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Contextual Materials:

Socio-Cultural Barriers And Sustainable Building Materials In Sedentary Maasai Communities

Laia Gemma García Fernández

Academic supervisor: Dr Andrea Rigon

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The DeCID project aims to develop a new approach for the participatory design of social infrastructure for children in urban areas affected by displacement. In partnership with humanitarian actors, local communities, municipalities and academics, the DeCID team developed a practical handbook to support those involved in the co-design. DeCID is a project led by The Bartlett Development Planning Unit (UCL) and CatalyticAction, and funded by UKRI through the Global Challenges Research Fund.

For more information about DeCID, please contact Principal Investigator **Dr Andrea Rigon**: andrea.rigon@ucl.ac.uk

Design and layout: Ottavia Pasta

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Author:

Laia Gemma García Fernández

Supervisor:

Andrea Rigon

MSc Building and Urban Design
in Development

The Bartlett

Development Planning Unit
University College London

01

INTRODUCTION

During the last United Nations Framework Convention on Climate Change (COP25), a group consisting of social movements, civil society and grassroots organisations spoke out to make an appeal in favour of the use of local building materials, arguing that:

'It is essential to recognise the right to the construction of habitats in continuity with local traditions, by making use of local materials linked to adapted techniques that promote the improvement of the local economy and provide employment to the producers of materials and construction workers.'

HIC-LA, 2019

Due to associated processes of globalisation and with the growing expansion of building and construction industries (Foroudi, 2020), which during 2018 accounted for 39% of the global Greenhouse Gas (GHG) emissions (IEA, 2019) this argument has, as a result become fundamental in the fight against climate change and achieving the eleventh UN Sustainable Development Goal for 'inclusive, safe, resilient and sustainable' dwellings and settlements (United Nations, 2015).

Several authors have witnessed the noticeable decontextualization process that architecture is undergoing. Hassan Fathy argued that Egypt was forgetting its indigenous identity and that its new houses had lost all sense of character (Bertini, 2020). Architect Demas Nwoko has written that preferences for 'modern' building forms and materials in Nigeria reflect a culture being architecturally colonised (Nwoko, 2020, as cited in Croyle, 2020).

Preferring the trappings of modernity and the imagery of material wealth, many local communities have given up their traditional constructions and vernacular techniques, by extension losing valuable knowledge needed to manage natural resources (Low, 1988). This has led to the disintegration of socio-cultural interactions with the environment and a resultant failure in the promotion of resilient and sustainable communities (Nwoko, 1979).

However, an adapted and updated vernacular architecture has begun to gain traction within the fields of architecture and anthropology (Bonell and Van Geert, 2009). In 2019, the academic Julia Watson published the book *Lo-TEK, Design by Radical Indigenism* in which she enhances 'ignored local wisdom and indigenous innovation' (Taschen review, 2019:1). Alongside this, other authors such as Paul Oliver or Bernard Rudofsky devoted part of their careers to cataloguing and interpreting vernacular architecture, putting into perspective the values and ethnological heritage of 'non-pedigreed architecture'. This is in turn a way of challenging

intellectual western-hegemony of architecture in favour of what Pietro Belluschi defined as ‘communal architecture’ (Rudolfsky, 1964:3).

Many practitioners and users have realised that vernacular architecture can teach us about ecological innovation while reproducing a connection to local context (Rumana, 2007).

Among others, Francis Kéré has designed schools across Burkina Faso using vernacular cooling technologies. Similarly, in Bangladesh, Anna Heringer (2019) demonstrated how buildings which include earthen walls and bamboo structures can reach a high level of quality while being aesthetically attractive, cheap and environmentally sustainable.

Unfortunately, many efforts to revitalise vernacular architecture fail to win the approval of locals as external influences and new social values bias preferences towards standardised building materials (Kaitilla, 1994; Rapoport, 1983; Magutu, 2015).

However, the complexities of the built environment make it difficult to homogenise the intertwined socio-political, environmental and economic structures influencing the choice of building materials. Hence, the challenge lies in boosting the use of locally-sourced building materials that are culturally-accepted (Grierson, 2009).

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1.1 Research Focus and Questions

Mirroring these debates, this dissertation wants to provide an insight into the important role of locally-sourced building materials in meeting the present challenges of reducing the construction industry's environmental impact and urban growth. In particular, this study will focus on the vulnerability of indigenous communities, highlighting the value of indigenous building techniques as a key element in the preservation and management of the environment.

