# TRACES OF LEAN CONSTRUCTION PRACTICES IN THE INDIGENOUS BUILDING CULTURE OF THE TALENSI OF NORTHERN GHANA

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## ABSTRACT

Lean construction (LC) is a project delivery system that focuses on delivering projects to meet the needs of clients while minimising waste. Even though a number of authors have indicated a strong link of LC to the Toyota Production System, there appear to be traces of LC in some indigenous building cultures. A closer study of the indigenous construction practices of the Talensi of Northern Ghana reveals traces of an LC philosophy. An attempt to establish an apparent link between the indigenous building culture of the Talensi and the concept of LC was carried out through field observations, interviews and a literature review. The study points to the fact that even though the term 'lean construction' might not have been coined by then, traces of LC as a culture, such as ensuring reliable flow, promoting collaboration, ensuring respect for people and improving transparency, were identifiable with the indigenous building culture of the Talensi. The outcome of this study should provide a basis to enhance the geographic spread of LC implementation by regenerating indigenous practices that identify with the lean concept.

**Keywords:** Talensi, lean construction, collaboration, transparency, indigenous building culture

## INTRODUCTION

A number of authors trace the foundation of the lean concept to the Toyota Production System (TPS) which is founded on the philosophies of continuous improvement and respect for people (Ohno, 1988; Womack and Jones, 2003; Liker,

2004). The term 'lean construction (LC)' was coined to contextualise lean principles within the architecture, engineering and construction (AEC) sector towards optimising value and reducing waste in the sector (Forbes and Ahmed 2011; Rybkowski et al., 2013). LC encourages a radical shift from the conventional approaches in construction to improved processes in order to meet customer needs and concerns.

Even though an understanding of the LC concept and its implementation strategies appears diffuse among practitioners and theorists, some common themes run through the various perceptions of LC and approaches at operationalising it. These themes, among others, include value generation, waste reduction, continuous flow, constant improvement, collaboration, concurrent engineering, participation, transparency, trust, and respect for people. Fulfilling and adhering to these themes in the practice of LC have led to the devising and adopting of various tools and systems such as the Last Planner System (LPS), Integrated Project Delivery (IPD), Lean Project Delivery System (LPDS), Target Value Design (TVD), Set-Based Design (SBD), Choosing by Advantages (CBA), standardisation, and Building Information Modelling (BIM).

Most of the documented practices of LC, especially those to be found in International Group for Lean Construction (IGLC) literature, have largely focused on separate or combined implementation of the LC tools and systems within contemporary construction settings. This article, however, brings to the fore some elements of LC associated with construction practices in antiquity. The paper specifically traces elements of LC practices within the traditional building culture of the Talensis of Northern Ghana. The Talensis are traditionally the native inhabitants of the current Talensi district in the Upper East Region of Ghana. Although the level of diffusion of LC is generally seen to be low, particularly in African countries such as Ghana (Kpamma and Adjei-Kumi, 2011), and a myriad of obstacles has been identified as possible challenges against the implementation of LC in Ghana (Ayarkwa et al., 2012), this research sought to identify some indigenous building construction practices which could be regenerated to provide a foundation for the geographic diffusion of LC, especially in Ghana as well as Africa as a whole.

## LITERATURE REVIEW

### Lean construction practice

One strategy of applying lean principles in construction requires the distinguishing characteristics of construction (compared to manufacturing), such as the one-of-a-kind nature of projects and temporary multi-organisation, to be minimised or given less recognition. This is in agreement with those who advocate that successfully implementing lean principles in construction requires construction to be more like manufacturing (where lean thinking originated). Koskela (1992), suggesting an approach to dampening the "one-of-a-kind" feature of construction process, indicates that exclusive solutions in a project not critical to the value of the project, but arising from

client or site idiosyncrasies, or the artistic expression of the designer, could be disregarded. In this way, he explains, proven standard work flows and associated components and skills could be employed. Koskela (1992) further recommends such actions as standardising components and processes, employing modularisation and prefabrication, as well as using enduring teams as practices to reduce the uniqueness of construction and bring it closer to manufacturing.

