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The concept of 'institutional waste within the Construction industry': A potential theoretical framework

Saad Sarhan[1], Christine Pasquire[2] and Andrew King[3]

Abstract

Question: Do imperfect institutional forces contribute to the generation and persistence of waste in construction projects?

Purpose: The ultimate purposes of this paper are to: (1) Contribute to the understanding of waste in construction by suggesting a new perspective on the generation and persistence of waste in construction projects; and (2) Shed light on a number of regulations, norms and routines, which are taken for granted and impede efficiency and improvement efforts in construction.

Research Method: The analysis of this paper is based on a critical literature review of theories of lean thinking, waste in construction and organizational sociology, in addition to industry experience and observation of co-authors.

Findings: This paper establishes the significance of considering the influence of the institutional context on the generation and persistence of waste in construction.

Research Limitations: This paper is conceptual and makes a case for further empirical research using neo-institutional theory – a branch of organisational sociology.

Originality/Implications: The concept of 'institutional waste within construction' offered within this study is novel and has the potential to deliver a theoretical framework that can be used for the prescriptive causal analysis of waste in construction, existing at the organisational, commercial and institutional levels.

Value to practitioners: The institutional perspective offered within this study highlights to practitioners the importance of thinking systemically and structurally. It could also enable clients and decision makers to consider the impact of institutional factors on the way they procure construction projects, and thus their desired project outcomes.

Keywords: Waste, Theory, Context, Systems, Norms, Contracts, Institutional, Organisational, Commercial Arrangements

Paper type: Full Paper

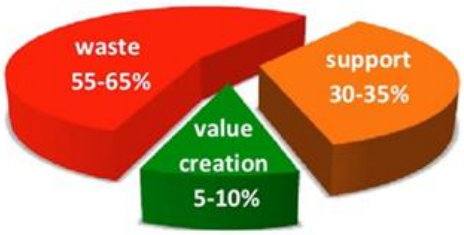
1 PhD Student, MSc Civil Engineer, Centre for Lean Projects, School of Architecture Design and the Built Environment, Nottingham Trent University, United Kingdom, Nottingham NG1 4BU, Tel: +44 (0)7961757059, sarhan_com@hotmail.com or saad.sarhan2012@my.ntu.ac.uk

2 Professor of Lean Project Management, Head of the Centre for Lean Projects, School of Architecture Design and the Built Environment, Nottingham Trent University, Nottingham NG1 4BU, Tel: +44 (0)115 848 2095, christine.pasquire@ntu.ac.uk

3 PhD, Programme Leader for MSc Quantity Surveying, Centre for Lean Projects, School of Architecture Design and the Built Environment, Nottingham Trent University, Nottingham NG1 4BU, Tel: +44 (0)115 848 2511, andrew.king@ntu.ac.uk

Introduction

It is widely accepted that there is considerable waste in the end-to-end design, construction and facility management process. Empirical evidence points to waste in excess of 50% of construction time (see Figure 1) where waste is defined as anything that is not required to create value for the customer/client or end-user. This is primarily process waste with some physical waste.



e.g. Accidents, Delay, waiting, Rework Over-ordered materials Damaged materials Multiple handling of materials Making-Do Poor payment systems Duplicate insurance cover Settling disputes after PC Tendering Procuring services on cost	**What the customer wants**	What we have to do to enable us to create what the customer wants e.g. Procurement Taxes Insurance Logistics Accounting Cost estimating Commercial management -for clarification see: Zimina & Pasquire (2011a)

Figure 1: Analysis and examples of waste in construction. Proportions based on studies by Diekmann et al. (2004) in the US and unpublished studies in the UK by Cameron Orr, AWD and Construction excellence as cited by Mossman (2009). Diagram adopted and modified from Mossman (2009)

The fact that much of this waste is common to many projects leads to the study's hypothesis: that there are institutional systems, structural arrangements and cognitive framework assumptions that support and encourage wasteful activities in construction. Institutions are commonly defined as '*the rules of the game*' (North, 1994; Peng *et al.*, 2009). Therefore, the aim of this paper is to contribute to the overall understanding of waste in construction and to shed light on a number of taken for granted regulations, norms and meanings that impede efficiency and improvement efforts in construction.