Underpinning the premise that architecture is a cultural device which embodies various information about beliefs and behaviours of its users (Memmot and Keys, 2015), its study makes it possible to use built forms to approach other facets of our social existence (Bonell and Van Geert, 2009). Drawing from this perspective, this research seeks to navigate architectural theories that are culturally-responsive and which offer an approach to decode socio-cultural expressions underlying the use of specific building materials in the context of indigenous Maasai communities.

By focusing specifically on Environmental-Behaviour Studies (EBS) and cross-cultural theories of architecture approaches, the following research questions are proposed:

- How do socio-cultural conditions influence the choice of building materials? Is it possible to analyse them in a constantly-changing society?
- How can the understanding of building materials' culturally-specific meanings be useful in the promotion and integration of sustainable design practices which include locally-sourced materials within local communities?

02

CONCEPTUAL FRAMEWORK

2.1 A Question of Culture

The relevance of culture in architecture

In a recent article published by The New York Times (2020), the Nigerian Architect Mariam Kamara argued for the need to reassess discourse around indigenous building technologies as not merely 'contextual' but irreducibly logical. By analysing the environmental pressures of the Niamey countryside, she examined how buildings kept their interiors cool and well ventilated through the use of heat-absorbing earthen walls. She also remarked on the use of this traditional technique as environmentally sustainable and cost-saving. Yet, earth masonry is considered a poor building material for the majority of locals and therefore using mud bricks in her latest project was deemed a 'provocative choice for a middle-class, urban project' (Snyder, 2020).

The evidence in support of using locally-sourced materials is beginning to challenge material and technical hegemony within architectural practice. Traditional vernacular architecture can be further improved by combining traditional materials and techniques with contemporary technologies. The difficulty lies in the fact that the symbolic value of modernity associated with certain building materials has taken precedence over functional requirements such as availability, cost or comfort (Kaitilla, 1994).

Several authors have written about the cultural significance that materials have in terms of socio-cultural identity, which in some cases prevents the adoption of locally-sourced building materials (Livingston, 1992; Beckman, 1972; Rapoport, 1983). The rejection of traditional construction techniques is a common phenomenon among developing countries. In Cross-cultural theory, Memmott and Davidson (2008) offer an insightful analysis surrounding the shifting perception of building materials in the Maya tradition. The vernacular dwelling has always been intimately linked to the Maya culture and cosmology. However, the current picture of Maya settlements reveals an ongoing process of both 'forced' and voluntary cultural change. Modern constructions are often similar in style to 'western' cottages built with concrete and iron roof sheets. Dwellers aspire to own such houses, and prefer to adapt their traditional customs to these new westernised constructions despite 'not being architecturally accommodating of such behaviours or being climatically responsive' (Memmott & Davidson, 2008:60).

Facing a similar demand for Westernised materials in his own country, the former President of Tanzania, Julius Nyerere, remarked in a public address that 'the present widespread addiction to 'European soil' (cement) and tin roofs is a kind of mental paralysis' (Mwafongo, 1984:23). He also

argued that if Tanzanian citizens wanted to progress more rapidly, they ‘must overcome at least some of these mental blocks and biases against alternative building materials.’ However, statements such as this demonstrate naivety as they do not consider the symbolic meaning that materials may have acquired in a specific context. In this case, the use of modernised building solutions provides a vision of a socio-cultural change, as they reflect an openness to expressing a new social identity (Rapoport, 2005).

Through a study conducted with C-re-a.i.d. Ngo (an architectural organisation dedicated to exploring responsible building practices in northern Tanzania) it has been observed how innovative technologies which include locally-sourced materials have often been rejected by local communities. Therefore, a thorough understanding of socio-cultural variables and their implications is essential to avoid architectural solutions that might be rejected by local communities.

In light of several researchers’ findings that link cultural context to preferences for building materials, the following section seeks to shed light on the challenging (and often confusing) concept of culture. However, it is acknowledged that culture as a subject of research ‘can hardly be captured completely because of its complexity’ (Bolten, 2001:128).

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A dynamic definition of culture

The first thing to note is that ‘culture’ is not something tangible but rather a constructed idea: ‘a label for the many things people think, believe and do and how they do them’ (Rapoport, 2005:77). One of the architectural cultural theorists examined in this chapter is Amos Rapoport (2005), whose theoretical treatise is primarily based around dismantling cultural variables that have had an influence on built forms. He also coined the concept of ‘culture-specific’ design. However, other author’s writings have contributed to the development of the term. For the purpose of unifying the impact of culture in the built environment, Rapoport devised a singular definition of culture:

‘Culture is about a group of people who have a set of values and beliefs which embody ideals, and are transmitted to members of the group through enculturation. These lead to a world view; a characteristic way of looking at the world and, in the case of design, of shaping the world.’

