UK Construction Processes and IT Adoptability: Learning from Other Industries

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Abstract

Process improvement has been identified as a mechanism of achieving the desired performance improvements of the UK construction industry. During the recent past, researches within UK construction process improvement research paradigm have been influenced by the initiatives of other industries like manufacturing and software. Despite the success stories within such industries, the unique characteristics of the construction industry demand a careful consideration of the applicability of these approaches within a construction environment. Based on a literature review carried out by the authors, this paper discusses the nature of this applicability issue further.

In addition to the above applicability issue, construction industry has suffered from a slow information technology (IT) adoptability issue, while IT has been considered as an effective enabler for process improvement in other industries. This has hindered the potential synergetic benefits of using IT within construction process improvement strategies. As such, it is important to understand the reasons behind this slow IT adoptability in order to ensure successful deployment of process improvement initiatives within the UK construction industry. This paper discusses this issue, by reviewing the literature to compare IT adoptability issues of the UK construction industry and other industries, with the aim of learning lessons from those to improve the UK construction industry.

Keywords: UK construction industry, construction process improvement, IT adoptability, IT-process co-maturation, construction IT

1. Introduction

The need for a change within the UK construction industry is discussed within number of studies during the recent past [1,2,3,4,5]. Growing dissatisfaction found among both its private and

public sector clients has been an effective motivator for these discussions [6]. These dissatisfactions are often attached to the poor performance of the industry. The required change has thus been identified to be in a form of performance improvement. Further studies about this requirement have revealed that the fragmentation and confrontational relationships are the major inhibits for performance improvement initiatives [4,3,5]. Fragmentation and confrontational relationships are sharpened due to the traditional functional view of construction projects, where the tasks are assigned to individuals based on their functions with minimum attention given to the integration issues [7,8].

Having identified this nature, Egan [3] highlighted that "focusing on the customer" and "integrating the process and the team around the product" as two of the key drivers to achieve the desired change within the UK construction industry. This emphasises the need of deviating from functionally oriented project structures towards a customer focused, process oriented project delivery mechanisms. It appears that the above recommendations from Egan are based on the view that the process improvement is the way forward to improve the performance of the UK construction industry [9].

2. Process Improvement

2.1 What is Process Improvement?

In literature "process" is often defined as a set of related activities attached to outputs, value and customers [39]. Davenport [10] states that "a process is simply a structured, measured set of activities designed to produce a specified output for a particular customer or market". Hammer and Champy [11] defined a process as, "a set of activities that, taken together, produce a value to the customer". As identified within above definitions, the process view integrates the product, procedures and the customer, so that the stakeholders of an organisation can view the big picture which they are contributing to. This essentially synchronises the individual functional objectives with the overall organisational objectives, enabling opportunities for improvements.

Literature covers a wide spectrum of terms related to process improvement. Business Process Improvement, Continuous Process Improvement, Business Process Re-design, Business Re-structuring, Business Process Re-engineering are some of those which appear frequently within literature [12,13,14,15,16]. All these concepts appear to have the major objective of achieving performance improvement within organisations, but vary from the magnitude of the desired level of change. It varies from continuously improving the processes to total re-structuring the organisation [17]. This determines the two extremes of the process improvement spectrum and defines the two major approaches to process improvement, the evolutionary approach and the revolutionary (radical) approach [18]. Within literature some times the term "process improvement" is synonymously used with the evolutionary approach and "process innovation" is synonymously used with revolutionary approach. Within this paper, "process improvement" is

used for both the cases, and where appropriate, evolutionary and revolutionary approaches are explicitly indicated.

2.2 Process Improvement in Construction

Recent construction literature show a clear focus on construction process improvement strategies. Within these literature, the best approach for construction process improvement is often debated (see: [4,19,20,21]. Historically, most of the process improvement strategies have evolved within production line based industries like manufacturing. Business Process Re-engineering (BPR) is one such strategy evolved to address the supply demand gap existed within most of production line based industries during early 90's due to the globalisation trend. BPR is an attempt to eliminate chronic wastes within processes in practice, by introducing new processes. The focus here resides within the ultimate outcomes of the processes in place rather than on the processes it self. Thus the existing processes attract minimum attention when designing new processes and a whole new set of processes could be the ultimate result. Due to these radical changes to processes, often this approach claims to produce significant level of improvements. Despite being a fashionable theme within some of the industries, BPR has received number of criticisms as a construction process improvement strategy (see: [4,19,20]). Considering the applicability of this approach, Love and Li [4] pointed out that the implementation of the BPR within construction is difficult due to the fact that the array of construction have not been designed systematically but have evolved in an ad-hoc manner. Further, direct applications of BPR in construction might lead to complications, due to the fact that the construction often consists of complex supply chain arrangements. Due to these complex relationships, there is a danger that the re-engineering exercises might impose negative effects on construction organisational processes, which would not be apparent for some time after implementation [22]. In addition, since BPR pay less attention to the "human side" of an organisation [23], it may adversely effect the construction organisations as it is perceived as labour intensive.