Ballard and Howell (1998), however, argue that, in line with the consideration of bringing construction closer to manufacturing, continuous waves of implementation would always result in remnants that have not yet been reduced to manufacturing and therefore are not yet capable of being made lean. Although the approach of making construction like manufacturing provides remarkable potential to reduce the time and cost of constructed facilities, the real challenge, Ballard and Howell assert, is to recognise the peculiar features of the remainder and to make them lean. A double-tier strategy of implementing lean in construction is therefore proposed (Ballard and Howell, 1998): (i) claiming for construction what essentially belongs to modern product manufacturing and minimising construction's distinctiveness towards taking advantage of lean techniques in manufacturing; and (ii) developing lean techniques adequate to dynamic construction, the remainder that resists the first approach.

Initiatives such as manufactured housing seem to adopt the first strategy of minimising construction's peculiarity. Simplifying site construction to final assembly and testing is one example of minimising construction's peculiarities. The second strategy of formulating lean techniques which are responsive to the uniqueness of construction poses the utmost challenge in implementing lean since it proposes to make lean a type of production that is not manufacturing (Ballard and Howell, 1998).

It has further been observed that when applying lean in construction, product and process design can be standardised for standard products. However, for non-standard products, it is necessary to standardise at the meta-level of planning and control so that standard procedures for planning and managing the design and installation of unique facilities are developed. This requires the creation of social unity among project participants as a prerequisite for collaborative process mapping and streamlining to order to maximise customer value and minimise waste (Ballard and Howell, 1998). The need for social unity in lean implementation is corroborated by Koskela (2015) when, in attempting to align lean and rhetoric, he points to the creation of a common ground as an essential activity to both lean and rhetoric.

The creation of social unity requires activating LC soft skill requirements (e.g. respect for people, transparency and trust) to nurture collaboration. Howell (2013), for instance, points out that one measure of creating a balance to minimise the diversity among members within project teams towards process efficiency is to introduce non-economic incentives such as fairness, equity and trust. It has, however, been observed that a section of practitioners and researchers, unfortunately, focus on the hard elements of LC skills (e.g. engineering process of flow, kanban standardisation, work-in-progress,

just-in-time delivery) to the neglect of the soft elements such as the social aspect of lean thinking (Liker, 2004; Santorella, 2011; Rybkowski et al., 2013).

Another approach to implementing lean in construction is to exploit the synergy between lean and sustainability, especially in the area of waste reduction for environmental performance and productivity. Waste, from the perspective of lean, refers to resources or activities that are time consuming and incur cost without creating value (Koskela, 1992). Sustainability is the long-term preservation and improvement of the well-being of man in the midst of limited planetary resources (Golzarpoor and Gonzalez, 2013). Sustainability has environmental, economic and social dimensions (Wentworth, 2012). It is argued that it is possible to integrate environmental concerns into lean approaches to reduce waste, save cost, and mitigate impact on the environment (Bantowsky, 2007). This illustrates the environmental or "green" dimension to implementing lean in construction (Golzarpoor and Gonzalez, 2013).

**Building culture of the Talensi**

The inhabitants of the Talensi area in the Upper East region of Ghana in West Africa are culturally and administratively termed Talensis (or 'Tallensi', as spelt by some authors). The cultural heritage of the Talensis is characteristically expressed in both their performing and visual arts, such as traditional architecture. The indigenous building culture of the Talensis is primarily centred on the design and construction of the homestead. The homestead is traditionally identified as a Talensi man's focus and fount of his key interests, his foremost drives, his deepest emotional connections and his entire structure of values; it his shelter, his storehouse and the stage of his life's drama (Fortes, 1949).