Rapoport, 1987:10

This definition emphasises the idea that human beings ‘shape their world’ by making decisions according to their values and beliefs. In turn, this will lead to the creation of lifestyles, landscapes but also the built environment, in many cases utilising building materials that embody their ideals.

The environment is therefore positioned as both the result of culture’s influence and the cause of it. Additionally, if knowledge is developed through experience with the close environment, the way in which local resources are used should encompass cultural habits and behaviors. Such specific knowledge is essential to survive and adapt to the natural conditions of a given environment (Metzner, 2002).

In this sense, the importance of culture lies in understanding the unbreakable connection between local knowledge and the environment. Thus, in order to achieve environmental and social justice, the role of culture is crucial (Uzzel et al, 2002).

Sedentary Maasai communities and Cultural Syncretism

With the rapid expansion of globalisation, conflicts between tradition and ‘modernity’ are becoming inevitable for many communities around the globe. Indigenous communities under pressure to modernise face the difficulty of coping with a cultural landscape that is changing fast. Rapoport argues that for developing communities the problem is neither development nor the influence of modernity, as both are inevitably natural, but ‘radical, abrupt and frequently excessive rapid cultural change’ (Rapoport, 1983: 254). In an effort to understand how such pressure might be alleviated, it might be helpful to examine the socio-political pressures that modern indigenous societies are facing.

The idea of a ‘self-contained European culture’ relies on the notion of ‘uncontaminated’ (Bhabha, 1994:52) non-European cultures. This is of course a false assertion due to the heterogeneous nature of culture and the problematic positioning of different traditional practices as ‘other’. Cultures are by nature plural and thus can only be conceptualised in relation to their surrounding environments and everyday practices. Furthermore, indigenous communities such as the Maasai, have been subjected to the influence of German and English colonial regimes. For this reason, Bhabha (1994) named this phenomenon as ‘cultures in-between.’ By understanding culture as a construction of different influences without a specific delimited area, today’s anthropological theories explore the blurriness of cultural boundaries and view them as active and alive rather than passive and static. This term fits with Anderson’s definition of indigenous cultures as ‘dynamic societies, in a continual process of adaptation, global impacts and changes of tradition at an unusually large choice, and constraint’ (Anderson, 2001:83). Such cultures ensure the preservation of traditions and living heritage, and at the same time, external influences enable the arrival of new patterns, techniques and activities (Hauser and Banse, 2011). Thus, new cultural practices arise and become gradually integrated in the every-day life.

The result of this process is not the copying of western models (as it could seem by glancing at the present picture of sedentary Maasai settlements) but rather such change will appear as a form of ‘cultural syncretism’ (Rapoport, 1983:255).

In the context of settled Maasai communities in Tanzania, this phenomenon can be explored by looking at the spatio-temporal nature of built forms. In this process of synthesis (and the reasons behind it) within design is what needs to be explored so to discover which elements are new, changing or being replaced and why.

Rukwaro (1997) identified the different cultural variables that have most affected rapid change in several Tanzanian Maasai settlements. These variables include: the shift of communal ownership of land to individual ownership, improved access to education, diversification of occupations, the adoption of new religions and changing familial structures. Such variables have triggered a shift in cultural values, with many implications at the settlement level.

The type of changes in architecture that can be identified include the incorporation of specific, novel and symbolic articulation within building designs in response to the diversification of economic, leisure and social needs alongside shifting cultural beliefs and values.

According to Linzey (2001), by carefully analysing both indigenous' context cultural traits and their daily production of interpretative aesthetics and activities, including architectural ones, it is possible to develop architectural styles that are highly culture-specific.

Culturally-specific Design

Architect Hassan Fathy gained significant notoriety for his sensitivity to local context and for the sophisticated use of 'poor' building materials within his projects. Despite the attention that Fathy's buildings attracted at the international level, it has been argued that he was not always successful in altering designs to fit the needs and desires of locals. According to some authors, this is in part related to the fact that local people desired modern houses and materials and consequently, he failed to meet these desires and projected his own onto clients (Rapoport, 1983; Adebayo et al, 2013). In order to avoid such failures, looking at local cultural nuances must be central to the design process.

As Mark Twain pointed out, everyone likes to talk about culture but barely anyone manages to effectively strike a balance. Rapoport (2005) suggests that the high level of generality and abstraction of the term makes it difficult to establish a relation between cultural processes and design outcomes. He also goes on to pinpoint some of the reasons why culture as an abstract concept is not very useful in design. Whilst culture is a vast realm, the built environment is only a small subsection of it. As a consequence, the relationship between these two becomes difficult to grasp (ibid.). Furthermore, culture cannot be used on its own as the basis for design because it is too abstract and too general, and therefore 'design for culture' is an impossible exercise. In order to reduce the broadness of the concept, the different components of culture need to be 'dismantled' (ibid.).

