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# Are We Catering to the Construction Industry KM Requirements? : A Literature Synthesis

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## Abstract

The concept of Knowledge Management is now familiar to the construction industry and various attempts are being made for the effective management of knowledge in the industry. This paper addresses the importance of people factor and tacit knowledge in construction and examines the current focus of knowledge management initiatives to find out the alignment with the industry requirements. Labour and knowledge intensive nature of industry is revealed with challenging aspects of construction performance. Dominant hard model of human resource management is uncovered and finally the mismatch between the current focus and industry KM requirements is unearthed.

**Keywords:** Tacit knowledge, knowledge worker, knowledge management

## 1. Introduction

In recent times, the UK construction industry has been forced to critically examine its performance as an industry which lags behind most other industries in terms of technology and productivity [1, 2, 3]. A number of government and academic reports [4, 5, 6] have repeatedly highlighted this issue and the necessity for a fundamental cultural and technical change in the construction industry (CI). It is argued [7, 8] that the publication of Latham's report [4] and the Egan's report [5] as very crucial milestones in the CI addressing issues such as fragmentation, client dissatisfaction, low level of investment in R&D and lack of skills in terms of improving productivity which have adversely affect the performance of the CI. The need for improvements within the industry was so acute with growing pressures exerted by these major reforms.

Within the CI, it is increasingly being acknowledged that Knowledge Management (KM) can bring about the much needed innovation and improved performance the industry requires [9, 10, 11, 12]. This has been further highlighted in a recent survey [7] by Management of Knowledge and Innovation Research Unit of the Open University: the move towards the change initiated by

the Latham and the Egan reports as the mostly cited driving force behind the KM in the CI. Yet, the term 'Knowledge Management' is relatively new to construction organisations [11], nevertheless, a growing number of organisations within CI [12] now perceive KM as an integral part of their competitive strategy for providing long term benefits for the organisation. The emphasis on KM reflects the growing realisation that it is a core business concern, particularly in the context of the emerging knowledge economy, where know-how of a company is becoming more important than the traditional sources (capital, land etc) of economic power [13, 14]. There is an emerging importance placed on the people factor in the CI, as one of labour intensive sectors of the economy, which is still considered to be an "under-charted territory" [15] within construction organisations. Yet, this issue has often been ignored or placed with less importance as evident from previous work on KM in CI, which has focused heavily on the delivery of technological solutions [11] probably due to increased concern in Information Technology (IT) in the eighties and early nineties.

The paper aims to highlight the mismatch between KM requirements of CI and its current focus by critically analysing the state of the art KM initiatives and frameworks through a comprehensive literature review and synthesis. Accordingly, paper is organised into three sections: the first section explore the salient features of the CI together with challenging aspects of construction performance and human resource management. The second section examines the apparent limitations and various efforts to improve KM in construction in terms of existing KM initiatives and frameworks, whereas in the final section, the disparity is outlined by considering the industry features, challenges, requirements and KM frameworks in a form of a discussion.

## **2. Construction – an Overview of Nature, Performance and People Management**

Construction is an industry which utilises a variety of separate firms in a temporary multidisciplinary organisation, to produce investment goods like buildings, roads, bridges etc, which are custom built to unique requirements. The industry is generally driven by single and unique projects, each creating and disbanding project teams made up of varying combinations of large and small firms from across the supply chain spectrum. The short-term temporary project based nature is considered as an intrinsic characteristic of construction and industry is considerably more fragmented than many other industries with a much greater concentration of small firms [16]. The scale of small firm activity in the UK CI is considerable, with, in 1999, 99% of UK construction firms having 1-59 staff [17, Table 3.1] and by 2002 delivering some 62% of the industry's workload [18, Table 3.3] and accounting for 122,220 small and medium construction firms in 2003 [16]. Further, the number of professional service firms within CI has risen from 48,202 in 1995 to 52,490 in 1998 [19] and the services offered by these professional service firms are characterised by being highly knowledge intensive in nature [20]. This in a way evident the shift towards the knowledge economy in UK CI and there is significant agreement that the principle means by which this growing body of professional service firms creates value through the successful management of knowledge [21]. The UK Government's Competitiveness White Paper, *Building the Knowledge Driven Economy* [22], refers to more effective use and exploitation of all types of knowledge, particularly in the traditional CI in

