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Push and Pull factors of Innovation Performance in Quantity Surveying Firms

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Abstract
Innovation has been defined as exploiting change as an opportunity. The enormity of changes experienced in the built environment such as changes in technology, changes in client desire due to variation in taste, aspirations and purchasing power, should therefore, provide the necessary stimulus for innovation. However, the built environment consulting industry rely heavily on "business as usual solution" rather than adopting innovative practices. The study uncovered specific factors affecting rate of innovation occurrence in Quantity Surveying Consulting Firms (QSCF). Specifically, this study investigates the factors that drives, enables or hinders innovation in QSCF. A questionnaire survey of 48 QSCF operating in the two largest cites in Ghana were reached for the study using snowball sampling technique. Findings revealed that the innovation performances of QSCF are affected by factors such as drivers, enables and barriers. The result should assist management in identifying relevant factors that can stimulate innovation for them to invest the needed effort. It highlights the barriers to innovation for the firms to find ways to manage their effect. Future research must focus on outcomes of innovation activities to derive management attention to the need to be innovative.
Keywords: Innovation, Principal Component Analysis (PCA), quantity surveying.

INTRODUCTION
Innovation has received attention of researchers in all fields of study and practice. This can be attributed to the numerous benefits that are associated with its occurrence in an organization. Such benefit includes contributions to economic growth of firm and the nation, competitiveness of a firm and improvement in quality of life (Ozohorn *et al.*, 2010). Whilst Ozohorn *et al.* (2010), see innovation as a complex and multidimensional process, Slaughter (1998) sees it as a non-trivial change in a product, process or system. The UK's Department of Trade and Industry (DTI) states that innovation is "the successful exploitation of new ideas" and that "it is the key business process to compete effectively in the increasingly competitive global environment" (DTI, 2007). In the view of Drucker (1993), the exploiting of such changes as an opportunity is what innovation is all about. These assertions suggest that the occurrence of change is a recipe for innovation. As Doyle and Bridgewater (1998) rightly put it, 'opportunities for innovation are created by environmental change'.

In the built environment today, the enormity of such changes is beyond compare and have also been occurring and reoccurring for years. Changes being experienced in the construction industry today includes changes in technology as well as changes in client desires as a result of variation in taste, aspiration and purchasing power, (Betts and Ofori, 1992), globalization , the rapid changes in project procurement and implementation process and the pervasive utilization of information and communication technology (Jaafar *et al.*, 2008).These changes have triggered intense competition in the construction industry in a manner that threatens the survival of many firm. The need for innovation has become grater as increasing the range of business opportunities has become necessary for a firm's continued growth, survival and profitability in competitive business environments like that construction. (Nkodo, 1999). Since innovation thrives on changes, the changes being experience in the construction industry must be welcomed as this will foster innovation that will enhance the firms' competitiveness and the outcomes will provide the needed range of business opportunities to enhance the firms' survival. Unfortunately, the ability to innovate and manage change appears to be lacking in the construction industry in general (Betts and Ofori, 1992; Gale and Fellows, 1990; Lansley, 1987)
There has been a limited study on the factors that favours or discourages innovation in a firm (Hardie and Manley, 2008). Previous research has addressed several aspects of innovation: (1) innovation value chain (Wolfe, 1994; Tangkar and Arditi, 2000; Rogers, 2003; Hansen and Birkinshaw, 2007; Roger *et al*, 2008; Ozohorn *et al*, 2010), (2) classification of innovation (Philips, 1997; Cann and Salter, 2000; Bossink, 2004; Hardie et al; 2005; Barret and Sexton, 2006), (3) innovation analysis and measurement (Slaughter, 1993; Dickinson et al., 2005; NESTA, 2006; Ozohorn *et al.*, 2010). Considering the occurrence of innovation in a firm, literature is almost silent on the factors that can bring about innovation or hinder its occurrence. As a result, an incomplete picture exists on the 'what' and 'how' innovation can occur in a firm.