An overview of waste-related studies in construction

The Construction industry, according to researchers, is seen as a slowly progressing industry with numerous problems. Over the past 60 years the industry has commissioned several reports with the aim of reviewing its performance and suggesting means of improvement. Of these, the Egan report, 'Rethinking Construction', was produced in 1998 to address concerns raised by clients engaging services of construction companies; and was followed by the 'Never Waste A Good Crisis' report published by construction excellence in

2009 to review the subsequent progress. The former report sent a clear message to the construction industry by stressing that:

> *"Recent studies in the USA, Scandinavia and this country suggest that up to 30% of construction is rework, labor is used at only 40-60% of potential efficiency, accidents can account for 3-6% of total project costs, and at least 10% of materials are wasted…The message is clear - there is plenty of scope for improving efficiency and quality simply by taking waste out of construction" (Egan, 1998, p.15).*

There are many general classifications of process waste as defined in lean thinking. For example, they include Tachii Ohno's seven wastes: transportation, inventory, motion, waiting, over-production, over-processing, and defects (Ohno 1988, pp. 19-20). In addition, the waste of human potential - e.g. 'Not speaking, not listening' by Macomber & Howel (2004), and the 'Making-do' waste presented by Koskela (2004) is included within this category. Koskela et al (2013) propose that the making do waste is the lead waste in construction. A systematic literature review on empirical studies of waste-minimisation in construction by Viana et al (2012) found that research is focused on addressing three different categories of waste:

1. Construction material waste (physical waste);
2. Non value-adding activities (process waste);
3. Specific sorts of waste (such as accidents and rework).

An analysis of the literature on waste in construction reveals that the concept has not been prevalent in the field of construction economics or management (Koskela and Ballard, 2012). Research efforts aimed at understanding waste are relatively limited when compared to other topics in construction, and many waste-related studies have focused on the causes; not on the *root* causes. Most of the contributions to the investigation of process waste and non-value adding activities are produced by members from the lean construction community (Viana *et al.*, 2012). There is no doubt that many problems that lead to the occurrence of waste are strongly related to the conceptual framework adopted in production management. However, very little, if any, studies have devoted attention to exploring performance-shaping mechanisms (i.e. systems and structural arrangements), as well as the context in which human actions take place and decisions are made regarding waste-minimisation strategising and implementation efforts.

To say that waste is created due to human error is unhelpful; blame arguably fails to facilitate learning to 'do better' and similarly fails to lead us towards effective methods of reduction or prevention. As Dr Deming taught us: '*94% of troubles and failures are attributed to the system (responsibility of management), 6% are due to special cases (such as human mistake)*' (Deming, 1984, p. 315). Human behaviour is always influenced by the environment in which it takes place (i.e. broader organisational system or institutional environment). Without a deep understanding of the economic, social and environmental issues contributing to poor decision-making, it is very likely that similar flawed or risky decisions will recur. For this reason, Levensen (2011) emphasises that:

> *"Without changing the environment, human error cannot be reduced for long. We design systems in which human error is inevitable and then blame the human and not the system design' (p. 61).*

From this review of approaches to waste, as understood in Lean thinking, it is clear that it does not feature in modern construction economics or management theory. These approaches fail to recognise the imperfect systems in which entities not only operate inefficiently, but additionally protect themselves by adding contingency and behaving opportunistically. The effect of these practices is to embed inefficient and wasteful processes across the supply chain and throughout the project life cycle. Consequently they have become part of the institution of the construction industry—"the way it does business".

Examples of imperfect systems and structures

Traditional lump-sum procurement systems and price competitive tendering

Traditional lump sum procurement methods are commonly used in the construction marketplace, even though they are associated with cost and design problems (Cheung and Yiu, 2006), cited in Love *et al*. (2011). It makes sense to say that lump sum procurement can encourage efficiency because it forces contractors to perform within agreed cost and time parameters. As such, this encourages them to be more efficient, which will hopefully allow them to increase their profit margins. Additionally, competition is generally seen as a means for driving out waste; it can for example force bidders to reduce or compromise their profit margin or risk allowance in bids (Laryea and Hughes, 2008).