order to give the UK a competitive edge. In addition, there are a wide range of professionals involved in construction sector, working as an inter-disciplinary team in delivering the construction products. The UK CI employed 19,130 workers per £1 billion output (total of 1,599,000 workers) in 2003 [16], hence considered to be one of the labour intensive sectors of the economy. In this context, CI is perceived as one of the labour and knowledge intensive value creating sectors of the economy.

The value-creating performance of the CI for its clients, however, has often been questioned. Firms in the CI are frequently being blamed for inefficiency of its operations and industry has been accused of being, at its worst, wasteful, inefficient and ineffective [23]. Construction also perceived as an industry which delivers products and services which are often of inappropriate quality and which fails to meet client's demands for price certainty and guaranteed delivery. The industry has long been recognised as having problems in its structure, particularly with fragmentation that has inhibited its performance [4, 5]. Latham's report, *Constructing the team*, was very much concerned with improving the performance of the CI by reducing conflict and construction cost; whilst Rethinking Construction [5] lamented that 'too many of the industry's clients are dissatisfied with its overall performance' (para. 3). This was further extended in Fairclough's report [6] with its reference to the "old fashion" nature of the industry. As a consequence, Fairclough report has identified the need for significant performance improvement as an urgent issue while stating that "the emphasis should be on key competitiveness & productivity" [6]. Thus, the next section discusses the challenges and problems faced by the CI in terms of their performance, which has gained much concerned in recent time due to aforementioned reforms.

## **2.1 Challenging Aspects of Construction Performance**

Despite the importance of business performance measurement in construction, it has received "scant attention" [24] within mainstream construction management literature, particularly concerning its role in "offering real-aid" [24] to improved construction performance. This little attention has resulted construction business performance measurement to rely on "traditional" performance measures, which is considered to be predominantly project specific and profit orientated with hard factors; failing to take account of broader intangible or softer issues. Business performance measurement in construction tends to rely on performance measures, such as efficiency, return on capital employed and profitability. At the construction project level, traditional success criteria centre on the achievement of cost, time and quality targets, failing to take a wider picture into account. These measures have been criticised by a number of authors, mainly because they:

- Over-rely on financial aspects;
- Encourage short-termism;
- Are retrospective (and hence always to some extent out-of-date); and
- Do not accurately reflect the interests of stakeholders.

Thereby, a broader knowledge on organisational technical, structural, contextual and more importantly human factors are essential to better understand why some organisations are more successful than others. Moreover, as Gann [25] criticised, the prevalence of short-term views within the CI has promoted the usage of strategies that yield superior quarterly or annual results even though they may cause long-run ruin for the whole organisation. Also it has been argued [26] that the short term perspective of construction promotes sub-optimisation and hampers innovation and technical development which adversely effect to the organisational performance. In addition, the project based nature of the construction too has fuelled the under performance in the industry to a certain extent. Though the construction team undergoes forming, storming and norming stages of the team development, just when the team has got to its performance level it is disbanded because the project is finished [27]. Hence, this reflects that intrinsic characteristics of the industry too have contributed to hinder its performance in the CI.

However, the ignorance of the people factor within the construction context has contributed to a great extent for the under performance of the industry as lamented by many authors. As contended by Nesan & Holt [28], the issue of the critical role that employees play in fostering an effective construction business (the people factor) has often been overlooked. According to Cooke-Davies [29], “it is people who deliver the projects and not processes and systems”, which gains increased validity in the context of construction, as a labour intensive industry. Hence it is argued [24, 30] that there is a necessity for the CI to define more appropriate performance criteria for both project and organisational level by redefining “traditional” success parameters to consider the knowledge, skills and behaviour inputs which contribute to superior performance. Hence, the following section deals with the human resource aspects of the CI with the view of exploring the current practice within the industry.

