the constraints?". The difficulties and barriers have been (1) consideration by some people, including some prominent researchers, in the author's earlier years, that macro-level studies are not worth doing, (2) the lower level of value attached to qualitative studies by some researchers, (3) insufficient interest in, and less regard for, works on developing countries and (4) difficulty in attracting funding for research projects and in funding graduate students by scholarships.

A final question is "What advice does the author have for new researchers on construction in developing countries?". First, they should seek quality and novelty in their work rather than pursuing high numbers of papers. Second, they should look for the long-term impact of their work or should design their programmes accordingly. Finally, they should aim for some of their works to be seminal papers (at least one in every 20 papers).

The research agenda and final conclusion is a poem...

If any item of construction: a factory, an office block, a house, a school, a hospital, a road, a bridge, an airport, a canal, a water and power distribution system is such a basic requirement for national development

Every country needs to have the capacity and capability
That will enable it to create, operate, maintain and improve over time
The constructed items of a wide range of types that it needs.

The construction industry is what provides this capability
Its capacity and performance do not happen by accident or by right but by planning, design and management
Strategies, policies and programmes must be translated into regulations, initiatives and incentives
Administrative and enforcement agencies should be replaced by executive entities

In creating its products, delivering its services, the industry must aim to make the investment most worthwhile by giving it greatest value over the long term
It should minimise long-term costs, enhance long-term affordability for all clients (government or private sector) and users (businesses, families or individuals)
Quality, durability, environment, safety and health should be watchwords
Others watchwords: Beyond legal compliance, client and user satisfaction, cultural sensitivity, and community acceptance

The construction industry must be at its best to deliver national, business, family and individual aspirations
Government, industry, civil society must do their part
Researchers, students have a major role to develop the basis for decision making
To build up the required databases, to apply the best methods, to make considered, practical, sound suggestions.

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