Against this background, the purpose of this research is to answer the question: What factors affect the rate of innovation occurrence within QSCF in Ghana. More specifically, this research has three objectives:

(i) To ascertain the factors that create the need for QSCF to innovate
(ii) To ascertain the factors that helps promote innovation within QSCF
(iii) To ascertain the factors that impedes the uptake of innovation within QSCF

That is, this research attempts to identify specific factors that can promote or hinder innovation occurrence in a firm. Essentially, this is in response to the call for studies into the factors that favour or discourage innovations in a firm since such studies are limited (Hardie and Manley, 2008). In addition, the study is limited to quantity surveying consulting firms of the built environment consulting industry because changes occurring in the industry are threatening their survival but such changes are in themselves a recipe for innovation. The findings of this research are expected to assist professional practitioners in channeling their energies to relevant factors that can affect innovations outcomes within their firms.

This paper is part of a larger study and discusses the findings of an empirical study addressing certain innovation performance factors that were measurable within QSCF. This paper has four parts; first, it reviews the extant literature relevant to innovation performance factors. The research methodology is presented, followed by data analysis. Next, the findings are discussed and summarized. The paper concludes with a discussion on the implications, limitations of this study and directions for future research.

2 Innovation

The term innovation may often be used as a synonym for change but in academic literature, the case is different. Ozorhorn *at al*. (2010) describes innovation as a complex and multidimensional process that has received the attention of researchers in all fields due to its contribution to economic growth, competitiveness and quality of life. Slaughter (1998) defines innovation as being understood to be "a non-trivial change in a product, process or system". Such a change in the view of Hardie and Manley (2008) can be at the level of 'world's first' or it can be at the level of 'a first' for a country, industry or individual organization. Ozorhorn *at al*. (2010) explains that innovation in general terms is the creation and adoption of new knowledge to improve the value of products, processes, and services.

Phillips (1997) distinguishes between technological innovation and non-technological (including organizational and marketing) innovation. Technological innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. Organizational innovation in the firm includes significant changes in organizational structures; the implementation of advanced management techniques; and the implementation of new or substantially changed corporate strategic orientations.

In the same vein, Bossink (2004) explains that the innovation process generally includes both technological and organizational streams. Technological innovations according to Bossink (2004) include improvements to construction materials, building processes and equipment whilst the organizational innovations include matters that have to do with communication systems, business strategies, human resources and knowledge management. Technological innovations are easier to recognize in an industry like construction, but it is possible that organizational innovations have more long lasting effects (Barrett and Sexton, 2006). Linkages between these two main streams of innovation have been found to be critical to success in project based industries like construction (Gann and Salter, 2000; Hardie *et al*. 2005).

It appears that the two main categorization made by Phillips (1997) and Bossink (2004) is too general and less specific because several other researchers have come out with other categorizations that are more detailed and specific. Henderson and Clark (1900) classified innovation as incremental, modular, architectural and radical depending on the degree of product/architectural knowledge required to implement. Again, DTI (2007) states that innovation can takes several forms including product innovation (changes in the products/services) which an organization offers; process innovation (changes in the ways in which they are created and delivered); position innovation (changes in the context in which the products/services are introduced); paradigm innovation (changes in the underlying mental models which frame what the organisation does). Marketing innovation, on the other hand, is the implementation of a new marketing method involving significant changes in product, price, and promotion strategy (OECD and Eurostat, 2005).

2.1 Innovation Factors

While the history of every company which achieves successful adoption and delivery of innovative practice is clearly different in detail, it is speculated that there are some features which such firms have in common. The

identification of these common features is useful to the firm itself as a validation of their own choices and practices but more importantly, it can provide some suggestions for other companies wishing to lift their performance. In the construction industry context, this idea was championed by Winch (1998), who explicitly identified the need for "more case studies of the trajectories of construction innovations" to encourage innovative practice. There have been some specific instances of research which attempted to do this for particular segments of the wider Architecture, Engineering and Construction (AEC) industries. For example, Salter and Gann (2003) have identified many of the sources of innovation for engineering firms. Contractors and subcontractors, however, may well have different sources, as noted by Manley *et al*. (2004). Gann (2001) found that the majority of construction organizations get their new ideas through published media and by participating in various industry networks.