## **2.2 Human Resource Management of the industry**

There is established dichotomy in the literature between ‘hard’ and ‘soft’ Human Resource Management (HRM) [16]. The former treats people as a resource to be provided and deploys as necessary to achieve organisational objectives. In contrast, later sees people as valued assets who offer a source of competitive advantage [31]. Construction as an industry which has a reputation for its dominant culture of command and controls consistently emphasises and correlates with the hard model of HRM. Also the culture of subcontracting and self employment marginalises the importance of people management and thereby reflects and reinforces the dominant industry receipt of hard HRM. Even though Dainty et al [30] argued that construction managers have always had significant discretion over problem solving and employment issues, the work employee relations survey [32] which investigated employee participation across twelve sectors revealed that in CI, participation in problem solving groups occurred in only 21% of workplace, which is the second lowest when compared with all other sectors. This dictates

that the hard model of HRM dominates not only for the construction labour force, but also for professional and managerial staff.

Soft HRM policies based on empowerment and commitment are much more prevalent within organisations orientated towards creativity [16]. This is true when it comes to the professional service firms within the CI, who compete successfully internationally by investing heavily in knowledge based services. As such it is an urgent matter for the CI to move towards the softer approach based teamwork from hard model of HRM to enhance the collective efforts due to several reasons. Firms within CI frequently claim that ‘people as their greatest asset’ [11] in a situation where literature on HRM repeatedly emphasises the need to treat people as a key resource. This is especially true in relatively low-tech, labour intensive industries such as construction [16]. However, people also represent the most difficult resource for organisations to manage. As highlighted in the intrinsic characteristics of the industry, construction employs extremely diverse range of people from a wide range of occupational cultures and backgrounds, including people in unskilled, craft, managerial and professional positions, challenging to manage people effectively to ensure organisational success. Nevertheless, the importance of the construction worker is highlighted by the fact that industry relies on skill and on the capacity to bring different skills together effectively [33]. Thereby the concept of the knowledge worker has long been important to construction organisations [16] and in recent years, with the growth of the service sector, this emphasis placed on the construction knowledge worker has gradually increased. Having discussed about the significant role of construction worker (people factor) within the industry in terms of intrinsic features, performance and management, the following section examines the current KM initiatives to unearth the importance given to the people factor within such frameworks.

### **3. Knowledge Management within the Construction Industry**

KM is not entirely new to the CI. What is new is the terminology used and the increased awareness that knowledge should be managed in a more structured manner [34]. This has been largely brought about by a number of factors such as the increased global competition, company size, geographical spread and employee turnover [34] and also as a consequence of construction domain becoming highly information intensive [35]. Knowledge is a valuable yet frequently intangible asset. Work by Polanyi [36], Nonaka and Takeuchi [37], divided knowledge into tacit (that which is stored in people’s heads and is acquired through experience) and explicit knowledge (that which could be documented and therefore physically stored). Within construction, the type of knowledge varies enormously, yet gains increase concern on tacit knowledge as a labour intensive industry. Specially, Engineers, Architects and other professionals within CI are not in a position to ‘cut and paste’ best practice [38] from the past due to the unique and the complex nature of the construction projects. They have to draw on the past to find solutions for the future. Tacit knowledge evolves from these shared practices and experience which need to be managed for the project and the organisational success. According to Wetherill et. al [35], knowledge in construction domain can be classified into three categories as illustrated in Table 1.

*Table 1: Classification of Knowledge in construction domain*

Domain Knowledge	The information available to all companies and is partly stored in electronic data bases
Organisational Knowledge	Company specific and intellectual capital of the firm which also comprises knowledge about the personal skills, project experiences of the employees
Project knowledge	Which includes both project records and the recorded and unrecorded, memory of processes, problems and solutions

By taking a different stance Stahle [39] suggests organisations into three-dimensional system i.e. mechanistic, organic and dynamic nature, depending on the different challenges presented for management of knowledge. Wetherill et. al's classification reflects the organisational hierarchy and when one moves from domain knowledge to project knowledge the concentration on knowledge too moves from explicit to tacit nature, which further highlights the knowledge worker concept in construction. Stahle's suggestion indicates both the management and the production of the knowledge. In a similar sense Moodley et. al [40] contends that the tacit knowledge is developed through the individual or project teams, while the explicit knowledge is created through process, procedures and other routines that can be codified.