Another process improvement strategy visible largely within manufacturing and automobile industries is the Continuous Improvement (CI). This is an evolutionary approach, based on the statistical process controlling. This strategy has its roots in the Japanese "Kaizen" approach to quality control, and to the Total Quality Management (TQM). It concentrates on planning and monitoring existing processes with the aim of continuously improving the same. The main problem of this approach, when applied to construction, is based on the project based nature of construction. Unlike in a production line environment, it is difficult to identify a linier relationship between processes in place within a project based environment. This limits the possibility of setting targets for processes in place and hard to monitor the performance of the same. On the other hand, this approach is largely depending upon repetitive nature of the processes visible within the production line environments. Thus, the "unique" nature of the construction product questions the applicability of this approach within a construction environment.

However, the above problems do not eliminate the possibility of using the principles of above process improvement approaches within a construction environment. As Lillrank [24] pointed

out, the innovations in one industry do not provide direct solutions to the problems of other industries. Rather those innovations have to be recreated within the receiving industry considering the capabilities and the characteristics of the same.

Considering the apparent problems above, some studies have suggested that, irrespective of the approach to process improvement, construction organisations need to embark on adopting quality management principles if the desired improvement to be achieved [4]. Within this context, it is suggested that an underlying process improvement culture has to be established before embarking on process improvement initiatives [4,8]. The major emphasis here is to prepare the organisation to receive the process improvement initiatives by increasing the capability of the organisation in question. Considering the different maturity levels of different construction organisations, a stepwise approach to process improvement is suggested by some recent studies [9].

Being a project based industry and showing some similarities to the construction, software industry has exemplifies a successful process improvement initiative based on the principles above mentioned. This approach has gained its popularity under the name "The Software Capability Maturity Model (CMM)". This model was developed for the US department of Defence (DoD) who is a major software purchaser [25]. The use of CMM includes the evaluation of software manufacturing organisations prior to award them contracts. CMM is based on a five levelled structure. Within this, organisations are ranged from level 1 to level 5 based on their maturity. Within this framework, a maturity level has been defined as "a well defined evolutionary plateau towards achieving mature processes. Each maturity level provides a layer in the foundation for continuous process improvement" [26]. Level 1 organisations are the least matured organisations where as level 5 organisations being the most matured organisations. In order to achieve a specified maturity level, organisations must satisfy all the key processes defined within the immediate below maturity level. The organisations are tested against "key enablers" to determine weather they have satisfied each key process. Through this framework, organisations are guided to adopt stepwise process improvements. This framework ensures that the organisation in question is ready for the next level of process improvement. This, intern initialise a process improvement culture within the organisation and guides the procedures and the people towards improvements, using the available and potential tools.

Sarshar et al [25] have attempted to apply the principles of this model within the construction industry. This attempt was named as the Structured Process Improvement in Construction Enterprises (SPICE). This research was carried out in stages, and currently, the dynamics up to the level 3 of the CMM were explored and customised to the UK construction industry (See: [9,25] for further details about this approach). While lower maturity levels of CMM establish the required capability and the background of the organisation, the higher maturity levels are responsible for dramatic and sustainable process improvements. Within the SPICE, the dynamics of higher maturity levels were not explored thoroughly, leaving its full potential unexplored.

The above exemplifies that possible solutions for some of the problems identified within the construction process improvement, have already been explored within other industries. A careful

consideration of the characteristic differences and unique requirements of the industries in question should then provide a mechanism for sharing knowledge between industries.

Apart from the process control mechanisms explained above, the information technology (IT) has been identified as the major enabler of the process improvement [10]. However, the construction industry has been criticised for its slow IT adoptability [27]. Further more; the industry has become frustrated with the falling of IT as many companies have invested in the wrong technologies without addressing the business needs [28]. The following section discusses the stand of the role of IT as an enabler for the construction process improvement.