Blayse and Manley (2004) found that there are six primary influences which either drive or hinder construction innovation. These were, 'Clients and manufacturers, the structure of production, networking, procurement systems, regulations and standards and the nature and quality of organizational resources'. However, there has been relatively little research into the operation of these factors in the construction industry and virtually none in the consulting industry, for instance QSCF. Again, the factors proposed are vague and also fail to pinpoint the specific issues such as drivers, enablers and barriers that can directly affect innovation in an organization. Ozohorn *et al.* (2010) has developed the variables in each factor and that has been used in innovation research works in construction at firm level.

The drivers of innovation are the factors that create the need for an organization to innovate. Such driving factors of innovation in the view of Ozohorn *et al.* (2010), Includes: Performance (cost reduction, productivity, and effectiveness), End-user requirements, Regulation and legislation, Competition, Technological developments, Aesthetics/ design trends and Environment/ sustainability. The enablers of innovation on the other hand are the factors that assist in the promotion of innovation within the firm. These factors includes: Leadership, Supportive work environment, Awards, grants, funds, Use of problem solving techniques, Deep understanding of the customer, Emphasis on research and development, Education and training policy, Knowledge management practices, Encouraging staff to get involved with external network, Reward schemes, Government schemes, and Collaboration with partners (Ozohorn *et al.*, 2010). The barriers are the factors that are seen as impediments to the uptake of innovation activities in a firm. The factors under this category includes: Availability of financial resources, Economic conditions, Fragmented nature of construction business, Inappropriate legislation, Belief that the industry is doing well without innovation, Lack of qualified staff, Unwillingness to change, Lack of awareness, Lack of government role model, Lack of clear benefits, Temporary nature of construction project, Risk in commercializing innovations, Lack of innovative investment / procedures / practices, Adversarial approaches within the supply chain, Extensive organizational change required and Lack of end-user involvement (Ozohorn *et al.*, 2010).

3 METHODOLOGY

3.1 Sampling

The target population for this study consisted of Quantity Surveying Consultancy firms that are duly registered by the Ghana Institute of Surveyors (GhIS) and earns its livelihood by engaging in activities so described as the duties and functions of Quantity Surveying firm in the GhIS constitution and the Act that establishes the professional bodies (NRCD 143). The unit of analysis is the individual firms that constitute the Quantity Surveying division of the GhIS.

The sampling frame was a list of Quantity Surveying practicing firms in Ghana as at 2012 that are self-employed in consultancy business in the private sector. A questionnaire survey of the 48 firms was conducted. Questionnaire was administered in collecting situation and by personal administration. Responses of 45 firms were retrieved, giving a satisfactory response rate of approximately 94%. The entire retrieved questionnaires were suitable for subsequent analysis.

Table 1 provides a socio-demographic profile of the respondents who participated in the study. The sample was highly dominated by small and medium sized firms and majority of the respondents (82%) did not have management background.

Table 1: A Socio-demographic Profile of Respondents

Characteristic of respondents	Percentage of respondents
Experience by years of operation	
Below 10	42.2%
10 - 20	40.0%
Above 20	17.8%
Size of firm by number of employees	
Less than 10 (small)	24.4%
10 – 25 (medium)	62.2%
More than 25 (large)	13.3%
Background of respondents	
Management related	18%
Highly technical	82%

Source: Field Data, 2013

3.2 Data Collection

The initial questionnaire was pretested with a convenience sample of approximately 15 QSCF who are largely based in Accra, Ghana. This was achieved by the use of Cooper and Schindler's (2006) collaborative participant pre-testing method. Data for the main study was collected over a three-month period during January and March 2013 via questionnaire survey. The questionnaire (see Appendix) was delivered to the top management member responsible for day-to-day running of the firm by the researcher.

Before conducting the survey, a list of registered QSCF together with their location, details were obtained from the GhIS. Telephone calls were made to the firms to book appointment for visit to the firms. During the visit, the purpose of the survey was discussed and each firm's top management's permission was obtained. Questionnaire surveys have been used previously in studies on construction marketing and innovation. A survey questionnaire was designed as the research instrument and administered to the respondents as in the similar studies carried out by several other researchers (Morgan and Morgan 1991; Namo and Fellows 1993; Marr *et al.*, 1996; Bowen and Rwelamila, 1995 Arditi *et al.*, 2008, Yisa *et al*., 1995, Morgan 1990)

Questionnaires were then delivered to the firms together with a package of paper napkins worth GhC 20 as an incentive for participation. Two weeks after the initial delivery of the questionnaires, a post card was sent to respondents reminding them to complete the questionnaire. Follow up surveys were sent to those respondents who had not returned their surveys with the one-month period until all the completed questionnaires were retrieved.