Cardinall (1920) suggested that house-building among the Talensi was planned and constructed sothat natives could defend themselves against hostile neighbours. Fortes (1949), however, asserted that, rather than the alleged lawlessness of earlier times, the mode of house-building by the indigenous Talensi was determined by such considerations as material availability, economic system and social organisation. Subsequent findings by Prussin (1974) as well as Schreckenbach and Abankwa (1983) tend to corroborate the views of Fortes (1949).

Traditionally, house-building among the Talensi goes beyond a mere physical process to a social process. Guided by a strong sense of kinship, house-building by a Talensi man is seen as a co-operative effort by the clan to which he belongs. The house construction process mobilises the social ties of the man, and the constructed house stands as an embodiment of the efficacy of those social ties (Fortes, 1949). A bird's eye view of an indigenous Talensi homestead or neighbourhood depicts a material projection of the social relations that make up a family or clan.

## RESEARCH METHOD

This article sought to trace elements of LC practices in the indigenous building culture of the Talensi in northern Ghana. The study largely relied on empirical knowledge of and literature on the indigenous building practices of the Talensi. At the time of conducting this study, the authenticity of the indigenous building practices of the Talensi had admittedly been generally compromised by the infiltration of contemporary cultural and construction practices, especially in the past two decades. The principal source of empirical data for the study, which was ethnographic in nature (Creswell, 1998), was based on the previous experiential knowledge of one of the authors who is a native, and grew up in the Talensi area. This author was not only an observer of the indigenous building practices, but also an active participant in the process (especially from 1980 to1995).

The experiential knowledge of the author was further verified by an interview with three traditional Talensi builders as well as by documented studies on the Talensis, especially those by Fortes (1945, 1949), Prussin (1974) as well as that of Schreckenbach and Abankwa (1983). Fortes is renowned as an anthropologist for his extensive ethnographic study of the people of Talensi and Ashanti in Ghana, culminating in notable works such as *The Web of Kinship among the Talensi* and *The Dynamics of Clanship among the Talensis*. Prussin (1974), as well as Schreckenbach and Abankwa (1983), produced notable seminal works on the traditional architectural and construction practices of inhabitants across various ethnic and climatic regions of Ghana and parts of Africa.

The analysis of data basically involved matching patterns of indigenous construction practices identifiable with the lean philosophy as they emerged from the multiple sources of data: the author's experiential knowledge, interviews and documentation. The specific themes that guided the pattern-matching process towards establishing a convergence between indigenous Talensi building practices and LC included collaboration, standardisation and sustainability. Literature reveals collaboration, standardisation and sustainability as fundamental elements in the implementation and practice of LC.

## FINDINGS

This section presents and discusses identified practices in the Talensi indigenous building culture aligned to LC. The findings are presented along the LC themes of collaboration, standardisation and sustainability.

### Collaboration

One of the key elements of LC is the stimulation of a collaborative atmosphere among project participants to enhance information sharing and a striving towards shared objectives. Collaboration as an element of lean has been expressed in various forms in LC literature. Ballard and Howell (1998) called for social unity among project

participants as a measure for collaborative planning and streamlining processes to maximise value and minimise waste. Koskela (2015) contends that, in many ways, LC attempts to create a common ground of values and facts among project participants.

Among the Talensis, collaboration is one of the strong manifestations of the social process in traditional house-building. Across the entire construction process, from site preparation to finishing, participants of diverse ages, social standing, skills and genders are involved. As Fortes (1949) observes, erecting the walls tier by tier, roofing the rooms, as well as finishing the walls and floors are tasks requiring considerable dexterity and cooperation among the participants. Collaboration within and across tasks fundamentally emanates from a strong kinship among the participants, based on the sharedness of their social ties with the owner of the project. Since most of the participants are generally connected by social ties, identify with the value of the project and share in its success, they are united in planning and working towards achieving the project goal. Figure 1 illustrates a case of collaboration in traditional wall construction and finishing process by participants who, through the strength of their kinship, share in the value and success of the project.