By studying the spatial patterns and movement through an environment, the complexities of interactions can be acutely observed (Low, 1988). In this sense, 'Space, as well as time, is given meaning through its symbolic and metaphorical ordering' (Fernandez, 1986:187).

Thus, culture-specific design can be more accurately defined as design which responds to and supports the specific cultural characteristics of various user groups (Rapoport, 1987).

According to the environmental psychologist Reser (1979), there is a high level of stress related to the lack of adjustment of buildings with cultural practices, which influences the capacity of adaptation and control over the environments. It should be implicit for the designer that the architecture they create takes a culturally appropriate form, as a way of promoting wellbeing 'by supporting the cultural beliefs and practices of its users in the physical environment and reducing environmental stressors' (Memmot and Keys, 2015:281).

As part of the complexity of the built environment, the use of building materials becomes a fundamental element in the process of promoting cultural-specific responses. The analysis of building materials used over time and space serves as a clear indicator of cultural and environmental changes. Understanding how communities communicate their desires and needs by replacing some materials and adopting new ones can provide significant clues to develop architectural interventions that are culturally-responsive.

By working across cultures, Amos Rapoport laid the foundations for a new field of architectural study, or Environmental-Behaviour Studies (EBS), under the premise that built environments are conceived to give support to people's behaviours and activities. Within EBS there must be an attunement to both the required dynamics of people-environment interactions and the cross-cultural diversity of behaviours (Memmot and Davidson, 2008).

Building upon EBS, research groups such as the Aboriginal Environment Research Centre (AERC), have sought to further develop a framework for socio-environmental design and a cross-cultural theory of Architecture. Despite the fact that EBS and Cross-Cultural Architecture look at design from a much wider angle than localised studies, the approach and methods used can be easily extrapolated to the realm of building materials.

The conspicuous nature of building materials has the capacity to turn them into powerful symbols which embody connotations of status and identity (Kaitilla,1991). Despite the significance of socio-cultural cues that choice of building materials can convey, the topic has not been adequately addressed in research (Baudrillard, 1996). In fact, materials have been often defined by their technical properties, paying much less attention to the social processes through which people relate to them. Above all, questions about how building materials are experienced and the environmental impacts resulting from their usage must be at the core of building materials' research (Richardson, 1982). Only by taking this into account will it be possible to successfully promote the integration of sustainable building materials into cultures of construction and architecture.

03

ANALYTICAL FRAMEWORK

3.1 The benefits of locally-sourced building materials

With the expansion of a globalised construction market, societies have tended to see building materials as products rather than as resources, leading to the dissociation of people from its own environment.

In the global south (and particularly in indigenous contexts) populations can however still be very connected to their environmental resources (Rudolfsky, 1964). The responsible use of materials for construction is a key element in promoting sustainable management of these resources. Tackling this issue means acknowledging that a change in the construction industry is required in order to reduce Greenhouse Gas (GHG) emissions, as for instance the production of cement that contributes as much as 8% of the total amount of emissions (Rodgers, 2018).

The current challenge in the context of the global south lies in effectively utilising and supplying affordable, innovative building solutions by using locally-available materials, as a way to reach the poor who constitute around 70% of the urban population (Magutu, 2015).

Two main reasons are proposed here as to why local and sustainably sourced materials are so important:

- **The contribution of locally sourced-materials in mitigating and adapting to climate change**

The production of building materials counts for around 40% of the total energy consumption within the construction industry, mostly through the production of cement and steel (Mankelov et al., 2010). According to the IPCC Report (2019) and the Paris agreement (2016), there is an urgent need to adopt measures in order to reduce GHG emissions and the construction sector plays an important role in achieving this goal.

Historic and traditional building techniques regulate temperature flows with passive cooling systems whilst often making use of local materials such as stones or earth, in turn reducing power demands and the need to transport material for long distances (Beckett and Ciancio, 2012; Orsini and Marrone, 2019). Vernacular mud houses in Nigeria are a valuable present example, and the traditional cooling systems employed are still used by architects such as Demas Nwoko (Croyle, 2020). On the other hand, many contemporary architecture strategies have largely avoided considering local climate conditions by incorporating air conditioning and heating systems. Active cooling

systems such as air conditioning release 1 gigatonne of annual GHG emissions (Foroudi, 2020), consisting of 20% of the total electricity used by buildings (IEA, 2018).