3.3 Measures

3.3.1 Innovation Performance factors

A multi-dimensional measure based on the innovation value chain (IVC) approach (Milbergs, 2004; Hansen and Birkinshaw, 2007; Roper *et al.*, 2008; Ozohorn *et al*., 2010) was adopted in this approach. The scales based on that were used to measure the different components of innovation at firm level using a Likert scale (1-5) for each question (see Appendix). The measure included a scale statements of which the scale points were labeled as follows: 1=not important 2=less important 3=moderately important 4=important 5=very important in responding to the following questions. In all, a total of 35 variables constituting the three factors (factors that create the need for a firm to innovate were operationalised as drivers, factors that helps promote innovation within firm were operationalised as enablers and factors that impedes the uptake of innovation within a firm were operationalised as barriers) were ranked by the respondents. Of the 35 number of variables, drivers had seven variables; enablers had twelve variables and barriers had the remaining sixteen variables.

3.3.2 Demographic Variables

The demographic variables measured include age of firm, size of firm and educational background of top manager.

3.3.3 Analytical Tool

The analysis in this section is based on the framework of analyzing innovation in construction. The innovation process is made up of a series of knowledge sourcing which are translated into a new product or process. The effectiveness of the creation and diffusion is influenced by a number of tools, techniques and strategies which

are employed by the firms, which are affected by external and internal factors such as drivers, barriers and enablers.

Principal component analysis (PCA) was used to find the weight of innovation performance variable in each of the marketing performance parameters (drivers, enablers and barriers). The use of PCA was informed by its ability as a statistical technique that linearly transforms an original set of variables into a smaller set of uncorrelated variables that represents most of the information in the original variable (Kellow, 2006). Again, the nature of the five parameters (i.e. drivers, enablers and barriers) is factors that cannot be measured directly. Fellows and Liu (1997) describes a factor as a type of latent construct in that a construct is an amalgamation of variables and is latent because it cannot be observed (and measured) directly but only through the constituent variables.

The value of the i^{th} marketing parameter (principal component) can be calculated using the following expression (Field, 2005):

$$PC_i = \sum_{j=1}^{p} a_{ij}X_j = \alpha_{i1}X_1 + a_{i2}X_2 + a_{i3}X_3 + \ldots\ldots\ldots\ldots\ldots + \alpha_{ip}X_p, \quad \textbf{(1)}$$

Where aij = factor scores and Xj= ratings received for marketing activities. In this expression, i = 1, . . ,3 representing each of the three innovation performance parameter, and j = 1, . . . , p representing the innovation variables within each innovation performance parameter. By definition, factor scores have a mean of "0" and a standard deviation equal to "1"

An index is calculated by normalizing the factor scores in order to determine the weights of the different marketing activities in each marketing parameter. The weight of the jth marketing activity in the $\boldsymbol{i}$ th marketing parameter (i.e. Principal Component) is calculated as follows (Ruiz – Tagle 2006):

$$W_{ij} = \frac{a_{ij}}{\sum_{j=1}^{p} a_{ij}} \quad \textbf{(2)}$$

Only one principal component was extracted using the statistical package SPSS in the form presented in equation 1 as the goal was to calculate the weights of marketing activities in each marketing parameter, and then the weights of the marketing activities were calculated using the factor scores such as in equation 2. The factor scores calculated using the statistical package SPSS, the weighs of each marketing activity, their average importance scores, and the weighted importance scores of the five marketing parameter are presented in Table 2.