3. Process Improvement and Information Technology

3.1 IT for Process Improvement

While process improvement is not purely a technological endeavour, Information Technology has been identified as a key process improvement enabler [10,11,29]. Within this context, new advancements of IT triggers new operational and management processes within organisations, creating a technology push for process improvements. On the other hand, the process improvement initiatives create an opportunity to change existing processes to be benefited from existing information technologies in place, creating a process pull for technological advances. This reveals a concept of duality between the process improvement and use of information technology [30].

The slow IT adoptability does not mean that the construction industry lags in implementing IT systems; rather, it suggests that the construction industry lags the other industries in impact of IT to the business [31]. Even though the issue has been identified as lack of awareness of how to exploit technology, a careful consideration of the "lack of awareness" relates the problem to the roots of "processes", as often immature management processes are responsible for internal and external communication gaps. In other words this suggests that, proper processes have to be in place in order to harness the actual benefits of the IT capabilities within construction organisations.

On the other hand, it could be argued that information technology has created a significant impact on some of the work patterns and processes of organisations irrespective of their industries. As an example, it is difficult to identify a an organisation today, which uses any report producing, letter writing mechanisms or tools other than personal computer based word processing solutions even within the construction industry. Further, emails have become a powerful and commonly used communication media commercially and individually. A survey conducted by Construction Industry Computing Association [32] based on over 400 construction organisations revealed that 97% of the construction organisations have access to email. Further, computer aided drafting tools such as AutoCAD have shown influential impacts during the recent past, and traditional drawing boards are becoming redundant rapidly. Above exemplifies the fact that, irrespective of

processes in place, IT has influenced organisations to change their work patters and processes. This further stresses the existence of the concept of duality within the construction industry as described above.

4. IT as a Change Agent

The concept of duality discussed above, creates a clear link between the organisational processes in place and the IT adoptability. This suggests that IT adoptability in a particular industry or an organisation, especially with the intention of improving its performance, should not depend entirely on the capabilities of the technology in question. Rather, the organisation and industry specific characteristics and processes in place will have to be investigated prior adopting such technologies. The next section discusses some evidence from literature highlighting IT usage patters of construction and adoptability problems visible within other industries especially related to processes in place.

4.1 IT Usage Patterns in Construction and Adoptability Problems

In order to understand the IT adoptability problems within construction, it is vital to identify the IT usage patterns within the construction industry and at the same time it is important to identify the drivers behind these usage patterns. A study carried out by Construction Industry Computing Association (CICA) gives an insight to the IT usage patterns and drivers behind the IT usage in UK based construction companies. 73 construction related companies were surveyed and one of the objectives of the study was to identify the drivers of the investments in IT [33]. It is visible from the survey results that the IT investments in construction is generally driven by short term tangible benefits rather than long term strategic benefits. For an example, the survey results reveal that general client expectations / requirements attracted 68.5% response rate as a driver for IT investments where as only 17.8% have indicated strategic board level decisions as a driver for IT investments in construction. On the other hand it is visible from the same survey that an imbalance between the technology-push and process-pull is visible within the industry. For an example, 60.2% and 40.0% of the respondents have indicated that affordability of technology and exploration of new technologies respectively as a drivers for IT investments where as only 32.8% respondents have identified process improvement as a driver for IT investments. The statistics show that construction lacks the strategic usage of IT. It also reveals that IT usage within construction is largely technology push driven.

Few facts can be highlighted as reasons for this. Most importantly, there is a clear communication gap and a conflict of interests between the IT implementations and decision makers. This gap is widened due to the absence of dedicated IT specific functions (roles) within most of the current construction processes. This leads to another reason for the visible gap between actual IT potential and its usage, a lack of formal approach to incorporate IT within organisation's development plans. It is also visible that the current usage of IT within most of the construction organisations are based on short term objectives such as gaining speed, minimising

human errors, etc. And in many cases, little consideration has been given to understand the function of the system in relation to the business [34]. Thus the short term, tangible benefits of IT, has become the driving force of IT adopting policy, while hindering the possibilities of tailoring IT to support actual system and process improvement requirements. Hence, it is also visible that current IT usage within the construction industry is more functional oriented.