At the local level, there is a need to put in place measures to control the excessive pressure on certain natural resources in order to mitigate adverse weather effects as draughts and excessive rainfall. Also, the proper management of local resources contributes to the knowledge around the close environment, leading to better adaptation to climate change.

- **Local materials' key role in promoting environmental justice and the autonomy of local communities**

For thousands of years humans have utilised the environment, transforming the materials found in the surroundings to generate construction systems that are attuned to (and in part constrained by) the geological, climatic and cultural conditions of a given place. For this reason, Habitat International Coalition-Latin América (HIC-LA) has recently launched a manifesto where it argues for the need to recognise the importance of and right to create constructions that use and build upon traditional knowledge by using local materials and adapted techniques.

The use of these technologies has the potential not only to reduce the impact of construction on the environment but also boosts circular economies by providing employment to producers of construction materials and to skilled workers. Alongside this, it can help to strengthen the social fabric, improve communities' adaptive strategies of resilience and fosters a sense of belonging. Furthermore, according to Turner (2018) the equitable supply of locally-sourced materials also contributes to the autonomy of societies, encouraging self-sufficiency by reducing the pressure on the mainstream construction market.

In the case of indigenous communities, the built environment is also an important aspect of their heritage, as traditional buildings are part of their identifying symbols and lifestyles. This helps in claiming and re-asserting their own identity and autonomy (Rowland, 2002).

The current challenge in the context of the Global South lies in effectively utilising and supplying affordable, innovative building solutions by using locally-available materials, as a way to reach the poor.

3.2 Three-tier categorisation of building materials' cultural meanings

Rapoport argued for a three-tier categorisation through which to understand how cultural meanings influence human-environment interactions. In doing so he hoped to develop an empirical method through which to dismantle and examine different socio-cultural influences on the built environment.

Drawing inspiration from this, this study seeks to reinterpret this technique in order to explore the significance of building materials as an essential component of the built environment. In this way, it is argued that this three-tier system of meanings could be applied in the following ways (fig. 1):