4. ANALYSIS

4.1 Drivers of Innovation

The drivers of innovation are the factors that create the need for an organization to innovate. Table 2 gives the results of the PCA

Table 2: Drivers of Innovation

ITEMS	Comp. Matrix	Score Coefficient Matrix	Weight of activities	Mean	Std. Dev.
Performance (cost reduction, productivity, effectiveness)	.614	.028	20.20	4.51	.727
End-user requirements	.607	.028	19.94	4.04	.737
Regulation and legislation	.293	.013	9.65	4.00	.826
Competition	.338	.015	11.12	3.96	.796
Technological developments	.687	.031	22.58	3.91	.793
Aesthetics/ design trends	.210	.010	6.91	3.84	.824
Environment/ sustainability	.292	.013	9.60	3.73	.720

Source: Field Data, 2013

Upon analysis, Table 2 shows that with respect to drivers of innovation, technological developments had the highest percentage weight of 22.58%. This indicates that technological developments have more influence on drivers of innovation than the others. Also, performance improvement emerged as the main driver followed by meeting end-users requirement and regulation and legislation with respective means scores of 4.51 and 4.04. This suggests that whereas the firm admits that innovation must bring improvement in itself, such improvement must meet-end-user requirement as well as regulations and legislation to be sustainable. This is necessary if such innovation will receive acceptance of clients so that it will be patronized to generate the necessary benefits to the firm. This findings confirms that of other studies (e.g. BERR, 2008; Gann, 2000; Slaughter, 1998)

4.2 Enablers of Innovation

The enablers are the factors that assist in the promotion of innovation within the firm. The Table 3 gives the results of the PCA.

Table 3: Enablers of Innovation

ITEMS	Comp. Matrix	Score Coefficient Matrix	Weight of activities	Mean	Std. Dev.
Leadership	.545	.025	8.47	4.36	.830
Supportive work environment	.684	.031	10.62	4.18	.960
Awards, grants, funds	.398	.018	6.18	4.16	.852
Use of problem solving techniques	.540	.025	8.39	4.13	.815
Deep understanding of the customer	.570	.026	8.86	4.13	.991
Emphasis on research and development	.527	.024	8.19	4.11	.804
Education and training policy	.519	.024	8.06	4.07	.837
Knowledge management practices	.648	.030	10.06	4.07	.889
Encouraging staff to get involved with external network	.514	.023	7.99	4.09	.925
Reward schemes	.501	.023	7.79	4.04	.737
Government schemes	.462	.021	7.18	4.02	.917
Collaboration with partners	.527	.024	8.19	3.84	.999

Source: Field Data, 2013

Here, Table 3 is the results of the factors that are seen to be significant in enabling innovation in a firm. Upon analysis, leadership (mean=4.36) and supportive work environment (mean=4.18) emerged as the top two factors respectively. This indicates that when schemes are put in place without the above factors, they will not flourish. The next significant factor is awards, grants and funds with mean equals to 4.16 which also indicate that motivation of staff is equally important. The first three factors are all related to the management of such firms. This means that management has a key role to play in the promotion of innovation occurrence in a firm. Surprisingly, collaboration with partners (mean=3.84) was the least important factor. Which may be due to the attitude of some firms to work in isolation which indicate that the concept of partnering and its associated benefits are not properly grasped by the firms.

4.3 Barriers to Innovation

These are the factors that are seen as impediments to the uptake of innovation activities in a firm. The PCA generated are given in table 4.

Table 4 shows the extent to which the listed barriers impedes the uptake of innovation in the firms surveyed. The top two barriers are availability of financial resources (mean=4.22) and economic conditions (mean=4.11). This is interesting because financial concern is a number one driver (see Table 2) yet a number one barrier. The firms claim to innovate to increase profit and at the same time believe that they cannot innovate unless economics allow. These factors are followed by fragmented nature of construction business (mean=3.98), inappropriate legislation (mean=3.96), belief that the industry is doing well without innovation (mean=3.89), and lack of qualified staff (mean=3.89). This affirms the findings of Ozorhorn *et al.* 2008.

5. DISCUSSIONS

This study investigated the factors that affect the occurrence of innovation in a firm – in the form of drivers, enablers and barriers. This study fulfils the call for studies into factors that favours or discourages innovation occurrence in a firm (Hardie and Manley, 2008) in an industry where such studies are nonexistent (built environment especially the consulting aspects).