This leads to the problem of IT stagnation within the construction industry, as the use of IT is not being looked at from an organisational wide angle rather from an individual, functions based angle. This has witnessed by some of the existing IT usages. Software based project planning tools are widely being used within the construction industry. But the fact that, it is being used in an uncoordinated manner has hindered the possibilities of using those to the maximum potential. For an example, most of the modern project management software (e.g. MS Project) are capable of analysing financial capabilities and requirements (e.g. cash flows forecasts) of organisations in addition to the obvious scheduling capabilities. But at point of usage, most of these functions are neglected due to the functionally oriented work patterns. This complies a classical example of the need for an industry wide, process based approach to IT implementation strategies within the construction industry.

The above situation drives the construction industry to a dilemma, in terms of the process improvements and the use of IT. It is important to have matured processes that support IT integration to enhance the maximum benefits from IT capabilities, and at the same time, new IT capabilities lay solid foundations for successful process improvements [30]. This is not a construction specific problem; rather it is visible within some of the IT adoption initiatives of other industries. The following case highlights a similar scenario within the healthcare sector.

4.2 An Example from the Healthcare Sector

A number of information technologies have been adopted in medical practice over the last century [35]. Some of the attempts to adopt various technologies have found ready acceptance (e.g. digital transmission of X-Ray images) while number of others have failed so far to gain acceptance [36]. Videoconferencing has been one of such technologies which have been tried since 1950s in several countries [37]. Bower et al [36] have investigated the adoptability of videoconferencing technologies within the health care sector and have presented some insights to the problem.

A technology push for the use of video conferencing in Scottish healthcare sector was visible due to the rapid fall of equipment prices, improvements in quality of transmission and installation of the basic telecommunication infrastructure. This was further reinforced by the policy pull of the Scottish office since 1998. The Scottish office has advocated proactive adaptation of visual communication technologies in healthcare to share the same basic communication infrastructure with other information and communication technologies in place [38].

Despite the strong encouragement from technology push and policy pull for adopting visual communication technologies in Scottish healthcare sector, [37] have sighted a study of ICTs in Scottish healthcare delivery, which concluded that rejection of innovations and technologies was probable where these have shown significant disruptions to the crucial process of the established practices. It has further been emphasised that the problem was evident in use of videoconferencing where it had the potential to change the clinician / patient relationship and the relationship between the professional groups within the health care delivery context. Moreover, Bower et al [38] highlight that organisations with unstructured and ad-hoc processes have more tendency to reject new technology and innovation.

This example case stresses the fact that the mere balance between technology-push and policy-pull (again technology driven) does not provide the perfect platform for IT adoptability. The strong processes and cultural concerns have a major impact on innovations and technology adoptability within a particular industry. Construction industry can also put within the same context, as it demands strong relationships between various stakeholders as with the clinician / patient, professional groups relationships within the example above discussed. Further, it emphasises that the construction has the potential to take the examples from other industries and as exemplified by this case, there is a need of compiling a balanced and process oriented IT adoptability strategy. Further, this demands the construction to consider this IT adoptability strategy as an integral part of its process improvement strategies.

5. Conclusions

Process improvement has been identified as a mechanism to improvement the performance of the UK construction industry. Despite the various strategies available for process improvement initiatives, the characteristics of the construction product and the industry have created a discussion on direct applicability of those initiatives within a construction environment. Identification of these characteristics enables the construction industry to evaluate other industries experiences within a construction specific framework. Success stories of process improvement within the industries like manufacturing and software then provide a platform within the construction to learn process improvement lessons from other industries.

A close relationship is visible between the information technology and some of the existing process improvement initiatives. Construction industry has shown a slow IT adoptability creating concerns about synergetic benefits between IT and process improvement in construction. Studies related to IT and processes have identified a duality between the IT adoptability and the organisational processes in place, emphasising the importance of considering IT adoptability strategies within process improvement initiatives. Some literature have provided empirical evidence from the industries like healthcare to strengthen this importance specially to justify the significance of considering industry specific characteristics and processes within its IT adoption strategies. Similarities and differences between other industries and construction provide a comparison basis to evaluate the ability of the construction to learn these lessons from other

industries with the aim of maximising the synergetic benefits of IT adoptability and process improvement.

Since this discussion has considered the common characteristics of the construction product and the production process, the genaralizability of the above conclusions are straightforward. This means that even though the examples discussed within this paper based on the UK construction industry, the arguments built upon those examples can easily be validated to the construction industry beyond geographical limitations.

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