On the other side, it can be strongly argued that under traditional lump sum competitive bidding methods, it is not unusual for contractors to bid low on a project with the intention to recover the loss (compromised profit) through either planned claims (Mohammad *et al.*, 2011); or through pushing risk down the supply chain (Laryea and Hughes, 2008). Additionally, work by Love *et al*. (2009) revealed how late and low payments for design services, through competitive tendering based on lowest price, can encourage wasteful activities. For example, such practices often result in short cuts and the neglect of important design procedures, including design reviews and checks, as they are not typically specifically included in payments. In some circumstances, design companies may even have to re-use existing designs and specifications from previous projects in order to maximise fees and reduce design times. This type of practice can result in designs that are inappropriate for their intended purpose (Love *et al*, 2009). Moreover, they potentially include unnecessary and excessive amounts of resources in order to meet, and in so doing exceed, safety criteria through over engineering (Winch, 2000).

Unfair contracts and structural arrangements

Certain types of contracts and structural arrangements that impose greater risks on one party over the other can also support waste. It is common practice for clients to exert most project risk, if not all, on contractors, in order to have more control whilst passing responsibility. Inequitable contractual risk allocation may, for example, encourage an opportunistic party to take advantage of the other party by transferring project risks (Osipova and Eriksson, 2011; Pasquire et al., 2015) or denying responsibility to avoid losses (Mitropoulos and Howell, 2001). Love *et al*. (2011) explain how a particular project was subject to disputes and a stressful working environment even though it was procured using an alliance contract. These problems were found to stem from the project team being

constantly pressured by the client, in addition to designers, who were not subject to liquidated damages, deliberately adopting a practice of producing design documents that were issued to contractors without conducting peer-reviewed checks in order to meet their deadlines.

Traditional Insurance Systems

It has been suggested by expert construction professionals that conventional arrangements for providing insurance cover add unnecessary costs to constructions projects, and can also obstruct collaboration between supply chains (Ndekugri *et al*. 2013). This wasted cost, ultimately met by the client, arises through duplication in insurance cover as stakeholders' policies overlap in the risks that they cover (Ibid.). Additionally, the practice of insuring the liabilities of individual project participants rather than the project risks themselves often leads to defensive attitudes between project participants, thereby hindering supply chain collaboration (Ibid.).

Textual complexity and comprehensiveness of contract conditions and standard forms

A contract demands commitments and procedures to be followed by contracting parties. According to Ting *et al*. (2007), information asymmetry and uncertainty induce the generation of entrepreneurs' opportunism. Therefore, the clarity of contracts, in terms of readability and comprehensiveness, is essential for maintaining communication and commitment between project parties thereby leading to less time-consuming and costly disputes (Rameezdeen and Rodrigo, 2013). A study by Rameezdeen and Rodrigo (2013) verified that some contract conditions are very difficult to read, and require at least college level reading-skills to comprehend half of the clauses.

In several case studies presented in Mitropoulos and Howell's work (2001), contractors' interpreted some construction contractual clauses differently, owing to their complexity, and this encouraged opportunistic behaviour, resulting in severe disputes. Similarly, complexity in insurance contracts, such as different policy wording and rights, issued by different insurers leads to unnecessary high transaction costs (Ndekugri et al., 2013). These interpretation difficulties and errors could be attributed to legalese and unnecessary formality in contract wordings. Therefore, it is important to emphasise here that lawyers and specialist surveyors are not the primary users of a contract; it is the project parties' ability to capture their meaning which is fundamental for contract performance (Rameezdeen and Rodrigo, 2013).

Having considered how imperfect systems and structures contribute to waste in construction. The focus now shifts to introduce institutional theory, which, in turn, provides the platform to explore neo-institutional theory in order to develop a more explicit theory of waste.

Background of the institutional theory

Institutional theory has a long and complex history dating back to the mid-nineteenth century and incorporates the pioneering insights of seminal scholars of the social sciences such as Max Webber (Scott, 2005). Old Institutional arguments relied on notions that 'institutional contexts structure action'. According to Meyer (2008) *'Individuals were seen as creatures of habit groups as controlled by customs and societies as organized around culture'* (p. 790). Theories stretched from the economic to political and religious fields,

emphasising more organisational or cultural forms of control. However, in general, the nature of institutions and their forms of control over action were always subject to a lack of clarity and consensus in social scientific thinking (Meyer, 2008).

The old institutionalism was encountered by constant debates about free will and determinism; as it saw humans, groups and organisations as naturally embedded entities in broad cultural and structural contexts. In brief, the old institutionalism was marginalised by the rise of the social sciences of modernity, where conceptions were built around notions of society being comprised of empowered, fairly rational, and rather free actors (Ibid.). These actors include individuals, governments, and the organisations created by people and governments. In addition, much of the work focused on institutionalism from these periods was subsumed in the storming advances of neoclassical theory in economics, behaviouralism in political science, and positivism in sociology. Further development by John Meyer and his colleagues at Stanford University led to a significant revival for the ideas of institutionalism from 1977 with the formulation of neo-institutional theory (Scott, 2005; 2008).