Figure 1: Collaborative wall construction and finishing process

Another dimension of collaboration in the building culture of the Talensi is the reliance on non-economic incentives to intrinsically motivate participants. Intrinsic motivation is significant in achieving collaboration towards lean project delivery (Darrington and Howell, 2010; Schöttle and Gehbauer, 2012). Although there is some form of reward in the form of foodstuffs for participants by the project owner (Fortes, 1949), this, rather than being an economic reward, is fundamentally meant to replenish the energy expended by participants in performing their various tasks. Participants' collaboration and performance in this case are intrinsically motivated by non-economic incentives such as trust, personal values and social norms. The ideals of trust and fairness are typical virtues shared among indigenous Talensis, based on which members of a clan, who essentially constitute the project team, voluntarily feel obliged to collaborate in building a house for a kinsman in anticipation of long-term reciprocal

assistance. The relationship among the project participants, including the owner, therefore follows a rational contractual arrangement which is argued (Lichtig, 2005) as able to build associations healthy enough to endure the inevitable conflicts and challenges that come with project delivery.

Respect among project participants was one of the identified drivers of collaboration in the traditional construction process of the Talensi people. Even though various individuals, through apprenticeship, specialise in specific tasks of the traditional construction process (e.g. earth kneading, moulding and masonry), the atmosphere of respect tends to relax the dichotomy among participants along the lines of professional expertise, thereby fostering integration among teams towards value delivery. There is mutual recognition among participants in respect of the crucial role of every participant along the project delivery chain.

The prevalence of shared mental models among project participants is also one of the elements of collaboration in the indigenous building culture of the Talensi. Similarity in mental models among project participants, Mathieu et al. (2000) observe, results in team members working towards common objectives with a shared cognition of how the team will function. One of the areas where the participants share mental models is knowledge of the capabilities and responsibilities of the various project participants. Essentially all members of the team do not only live and work together in one community, but may also have participated in previous projects, making it possible for familiarity in respect of member talents and capabilities. In alliance with this observation, Koskela (1992) recommends the use of enduring teams as a strategy to reduce the uniqueness and the one-of-a-kindness of construction projects in order to bring construction closer to manufacturing for lean implementation.

**Standardisation**

Standardisation of products and processes is one of the recommended strategies for implementing lean in construction by making construction more like manufacturing (Koskela, 1992; Ballard and Howell, 1998). Design and construction of indigenous houses of the Talensi are standardised in various dimensions. This contributes significantly to a reduction in uncertainty and process variability, thereby enhancing flow, efficiency and collaboration. The repetitiveness, predictably and recurrence of a standardised process, apart from resulting in cost reduction, also allow the project participants to understand what is required (from whom, and by when), therefore leading to an enhanced transparent process, fewer conflicts, fewer change orders, reduced unplanned schedules and costs, as well as a more stable workflow (Gibb and Isack 2001, Pasquire and Gibb 2002; Tam et al., 2007).

One manifestation of standardisation in the traditional architecture of the Talensi is the layout of the homestead which is standardised along the social connections and hierarchical relationships among the occupants. The family compounds and homesteads are standardised sociograms of the kinship groups (Prussin, 1974). Fortes (1949) observes that individual idiosyncrasies do not affect the layout of a homestead so that apart from minor variations, the layout wholly depends on the composition of the

domestic unit. This, incidentally, agrees with the view of Koskela (1992) who recommends a reduction of client idiosyncrasies towards standardisation in order to address the challenge of the "one-of-a-kind" nature of construction, when implementing lean in construction project delivery process.

Another element of standardisation in traditional Talensi architecture is the choice of building form. The circular form is generally the standard choice for indigenous buildings among the Talensi. In the north-eastern half of Ghana of which Talensi forms part, Schreckenbach and Abankwa (1983) identified buildings to be generally circular and arranged as cells around an inner courtyard. An aerial view shows every traditional Talensi homestead as covering a roughly circular area (Fortes, 1949). The standardised choice of a circular form is drawn from various considerations (Prussin, 1974). One consideration is the continuity of the circular form which is a source of structural stability for the earthen walls. Another consideration is that the circular form, unlike a rectangular form, helps to concentrate thermal radiation in a central enclosed interior space to balance the wide diurnal temperature range of the savannah to enhance interior comfort. It is also considered that the curvilinear surfaces, combined with the coarse texture of the earthen walls, eliminate the harsh and irritating contrast between light and dark created by perpendicular intersecting planes, and adapt it to softly graded shade and shadow (Prussin, 1974).