Review of current literature reveals numerous definitions and techniques of KM due to wide range of interest, perspectives and issues represented by different authors. These fall mainly into the IT perspective (Explicit knowledge) where authors focus on IT tools to deliver KM solutions [41, 42], the Human Resource (Tacit knowledge) perspective that relies on the people aspect to provide KM solutions [43, 44] and the integrated perspective which acknowledges that both the IT and HR perspectives complement each other [45,46]. Nevertheless, KM is defined as 'process of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organisations' [45], which emphasis both aspects. Managing knowledge more effectively offers construction organisations a possible mechanism for improving their performance in times of greater competition [34].

However, despite the interest and the effort put into KM by many leading companies, the discipline is still in its infancy in the CI and is at an embryonic stage in UK construction [21, 34]. As Rezgui [47] cited, there are few key reasons that limit current approaches of KM in CI. Among the key factors for these limitations are;

- Much construction knowledge, by necessity, resides in the minds of the individual working within the domain;
- The intent behind the decisions is often not recorded or documented;
- The individuals who have knowledge about the project are likely to left for another project at the end of the construction stage; hence their input is not captured.

As such all these three limitations indicates the direct correlation with the human factor in the CI and highlights the importance of tacit knowledge and the people-centred approach of the KM to overcome these limitations. This further stresses the importance of the concept of knowledge

worker which has long been central to CI performance. Despite difficulties in KM approaches in construction, several KM projects and initiatives have been undertaken, which are outlined in the succeeding section.

### 3.1 Knowledge Management Frameworks in Construction

CI is evident with paucity of academic research and inadequate empirical studies on KM and even the limited number of studies that have been conducted focused heavily or solely on explicit knowledge [7] and on the role of information technologies [11]. Too often, KM is limited to the appropriation and exploitation of explicit knowledge. Tacit knowledge or people aspect is either ignored or ‘converted’ to explicit knowledge. In academia, research papers published on KM relevant to construction include: the provision of a KM framework [8]; knowledge transfers between organisations [48]; the role of IT [11]; the impact on construction innovation [10]; the impact on business processes and performance [21]; and case studies within specific construction companies [40]. In addition, following table identifies examples for research projects carried out within construction, in terms of managing knowledge.

*Table 2: Research projects in construction to improve KM*

CLEVER	Cross-Sectional Learning in the Virtual Enterprise (CLEVER) focused on 3 key aspects of KM- intra-project, inter-project and cross-sectoral- with the view of developing a generic multi-disciplinary framework covering the organisational & cultural implications for knowledge-based businesses.
KnowBiz	Knowledge Management for Improved Business Performance (KnowBiz) concentrated in improving construction organisations business performance through their improved management of the knowledge resources. The development of KM framework and the supporting IT architecture highly emphasised on the use of KM principles to facilitate construction companies in collating and keeping track of the data required for input into key business performance measurement models.
CSanD	Within construction projects, knowledge about sustainability is being developed continuously, but there is little understanding of the best ways to foster the creation of this knowledge, less about how to capture such knowledge and even less about how to ensure that knowledge is available quickly and easily to other individuals and projects. Creating, Sustaining and Disseminating Knowledge for Sustainable construction: tools, methods and architecture (CSanD) aimed at addressing this pertinent problem by developing software tools for capturing and retrieval of relevant knowledge.
E-COGNOS	Methodology, tools and architectures for electronic COnsistent knowledGe maNagement across prOjects and between enterpriSes in the construction domain (E-COGNOS) aimed at specifying and developing an open model-based infrastructure and a set of tools that promote consistent KM within collaborative construction environments with a particular emphasis on a web based infrastructure.
KLICON	Knowledge and Learning In CONstruction (KLICON) focused on the role of IT in capturing and managing knowledge for organisational learning on constructional projects.