Neo-institutional theory

Neo-institutional theory developed in response to specific processes and structures (i.e. causes of structural change in organisations) that were not adequately explained by prevailing rational-actor and contingency theories (DiMaggio and Powell, 1983; Scott, 2005). For example, bureaucratic organisations continued to follow rules that in some cases conflicted with the organisations' own goals (Mahalingam and Levitt, 2007). The general argument advanced by the foundational work of Meyer and Rowan (1977) was that formal organisational structures reflected institutional forces instead of technological requirements and resource dependencies. They argued that many of the models giving rise to organisations are based on rationalised myths and rule-like frameworks that depend for their efficacy on imitation and the fact that they are widely shared and disseminated.

At the time, when research efforts in the 1970s were focussed on understanding the reasons for variations amongst the *kind* (i.e. structural features) of organisations, seminal work by DiMaggio and Powell (1983) sought to explain *homogeneity* of organisations and practices rather than their variations. Their contention was that:

> *"Highly structured organisation fields provide a context in which individual efforts to deal rationally with uncertainty and constraint often lead, in the aggregate, to homogeneity in structure, culture, and output" (p. 144).*

They described this phenomenon as institutional isomorphic change, which occurs through three mechanisms:

1. Coercive isomorphism that results from political forces and legitimacy issues;
2. Mimetic isomorphism occurring due to standard responses to uncertainty; and
3. Normative isomorphism associated with professionalisation.

Organisational fields can be defined as those independent organisations that produce similar services or products and constitute a shared culture and social sub-system (DiMaggio and Powell, 1983; Scott; 2008). The logic for applying work at organisational field levels is that it provides us with a more systematic level of analysis; as attention is shifted from focussing merely on *organisations in environments* to focussing on the

organisation of the environment, with particular consideration to organisations as the key players of the field (Scott, 2008).

Conventional neo-institutionalism literature, in replication of the old institutionalism, emphasised the ways by which institutions constrained and directed people (now perceived as bounded, purpose and empowered actors) to behave in certain regular, relatively rational, but homogeneous and expected ways (Meyer, 2008; DiMaggio and Powell, 1983). With more than 30 years of progress since the neo-institutional theory penetrated organisational sociology, the theory has been subject to various developments including reformulation of some of its arguments. In this paper, we will briefly highlight two main areas of development (for a full**er** review, see Scott, 2008).

Towards a comprehensive conceptual Schema

Institutional theory has been widely employed among social, economic and political sciences to examine systems ranging from micro-interpersonal interactions to macro global frameworks. Despite the fact that the theory had multiple roots; there is a wide consensus that institutions matter (Peng *et al.*, 2009). Nevertheless, social scholars in various ways were adopting the theory, and there seemed to be a crucial need to move from a looser to a tighter conceptualisation. For this reason, iconic sociologist W. Richard Scott provided a comprehensive conceptual schema (see Table 1) that guides directions for pursuing such a theory. Scott defined institutions as:

> *"Regulative, normative, and cultural/cognitive systems and structures that, together with associated activities and resources, provide stability and meaning to social life' (Scott, 2001, p. 48).*

His aim was not to provide a new integrated theory of institutions, but instead to better enable us to **capture** both the commonality and the diversity of past and present conceptions of institutional theory (Scott, 2008).

Table 1: Scott's Typology of Institutional Pillars and Carriers (Scott, 2001)

	Pillars		
Carriers	*Regulative*	*Normative*	*Cultural-Cognitive*
Symbolic Systems	▪ Rules, laws	▪ Values, expectations	▪ Categories, typifications, schema
Relational Systems	▪ Governance & power systems	▪ Regimes, authority systems	▪ Structural isomorphism identities
Routines	▪ Protocols, Standard Operating Procedures	▪ Jobs, roles, obedience to duty	▪ Scripts
Artifacts	▪ Objects complying with mandated specifications	▪ Objects meeting conventions, standards	▪ Objects possessing symbolic value

From determinant top-down to interactive bottom-up perspectives

Institutional theory pays significant attention to the context. It considers the processes by which structures including rules, norms, and routines become established as authoritative guidelines for social behaviour. Much of the early studies of institutional theory emphasised that organisations and actors, operating within a specific context, were pressurised to conform to the requirements and constraints of their institutional environment (e.g. DiMaggio and Powell, 1983). Organisations' self-interested rewards obtained from conformance to these institutional forces include, for example, legitimacy, enhancing likelihood of survival, social support, stability, access to resources, acceptance in professions, and expedience to avoid questioning (Oliver, 1991). For these reasons, the prevalent language used was one of 'institutional effects', thereby inferring a determinant 'top-down' argument (Scott, 2005).