The factors that emerged as important in creating the need for the QSCF to innovate included: performance improvement, meeting end-user requirements and regulation and legislation in that order of decreasing importance. This is consistent with research works that concludes innovation outcomes that results in performance improvement of a firm must meet end-user requirement as well as legislation and regulations (BERR, 2008; Gann, 2000; Slaughter, 1998). This is essential for sustainable performance of firms.

Table 4: Barriers to Innovation

ITEMS	Comp. Matrix	Score Coefficient Matrix	Weight of activities	Mean	Std. Dev.
Availability of financial resources	.610	.028	8.47	4.22	.795
Economic conditions	.503	.023	6.98	4.11	.804
Fragmented nature of construction business	.450	.021	6.25	3.98	.812
Inappropriate legislation	.451	.021	6.26	3.96	.852
Belief that the industry is doing well without innovation	.191	.009	2.65	3.89	1.017
Lack of qualified staff	.432	.020	6.00	3.89	1.172
Unwillingness to change	.351	.016	4.86	3.87	.919
Lack of awareness	.273	.012	3.79	3.84	.796
Lack of government role model	.386	.018	5.35	3.82	.936
Lack of clear benefits	.607	.028	8.42	3.82	.971
Temporary nature of construction project	.272	.012	3.77	3.78	.823
Risk in commercializing innovations	.585	.027	8.11	3.76	.883
Lack of innovative investment / procedures / practices	.548	.025	7.61	3.68	.909
Adversarial approaches within the supply chain	.475	.022	6.59	3.68	.934
Extensive organizational change required	.589	.027	8.17	3.67	.674
Lack of end-user involvement	.484	.022	6.71	3.59	.972

Source: Field Data, 2013

5.1 Summary of findings

The results also indicate that the three factors that are seen to be important in assisting in the promotion of innovation in the QSCF are: leadership, supportive work environment and awards, grants and funds in that decreasing order of importance. This finding reveals the role of management in the provision of enabling environment for innovation to flourish by providing appropriate leadership coupled with supportive work environment and the needed motivation of workers. Collaboration with partners was considered least important factor in assisting the promotion of innovation within QSCF largely because partnering appears be alien to our business culture as a country.

Again, the factors that are seen as impediments to the uptake of innovation in a firm included: Availability of financial resources, economic conditions and fragmented nature of construction business, in that decreasing order of importance. This is interesting because financial concerns were the number one driver yet it is also a number one barrier. This finding is congruent with conclusion by Ozohorn *et al.* (2008) that financial concerns can both act as a driver and a barrier.

5.2 Managerial implications

Today, managers as well as academics recognise the indispensable role innovation can play to enhance the competitiveness of a firm in midst of competition in the construction industry, in order to survive competition and be profitable. To meet the prerequisites for innovation occurrence in a firm, managers must understand their role in ensuring the occurrence of innovation.

The results of the study suggest that leadership is a key factor that assists in the promotion of innovation in the firms surveyed. Management must take the lead, define the focus and provide the needed direction that will ensure that a sustained effort is put up for pursuing innovation in the firm.
Next, the findings have also highlighted the need for management to ensure a supportive work environment where innovation will thrives.

Again, motivation of workers is critical in that the outcomes of everything the firm are a reflection of their effort. Therefore, motivation in the form of awards, grants and funds must be given as means to appreciate and to encourage the workers to give out their best.
The belief that the industry is doing well without innovation is a misconception. Management must work hard to erase that erroneous impression from the minds of the labour force and rather pursue a program of awareness creation throughout the firm to inculcate the need for innovation in their hearths.

5.3 Limitations and directions for future research
The study did not measure the effect of certain demographic data such as age of firm, size of firm and the educational background of the respondents. It is believed some differences in the findings could have been explained in such demographic factors. Again, the majority (86.6%, see Table 1) of the firms fall within the Small to Medium size Enterprises (SME's). This suggests that the findings relate more to SME's than larger firms and as such the findings cannot be generalised to larger firms.

Future studies should examine other potential factors that might influence respondent's perception about the importance of the innovation performance factors. In particular, the age of firm in terms of years of existence, size of firm in terms of the number of employees and the educational background of the respondents.

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