As evident, these frameworks have concentrated on different aspects of construction KM other than knowledge workers within the industry, with a very high emphasis on the role of IT. Yet one apparent finding of a research carried out by Management of Knowledge and Innovation Research Unit [7] was that the Information Technology's incapability of transforming tacit knowledge to explicit knowledge and IT as a tool to transform tacit to explicit knowledge was considered as 'a step too far'. Therefore, it was suggested that the extensive use of IT could reduce the chances of face-to-face communication which they considered to have a significant role to play in effective KM. Having examined the state of the art KM initiatives, frameworks and research work in construction; following section outlines and critically discusses the disparity between KM requirements and current focus in CI.

## 4. Discussion

The labour intensive and knowledge driven nature of the CI together with other intrinsic characters were outlined in the initial section. Further, the importance of recognising the people factor and the necessity of managing construction knowledge worker with softer human resource approach was highlighted in the paper. Yet, as Egan [5] asserted;

*"...much of construction does not yet recognise that its people are its greatest asset and treat them as such. Too much talent is simply wasted, particularly through failure to recognise the significant contribution ..... We understand the difficulties posed by the fragmented structure of the industry, but construction cannot afford not to get the best from the people ....."* (para 17; p14).

In this context, Management of Knowledge and Innovation Research Unit [7] has empirically established that problem solving, managing change and innovation as the main triggers of the knowledge production in construction organisations and even out of these three categories, majority of the triggers were associated with problem solving aspects of the professionals. Also in this survey the majority of respondents have noted that they rely on their colleagues as a primary knowledge source and in addition, 'the construction project team' has been cited as the second mostly used knowledge source. Yet another survey [49] of 170 UK construction organisations, indicated that communities of practice as the most widely used technique for KM particularly in large construction organisations. Further, Robinson et al. [21], in a study of the state of KM within the UK construction sector, discovered that over 70% organisations intended to have a KM strategy in place by the end of 2002. The main three reasons for this were:

- The need to encourage continuous improvement (92.5%);
- To share valuable tacit knowledge (88.7%);
- To disseminate best practices (86.8%);

All these empirical studies highlight the importance of the people factor and their tacit knowledge than the explicit knowledge in the construction context. Despite the contextual differences, the tacit knowledge obtained from the colleagues and the project team were considered highly in 'enabling' the respondents to solve the problems they were faced with [7].

As discussed elsewhere, much of the KM frameworks in the CI have orientated towards the management of explicit knowledge via IT tools, in a situation where people-centred tacit approach of KM, as evident from Robinson et al's [21] work, is demanding by the industry. This indicates the mismatch in terms of KM initiatives in the CI. The early focus on KM resulted in technological solutions with a bias towards the use of IT, however, many of these were not successful because they ignored the people required to make them work in construction [34]. More recent work has focused on the importance of HR in KM but these have yet to be developed in terms of concepts and frameworks [50]. It is noted that employee participation in problem solving groups occurs in only 21% of construction workplace when problem solving in the CI is recognised as the major trigger of the knowledge production. Also in a situation where colleagues and project team are considered as the primary knowledge sources and communities of practice as the widely used KM technique, the necessity to shift from hard model of HRM to Soft HRM policies based on empowerment and commitment is much more compelling than ever to foster KM exercises through which CI performance could be enhanced.

## 5. Conclusion

KM is evolving rapidly but construction organisations are at the emerging level and there is a lot of work to do. The alignment between the KM focus and the KM requirements of the industry is of utmost importance to enhance the performance and to achieve the competitive edge in the CI. This paper has revealed the disparity between the current KM focus and the KM requirements of the construction as a labour intensive and tacit knowledge driven industry. This provides the basis for more empirical research on people centred KM approaches in the CI.

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