Developing Appropriate Metrics for Enhancing Construction Industry Innovation Studies

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ABSTRACT

Debates on the construction industry’s low innovation practices have been ongoing and well documented in literature. A number of scholars blamed this on the inappropriate metrics to which construction innovations were subjected. This is because existing metrics were assessed to be inadequately capturing the innovation peculiarities of the construction industry. Hence, the construction industry is relegated to the background compared to other industries in terms of innovation adoption/practices. The conceptual paper is aimed at providing insights on the weaknesses of the existing innovation metrics and suggesting the way forward towards developing appropriate innovation metrics for enhancing better result-oriented construction industry innovation studies and practices. Based on our evaluated literature studies this paper suggests that a result-oriented innovation metrics that address innovation peculiarities of the various sub-sectors (levels/units/sub-units) of the construction industry be developed. In this way, the paper will contribute towards effective construction innovation studies.

INTRODUCTION

These days, the need for innovation practices in the construction industry which provides housing (a basic necessity of human life) and infrastructures for socio-economic development of societies has been well acknowledged and documented [1]. For example, [2] emphasized the need for construction organizations’ innovation in the face of increasing technological capabilities, changing clients’ requirements, tighter control over environmental regulations and quality standard, rising construction costs, increased competition and other challenges. Most empirical research and surveys of firms show that innovation leads to new products and services that are higher in quality and lower in price [3].

Innovation has been defined as a process through which new ideas, objects and practices are created, developed or reinvented [4]. Innovation was however considered in the context of new products, new processes, new raw materials, new forms of organization, and new markets [5]. Without innovation, an organization’s value proposition can be easily imitated, leading to competition based solely on price for its new commoditized products and services. Hence, innovative organizations create more value to shareholders in the long-term [6].

However, studies have shown that construction industry scores poorly against the standard measures of innovation [7]. Scholars have adduced various reasons for this which include; level of assessment at which construction industry innovation studies were undertaken [2], the complex operation mechanisms of the construction production system [8] and application of inappropriate innovation metrics that failed to address construction industry innovation peculiarities [9], among others. The traditional indicators of innovation performance are heavily biased and generally directed towards investment in science and technical inventions (such as R&D, patents, trademarks, etc.) and finance-based and therefore cannot adequately capture innovation in non-research intensive industries like most segments of the construction industry [7]. This has created a gap between actual innovation activity and the conventional measures that are intended to represent it.

It is against this background that this conceptual paper on construction innovation metrics is undertaken with the aim of generating insights into the weaknesses of the existing innovation towards developing appropriate innovation metrics for construction innovation activities.

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Methodology:

The method adopted for the study is the review of secondary data sourced from relevant journal articles and related texts, among others.

(i) Diagnosis of Construction Industry Innovation Studies /Metrics Controversy:

Debates on construction innovation have shifted from the industrial/organisational level to focus on sub-sectors (department/unit, project, consultancy, etc.) levels [2] [10], where innovation initiatives and programmes can be more easily established [11] and therefore monitored to its logical and successful accomplishment.

Looking at the controversy from the metric point of view, [9] notes that attributes of construction industry innovations make it difficult to measure. They observed that measurable innovation factors are either in-exhaustive or the existing/designed measurement parameters cannot adequately capture them. As such, assessment is generally bias, cumbersome and lacking comprehensiveness [8] thereby leading to unsatisfactory outcome.

The need for measurement can never be over-emphasized as it is a means of monitoring progress by comparing measured performance with the expected outcomes (earned values) [12]. A systematic view on the scope of construction innovation studies as well as its measurement is therefore imperative if the industry should maximally benefit from its innovation practices.

(ii) Evolutions in Innovation Metrics:

Examples of innovation measurement metrics that evolved through history have been categorized into four generations as follows [9].

First Generation (1950s–60s):
Focus on inputs indicators such as R&D investment. Reflect linear conception of innovation.

Second Generation (1970s–80s):
Focus on output indicators but complements input indicators by accounting for the intermediate outputs of science and technology (S&T) activities.

Third Generation (1990s):
Focus on innovation indicators and indexes based on surveys and the integration of publicly available data.