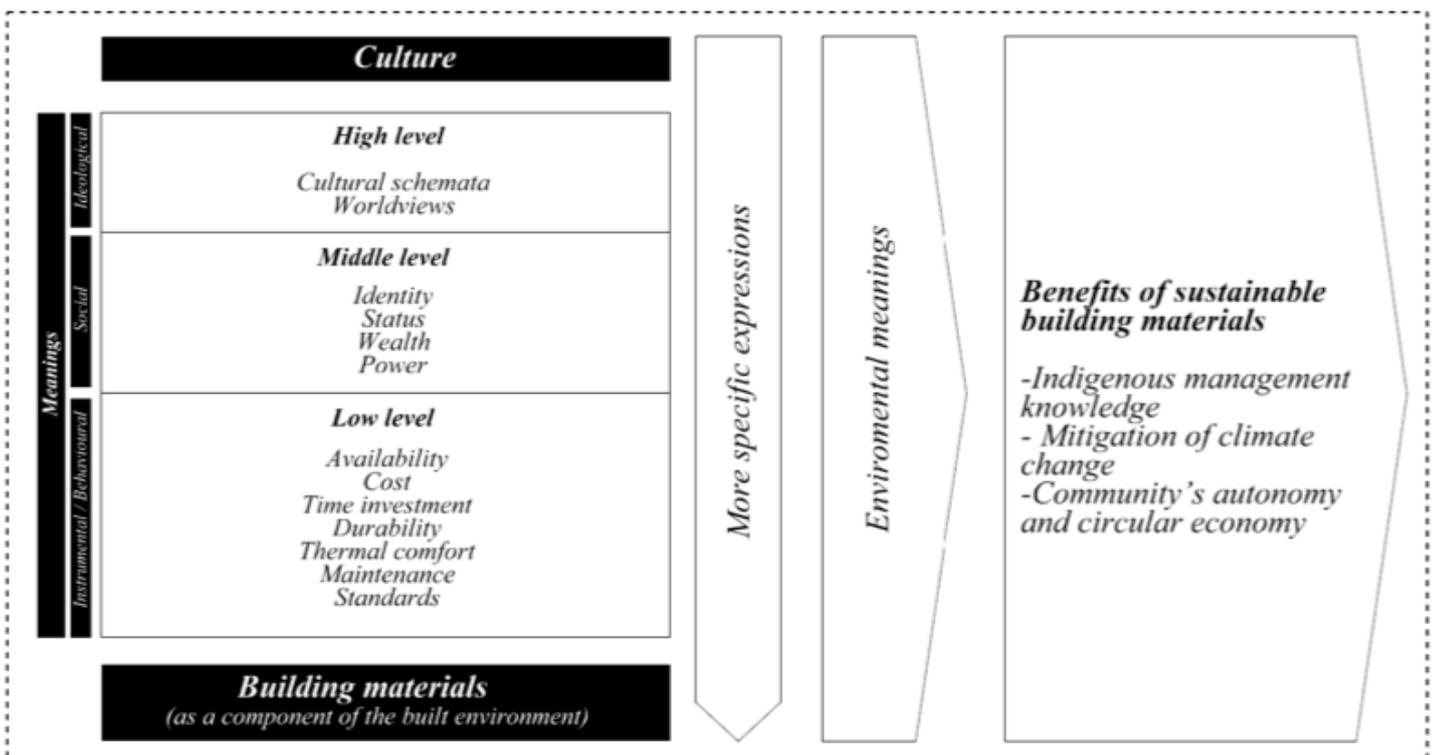
- 1. High level or Ideological meanings.** They relate to the most spiritual and symbolic level of meanings, and therefore are the least specific. However, two types of meanings might still be useful in the exercise of unpacking cultural dimensions of building materials: cultural schemata, so mental structures which contain knowledge about culture and social interactions and are often created through common-shared experiences (Garro, 2000) and worldviews, as the particular way in which a certain group see the world, that is intimately linked to the values of a society.
- 2. Middle level or social meanings.** This set of meanings relates to social expressions of culture, that are highly relevant to understanding the way in which indigenous communities associate to building materials. Of particular concern are: identity, so how a group maintains a view of itself over time; status, so which are the key indicators of a high-reputation in a certain social context; wealth, as it is quite easily expressed through sought-after and expensive materials used in facades and roofs and power, as building materials used by influential groups of people may become associated with authority.
- 3. Low level or behavioural meanings.** These sets of meanings are the most straightforward signifiers that can be observed from the use of building materials. In order to find low level meanings in the built form, patterns such as practicality, accessibility, privacy and the like are analysed in relation to peoples' behaviours (Rapoport, 1990). By focusing on these instrumental meanings, we are able to understand the mundane and day-to-day interactions with certain building materials. Transparency, texture, warmth, etc. all have an impact on daily behaviour and navigation through space. In order to narrow the scope of the study, only specific indicators will be subject to detailed analysis: availability, measured in relation to the quantity of a material available locally and the distance users need to go through to have access to a certain material; cost, so the affordability of a material; time investment, in relation to the amount of time needed to complete a building using a specific material or technique; durability, which refers to resistance to the elements and aging; thermal comfort, concerning the capacity of a certain material or technique to maintain comfortable temperatures inside the building; maintenance, which refers to the required

amount of repairs or adjustments that a material or technique may need within a period of time and standards, concerning policies and norms about the quality and suitability of a building material.

It is also important to note that Rapoport has argued that this classification of meanings requires a flexible capacity of understanding when some meanings may shift (Rapoport, 1990). A precondition for the threefold classification of meanings is that a theory of cross-cultural architecture must also be able to explore how different meanings may vary across time and to seek to explore which variables are influencing such change.

Figure 1.

Analytical framework representation. Culture is unpacked in three types of meanings that influence the built environment. The analysis also takes in account the benefits of using sustainable building materials. Source: Own illustration.



04

CASE STUDY

4.1 Methodology and limitations

This analysis applies qualitative research methods by using both secondary data from published academic literature and primary research. The latter was collected across several fieldwork periods between June 2018 and September 2019 and predominantly based on an ethnographic study conducted in a specific Tanzanian Maasai village with the support of a C-re-a.i.d NGO.

It is acknowledged that the findings might be neither representative nor applicable in a wider context due to the singularity of Maasai culture and the narrow field of study within one village named Maji Moto (Arusha). As such, the aim of this study is to analyse the different socio-cultural meanings that have influenced the choice of building materials in this specific Maasai settlement. This research could further help in understanding future changes and in influencing the design outcome of architectural projects in other sedentary Maasai settlements due to the similarity with the case study village.

4.2 Chronological analysis of Maasai Communities' building techniques: The case of Maji Moto

Evidences from Nomadism

According to the tribe's own oral history, the Maasai originally from the Lake Turkana started migrating from the area of the Great Rift Valley in the 15th century (Waller, 1976). The extent of Maasailand has been reduced in the present to areas around the border between Kenya and Tanzania (Coast, 2000). The reason for such reduction of Tanzanian Maasai lands relates with the numerous evictions that the Maasai have been subjected to since 1896 (Homewood et al, 2009). First, due to the new regulations to control wildlife introduced by the German colony, and later increased by the British colony since 1940 onwards (ibid.).