Standardisation of the traditional architecture of the Talensi is also shown in the choice of construction materials and process. Wall construction as a standard process, for instance, generally involves hand-moulding kneaded laterite into standard spherical sizes and using the balls to construct the wall tier by tier. Wall finishing also involves a standardised process of plastering the wall surfaces with a mixture of mud, cow dung and juice from boiled empty locust bean tree pods. The juice acts as a stabiliser, hardener and waterproofing.

Furthermore, standardisation reflects in the planning and scheduling of the construction process. In the view of Ballard and Howell (1998), where there is difficulty in standardising construction products for implementing lean, the recommended approach is to standardise at the meta-level of planning and control so that standard procedures for planning and managing the design and installation of unique facilities are developed. As a standard schedule, traditional Talensi construction generally occurs in the dry season between December and April. This period is without rainfall and the entire construction process, from site preparation to wall and floor finishing, is planned in this period. The need to standardise the construction schedule within this period is further reinforced by the fact that most traditional construction participants are farmers and would be engaged in farming in the rainy season. The standardised scheduling in the dry season is transparent and understood by all participants, thereby enhancing the reliability of the commitment of the entire team to planned activities for projects. This tends to stabilise the flow of construction activities within the planned durations.

## Sustainability

Sustainability is critical to LC, especially in respect of waste reduction as well as social and environmental friendliness (Ogunbiyi et al., 2014). One element of sustainability of the indigenous building culture of the Talensi is the environmental friendliness of the process which is associated with less generation of waste. This fundamentally stems from the recyclability and reusability of the traditional materials, especially laterite for wall construction. Apart from the earth from borrowed pits (Prussin, 1974), another source of material for traditional wall construction among the Talensi is to remold broken walls from old buildings. This involves soaking and mixing the broken pieces in water before kneading them into workable consistency. The implication is that decommissioned walls can readily be reused or recycled into new walls without any trace of waste.

Another dimension of the environmental sustainability of the building culture of the Talensi is the ability of the traditional building materials to merge back into the natural environment when they are not in use. When the earth used for the wall and roof (in the case of flat mud roofs) construction is disposed of, it easily merges with the top soil to support farming activities, thereby leaving no evidence of waste. The biodegradable nature of materials for the thatch roofs also puts them in a position to easily merge with the natural environment when they are decommissioned.

The sustainability of traditional Talensi architecture also finds expression in the adaptability of the compound residence to changing family size and relationships. Prussin (1974) observed the uniqueness of the compound residence in respect of its kinetic quality in that it reflects the varying connections in the cycle of the family lifespan. As the joint family expands with the addition of more children and wives (Fortes, 1949), the compound expands adaptively through the addition of new, enclosed or clearly demarcated extensions in space (Prussin, 1974). The use of non-permanent materials particularly plays an important role in the adaptation of the traditional Talensi homestead to the changing family size and social connections. The earthen wall construction is easily demolished and remolded in the adaptation process. The loose-fit connections in the traditional thatch roofing system allow for easy demounting and reassembling of roofs.