This unilateral perspective based on obedient organisations defocussed attentions of institutional scholars away from the fact that social structures are continuously modified by the individual and collective actions of social actors. Thus, according to Scott (2008), one of the important advances to the progress of institutional theory is the introduction of agented actors and accordingly the rise of interactive argument, which suggest that 'institutional processes' can operate in both 'top-down' and 'bottom up' directions. This was important because it allows us to also identify the social actors who held the widely shared beliefs, or were enforcing taken for granted norms (Scott, 2005).

It was the seminal work of Oliver (1991) who affirmed the role of organisational self-interest and active agency within institutional contexts; by cleverly integrating resource-dependence predictions of organisational strategy with the more limited responses to institutional pressures that traditional institutional models provoked. She pointed out that although acquiescence to institutional processes is the most likely response by organisations and their leaders; strategic responses could range from passive to active resistance including: acquiescence; compromise; avoid; defy; and manipulate. Accordingly, organisational reactions to institutional pressure towards conformity will depend on five institutional antecedents (Table 2).

Table 1: Antecedents of strategic responses (extracted from Oliver, 1991)

Institutional Factor	Research Question	Predictive Dimension
Cause	Why is the organisation being pressurised to conform to institutional rules or expectations?	▪ Legitimacy or social fitness; ▪ Efficiency or economic fitness
Constituents	Who is asserting the institutional pressure on the organisation?	▪ Multiplicity of constituent demands; ▪ Dependency on institutional constituents
Content	To what norms or requirements is the organisation being pressurised to conform?	▪ Consistency with organisational goals; ▪ Discretionary constituents imposed on the organisation;
Control	How or by what means are the institutional pressures being exerted?	▪ Legal coercion or enforcement; ▪ Voluntary diffusion of norms;
Context	What is the environmental context within which institutional pressures are being exerted?	▪ Environmental uncertainty; ▪ Environmental interconnectedness

Institutional waste within the construction industry

Based on this study's hypothesis—that there are institutional systems, structural arrangements and cognitive undergirding assumptions that support and encourage wasteful activities in construction—and building on the seminal studies of DiMaggio and Powell's (1983) institutional isomorphism, Scott's (2001) three pillars of institutionalism, and Oliver's (1991) topology of strategic responses; institutional waste is defined as:

> 'the regulative, normative, and cognitive-culture institutional processes which support and/or encourage wasteful activities, that the industry (organisation field) accedes to in the form of habitual, imitation or compliance; in order to achieve social legitimacy, survival and stability at the price of production efficiency and effectiveness'.

By habitual, here we mean: adhering to invisible, widely shared and taken for granted norms that have been historically repeated; by imitation: consciously or unconsciously mimicking what other more successful organisations do and strictly following imperfect advice from consulting firms and professional institutions; and by compliance: obeying imperfect institutional requirements. This could include imposing more control in contracts and structural arrangements, for example, as a response to problems of a lack of trust.

The study will adopt an ethnographic research approach for collecting data and providing empirical evidence. An exploratory and inductive-deductive (takes account of the hypotheses) case study will be conducted. Hence, perception, reflexivity and presence of the researcher are common critics associated with studies of this nature (Laryea, 2011). Focus groups will be utilised because they are ideally suited for the type of the study, as conversation is developed by group members and with minimal prompting from researchers. The focus groups will be structured in an approach similar to that adopted by Hughes et al. (2001), whose study aimed to develop mechanisms for measuring the true costs of tendering. The focus group transcripts will be analysed using ethnographic content analysis. This approach ensures that the information generated is not just a confirmation of the researchers' preliminary perceptions, but instead allows concepts to emerge out of the research context (Hughes et al., 2001). To elaborate and demonstrate our definition within the context of construction, the following propositions (tentative guiding hypotheses) have been constructed.