These lands have historically been used by the Maasai to practice nomadic pastoralism so as to search for water and pasture for their cattle, which is their main source of livelihood (Sambu, 2018). Given the nomadic character of this community, shelter has generally been treated as temporary and consequently the materials employed to build a traditional Maasai hut (enkaji in Maa language) must be readily available in a dry-savanna environment. Thus, traditionally, un-intensive materials are frequently used then discarded.

Normally, the walls of the enkaji are built with wattle and daub, an indigenous construction technology consisting in a wooden framework smeared by a mix of cow dung and mud (Coast, 2000). Similarly, rooves are built with a thatching technique, which consists of a layering of dry vegetation such as straw, water reeds or rushes (Fig. 2). On top of it, several layers of cow dung and mud are applied to provide a waterproof surface (Edström and Nyman, 2017).

The traditional form of the Maasai hut is either circular or semi-rectangular and normally pastoralist Maasai move in groups creating compounds, Olmarei: a 'collection of houses about a communal gate' (Coast, 2000:38). In nomadic Maasai culture, women own their houses and are responsible for their construction and up-keep. Women build their houses for themselves and their children, whilst husbands will only stay periodically. Talle (1987) describes women as the 'head of houses', which has given them a certain level of economic and domestic autonomy. The role of women in construction is important in understanding the shape of the houses and the choice of building materials along with proximity and pressing domestic responsibilities (ibid.). The use of temporary materials to build enkaji, enables pastoralist groups to move away whenever is needed and at no cost. In this way, building materials are intimately connected to lifestyle and activity systems forming part of the encoded symbols within nomadic Maasai communities. Thus, as Rapoport argues (1983:258), 'highly supportive environments become essential' to maintain the lifestyle and practices of a given group of people.

In order to deepen the understanding of building techniques socio-cultural meanings, traditional pastoralist building techniques must be analysed through the lens of Rapoport's three-tier categorisation of meanings. However, ideological meanings within the Maasai nomadic lifestyle do not seem to be of relevance, as in their vernacular form, building materials are essentially significant in that they support nomadic activity systems which are relational to the environment. Nevertheless, cultural schemata is reflected in the traditional Maasai hut, as a form of active involvement of members within the close environment, which is also an essential and supportive element of the Maasai culture (Coast, 2000).

In relation to social meanings of building materials, they resolve around identity. Building materials, and by extension the way in which dwellings are built, are powerful in connecting individuals to the identity of their group, embodying their nomadic essence. The sense of membership increases cultural identity through the connection with the traditional practices around the construction of dwelling.

Low level or behavioural meanings are the easiest to categorise within the nomadic period due to their connections to context. One factor is availability. The presence of suitable building materials has a direct impact on the techniques used to work with them. Mud can be found anywhere and those Maasai households who are still pastoralist and own cattle, have easy access to cow dung, alongside sticks and straw which occur naturally throughout the savannah. In terms of cost, these materials are free and by contributing with labour, households can build their own houses. The investment of time required to build a house was

also taken into consideration by homeowners, since the vernacular hut is a temporary construction and therefore its construction needs to be quick. Thus, they can provide shelter rapidly whenever the household needs to move (Svard, 1980).

The transition from nomadism to sedentarisation

Until 1896, Maasai communities of Tanzania had been able to practice nomadism without much difficulty as all land was managed and owned communally (Sambu, 2018). Yet, during the colonial period in the 1940s, individual land ownership began to be imposed over Maasailand (Coast, 2000). As a result, nomadic territory shrunk and land-use changed, drastically reducing the extent of their lands (De Vries and Fortmann, 1979). Another factor that has contributed to a progressive decline in the nomadic Maasai lifestyle have been conservation policies, through which large tracts of land were expropriated for the exclusive use of national parks and wildlife conservation.

Yet the most significant policy was introduced in 1967 when the Tanzanian government led by Julius Nyerere, implemented so-called 'villagisation' policies (Cannon, 1999). These policies were aimed at encouraging nomadic communities to shift to a sedentary lifestyle by settling in official villages. By 1973, the voluntary villagisation policy became compulsory and within a period of three years, many nomadic groups were obliged to live in villages (Raikes, 1978). Thus, the traditional Maasai hut built with wattle and daub and thatch was no longer suitable for a sedentary lifestyle (though in some cases they still practice semi-nomadism).