Fourth Generation (2000s plus emerging focus):
Focus on process indicators grounded in a knowledge-based networked economy remain ad-hoc and are the subject of measurement.

A number of developed indices that attempted to measure innovation include:


Innovation Index: developed by the Indiana Business Research Centre, for measuring innovation capacity at the county or regional level in the United States.

State Technology and Science Index: developed by the Milken Institute is a U.S. wide benchmark for measuring science and technology capabilities.

Bogota Manual: focuses on innovation in Latin America and the Caribbean countries.

Creative Class: developed by Richard Florida for assessing economic competitiveness, demographic trends, and cultural and technological innovation.

Innovation Capacity Index (ICI): published by a large number of collaborating international professors. The top scorers of ICI 2009–2010 being: 1. Sweden, scoring 82.2; 2. Finland, scoring 77.8; and 3. United States, scoring 77.5.

Global Innovation Index: a global index for measuring country’s level of innovation produced jointly by Boston Consulting Group (BCG), National Association of Manufacturers (NAM), and Manufacturing Institute (MI), among others.

RESULTS AND DISCUSSION

The above highlighted innovation metrics tend to be index-oriented, composites of the perceived components of innovation that rank regions’ or nations’ innovation capacity and therefore their application cannot be generalised. In an attempt to address this gap in innovation measurement/management, [13] suggested the firm level assessment. They develop a synthesized framework of the innovation management process...
consisting of seven elements: inputs management, knowledge management, innovation strategy, organizational culture and structure, portfolio management, project management and commercialization.

The above lists of innovation indicators are highly restrained and do not adequately capture the peculiarities of innovation generations of the construction sectors. Developing and applying the right metrics for each innovation project is fundamental in innovation practices and studies [3]. Innovation projects (like any other projects) can and should be aligned with the strategic objectives, create value to the organization, and support internal procedures [14]. Appropriately managed innovation generates long-lasting advantages because these metrics help to rationalize (allocate) organization internal resources and reflect a reorientation in its governance model [15]

Summary:

In consideration of the above literature overview, the thesis of this paper is that innovation metrics and studies should be addressed to the basic sub-unit levels of construction activities such as consultancy sector, project operation, project life-cycle stages, project procurement, and sub-contract levels for a more focused and streamlined innovation management. There is also the need to categorize the sub-units (at least based on their respective causal work study) and harmonize the factors that are basic to each of them and develop appropriate metrics for assessing their respective innovations. It is therefore suggested that a streamlined process should be evolved in developing innovation metrics that is valid and universally reliable, but devoid of weaknesses associated with existing metrics. Without appropriate metrics, innovation management can only be judged by common sense, idiosyncrasy and/or political interests. Bad (wrong) metrics usually lead to incorrect diagnoses, decisions and actions that lead to non-intended orientations and outcomes. Furthermore, the process of developing appropriate metric for construction sectors should look beyond innovation inputs/outcomes by putting into consideration the related determinants such as demand, customer value creation and global markets, inter-firm linkages, government policy environment and the infrastructure for innovation, innovation processes, etc. [9]. This can be done by adapting the review strategy used in [13] (see Appendix 1) or other frameworks of similar objective. In this way, the paper will contribute towards effective construction industry innovation studies that will properly diagnose the real problems of innovation practices in the industry.

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Appendix 1: Proposed Review Strategy

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<thead>
<tr>
<th>STAGE</th>
<th>PROCESS</th>
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<tbody>
<tr>
<td>1</td>
<td>Establish review team and scope and nature of the question and search strings</td>
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<tr>
<td>2</td>
<td>Undertake Delphi investigation</td>
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<td>3</td>
<td>Preliminary search of electronic databases</td>
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<tr>
<td>4</td>
<td>Develop analytic framework</td>
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<tr>
<td>5</td>
<td>Secondary search of electronic databases and Delphi study</td>
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<tr>
<td>6</td>
<td>Content analysis of data set, sorting of measures into first order categories defined by the analytic framework</td>
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<tr>
<td>7</td>
<td>Review measures against framework for gaps</td>
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