Proposition 1:

> *The higher the degree of security, social legitimacy or stability, conceived by social actors, to be attainable from acquiescence to imperfect institutional pressure, the greater the likelihood of waste to be institutionalised within construction.*

An example of this could be the adherence of the construction industry to use short time-frame and price-competitive tendering processes, as a widely shared and taken for granted practice, despite it being associated with many flawed risk assumptions and criticised cost estimations (Laryea and Hughes, 2008; Laryea, 2011).

Proposition 2:

The higher the degree of dependency of social actors on the institutional construction environment, the more the likelihood of waste to be institutionalised.

An example of this could be organisations which depend on obtaining their funding through bank loans, and as a result may pay more attention to their funders' requirements rather than their customers' needs (Chiang and Cheng, 2010; Zimina and Pasquire, 2011b). This could also be associated with the way that clients' advisors often set the 'rules of the game' (i.e. procurement type and construction periods stated in tenders) and then everyone else has to work within these rules, which could sometimes be dysfunctional.

Proposition 3:

The higher the degree of consistency of organisational goals and purposes with imperfect institutional pressures and norms, the greater the likelihood of waste to be institutionalised within construction.

For instance, it's not unusual for construction organisations, because of competitive pressure, to rely on making their profits solely through commercial processes and manipulating roles with others, rather than struggling to improve production efficiency (Zimina and Pasquire, 2011b). As one of the interviewee's in a study by Chiang and Cheng (2010) commented, contractors could only make profits, in this highly price-competitive industry, if they concentrated their efforts on three issues: (1) procurement of building materials; (2) cash flow management with their downstream supply chain; and (3) planning for and application of claims.

Proposition 4:

The higher the degree of voluntary diffusion of imperfect institutional practices, routines or norms, the greater the likelihood of waste to be institutionalised within construction.

This is mainly associated with mimetic institutional waste. An example could be the imperfect norms, job duties and responsibilities diffused by professional institutions or trade associations, with which its members are requested to conform. In such cases of very widely taken for granted understandings of what constitute genuine practices, it is highly likely that practitioners will conform because it does not occur to them to do otherwise (Oliver, 1991). Another example would include decision maker's simply trying what others have found to work, for example traditional procurement or critical path planning – push system technique.

Proposition 5:

The higher the degree of environmental uncertainty, the greater the likelihood of waste to be institutionalised within construction.

Environmental uncertainty in the construction industry can include, for example, fluctuations in the state of the economy comprised of factors such as inflation, changes to government macroeconomic policies and periods of instability of funding. Under such conditions, it is more likely for organisations to adhere to imperfect institutional regulations, norms and requirements imposed on them by governmental management, funders, professional association and public media pressure for the sake of survival, legitimacy, and protection from environmental turbulence (Oliver, 1991).

Conclusion and recommendations

Institutions influence beliefs, norms and actions; thus they shape performance and outcomes. There is a broad consensus among social and economic researchers that 'institutions' matter. However, this study found that the concept of institutions is not well established in construction management and economics research, specifically in waste-related literature. A critical review of the concept of waste in construction, revealed that very few, if any, studies have sought to consider the relationship between the prevailing organisational, commercial and institutional environment and waste in construction

This paper has exemplified various imperfect systems and structural arrangements that encourage and/or support wasteful activities in construction. Professionals and researchers are recommended to shift their attention from focussing merely on human behaviour and mistakes (silo thinking), to thinking systemically and structurally. It has also been demonstrated how neo-institutional theory - a branch of organisational sociology - has the potential to be used as an analytical lens to deliver a more explicit theory of waste, relating cause and effect within the wider aspects of construction systems and relationships. Finally, an outline of the concept of 'institutional waste within construction' is defined, and five guided propositions are provided for future empirical examination.

Further studies are recommended to adapt the institutional theory to capture the crucial institutional knowledge required to enable an understanding of why and how lean construction practices are more successful in some countries, for example the United States, than in other developed countries such as the United Kingdom (UK). An important point for future investigation is discussing whether there are evidences, from other sectors, that the focus on changes in the organizational context has been effective for waste reduction. This study is part of an on-going PhD study at Nottingham Trent University, UK, which aims to define institutional waste within the construction industry. It is anticipated that the research project can lead to modifications in governmental policy, legalisation and future re-shaping of the roles and responsibilities of the professions and wider participants involved within the construction sector in order to increase the production efficiency and effectiveness of the industry.

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