## DISCUSSION

The findings as presented above indicate a strong convergence of some fundamental elements of LC with indigenous construction practices of the Talensi. Specifically, collaboration, standardisation and sustainability are fundamental to both LC and indigenous Talensi construction. Collaboration, a critical element in a successful LC implementation, is largely driven by a good sense of community which intrinsically motivates indigenous Talensi inhabitants towards shared goals and respect for people in their traditional construction undertakings. Standardisation, which is also essential in aiming at a lean culture (Höök, 2008), generally manifests not only in the repetitiveness of the building form and materials of Talensi architecture, but also in the recurrence and predictability of the production process which is associated with a smooth and

standardised pace. Sustainability is expressed, not just in the friendliness and responsiveness of the traditional building materials to the physical environment, but also in the reduction of waste and the enhancement of value as result of the reusability, recyclability and adaptability of materials and form. Even though the LC practices of collaboration, standardisation and sustainability may not necessarily represent the total culture of LC practice, their pervasiveness in a particular setting presents a fertile foundation to extend to other LC practices.

Notwithstanding the prevalence of elements of LC in the indigenous building practices of the Talensis, some other components of these practices appear to be adversarial to LC. For example, an overly standardised process and products tend to be an obstacle to the LC principle of continuous improvement. Even though traditional construction practices of the Talensis might have evolved over the years, most of these indigenous practices remain static over a long period of time without conscious efforts towards continually improving to enhance value delivery. The current sporadic permeation of so called contemporary construction materials and technologies in the Talensi area is generally out of context with the physical and social environmental settings of the area and cannot be said to be an improvement on the indigenous building systems. A more socially and environmentally responsive cycle of improvement of the traditional building practices would have been more appropriate and sustainable.

It is worthwhile noting that even though this study focused on the indigenous building culture of the Talensis, some of the findings could be extended to other parts of Ghana and Africa as whole. Notwithstanding the fact that there are occasional peculiarities, the established practices of the Talensis are generally a representation of what happens in most parts of northern Ghana and other parts of Africa, such as Burkina Faso and Mali (Prussin, 1974). The kinship spirit that drives collaboration, standardised forms and materials, as well as sustainable systems can all be traced among indigenous groups in other parts of Ghana and Africa.

Admittedly, the originality of indigenous construction practices among the Talensis has been compromised. This results from the spread of other cultures and practices, especially with the advent of globalisation, to the Talensi area. The kinship spirit that translates to a commitment to shared values in the house-building process is gradually diminishing. The drive behind participation and collaboration has gone beyond the non-economic incentive of social ties to monetary incentives. Focus has also shifted from the use of non-permanent and organic systems to permanent systems and materials such as sandcrete blocks, metal roofing sheets and synthetic finishes. This makes the so-called contemporary buildings less responsive to the social and environmental dictates of the area. There is therefore a need to regenerate the identified traces of LC, identifiable with the indigenous building cultures in Ghana and Africa, to serve as a medium for lean diffusion in Ghana and the rest of Africa.

## CONCLUSIONS

LC involves practices in the design and construction of buildings to reduce waste and maximise value for users. Although LC is primarily believed to have evolved from the Toyota production system, this article sought to illuminate traces of LC practices in the indigenous building culture of the Talensi. It has been demonstrated that collaboration, standardisation and sustainability are some of the dimensions in which LC practices can be traced in the traditional building practices of the Talensi. Even though the geographic spread of LC implementation is generally seen as low, especially among countries such as Ghana, the article provides an impetus to explore and regenerate some building practices in antiquity towards diffusing and implementing LC.

The exercise of tracing elements of LC in an African indigenous construction practice was not an attempt to over-simplify or downgrade the concept of LC, though LC is regarded as a contemporary concept in construction project delivery. The exercise rather sought to present LC as a cultural and social phenomenon that requires organisational acceptance. Undoubtedly, technology and physical infrastructure are essential for LC implementation, but the effectiveness of this infrastructure depends on an organisational orientation towards the foundational LC soft elements of respect for people, shared values, transparency, trust and team spirit.

Even though the diffusion of LC within Africa still remains emergent, the findings of this research indicate that LC, as a concept, is not necessarily remote from the social and cultural context of Africa. Some of the elements of LC are found to be embedded in the traditional social and cultural fabric of Africa. Therefore, rather than viewed as an alien and sophisticated concept, traditional African systems and norms could be revived and regenerated to provide a fertile foundation for the implementation of the LC concept on the continent.

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