The first villagers arrived at Maji Moto in around 1976, according to several elder interviewed neighbours. This coincides with the period in which the villagisation process was completed by the Tanzanian government. This process has continued to have a profound impact on the culture of Maasai communities (Sambu, 2018) and has in part led to the substantial loss of traditional knowledge.

- **Ideological meanings**

With the implementation of the villagisation policy, the forced abandonment of their previous pastoralism changed their worldview considerably. In this way, new cultures, lifestyles and values started to develop and in turn opened the Maasai up to new building techniques and styles that were used by other already sedentary groups (Rukwaro et al, 2001).

- **Social meanings**

One of the key middle level meanings was the manifestation of economic improvement and wealth. (Rukwaro, 1997). New materials bought with money encoded information about the purchasing power of community members. For the first time, as they settled permanently, they started acquiring materials like CIS that were more durable and waterproof.

- **Behavioural meanings**

The degree of permanence of building structures was essential to permit the transition from a nomadic lifestyle to sedentarisation and thus durability and maintenance became a key low level meaning

(Coast, 2000). CIS were relatively easy to find in near-by towns, and by protecting walls with a pre-constructed waterproof material (unlike complex thatch), there was less need to repair the roof during the rainy season (Svard, 1980). As Coast pointed out, the presence of CIS for housing 'may be both a cause and an effect of increasing levels of sedentarisation' (2000:38). Also, adobe bricks started to be used, which also requires less maintenance than wattle and daub (Fig. 2). Consequently, the use of wattle and daub and thatching roofs decreased.

With the arrival of a more sedentary lifestyle, so too did the need for greater thermal comfort. The thickness of adobe bricks protects from the direct heating during the day and retains heat to be released at night, during the coldest hours.

Sedentary lifestyle

From 1976 onwards, Maasai villages experienced a drastic transformation of their built environment. The gradual reduction of cattle and the introduction of agriculture has visibly changed local architecture (Bryceson, 1990). However, the sedentarisation process has also led to the loss of traditional knowledge, which has led to a reliance on external resources and building materials. These are expensive and as a consequence, this has led to the impoverishment of its inhabitants and men have emigrated to towns in order to provide for family members.

Adobe bricks themselves are currently largely neglected in favour of newer building materials. The most popular walling solutions are fired clay bricks. These are an 'improved' version of adobe bricks, consisting of mud bricks that bake for 48 hours in a stacked hand-made oven (Edström and Nyman, 2017). The main problem in the use of this material is the process of desertification that is associated with its production. According to Lafarge Holcim Foundation, 14 trees need to be cut down to produce enough bricks for one house (Lafarge Holcim, 2016). Similarly, intensive production of concrete blocks has become popular (Rukwaro et al, 2001).

The use of the thatching technique as a roofing system has almost disappeared, and the few vernacular houses with a thatched roof, are abandoned or used as kitchens (Fig. 2). Furthermore, while several years ago CIS needed to be purchased in Arusha Town, 40 km away from the village, they are now widely available in the surrounding settlements.

- **Ideological meanings**

By analysing building materials used in Maji Moto in the present, one might notice that traditional beliefs, worldviews or cultural schemata are no longer expressed by architecture (Memmot and Davidson, 2008). In an attempt to understand how socio-cultural dynamics have changed in relation to this, it is argued that the few ideological meanings have been 'eroded' and replaced by mostly middle level or social meanings.

• **Social meanings**

Middle level meanings have recently acquired more importance and for this reason, it appears as if they have shifted their position, moving to a higher level as primary symbols. The most meaningful social meanings that building materials embody in the present context are largely related to status. By progressively introducing new materials that are signifiers of greater wealthy, those who can afford the purchase of CIS and concrete blocks gain social status among the villagers (Kaitilla, 1991). As such, building material becomes a kind of identity of its own. Similarly, ‘desirable’ stylistic cues are frequently drawn from houses of the elite. For this reason, by choosing these building materials that are socially desirable, one might be able to communicate power.

• **Behavioural meanings**

Currently, villages have become integrated into institutionalised systems, and therefore houses need to be built following building and planning regulations. As such, standards have gained importance. Alongside this, the government is promoting the use of standardised materials in order to have control over quality, whilst progressively neglecting the use of earthen and other natural building techniques (Makenya and Nguluma, 2007). In doing so local materials are incorrectly deemed as poor-quality.

Figure 2.

Chronological analysis of building techniques. Table shows materials and their related meanings over time. The percentage represents the rate of each material’s use. Source: Own illustration.

<i>Building materials as Core Elements</i>		<i>Building Materials as Peripheral Element</i>	
<i>15th century</i>	<i>1896</i>	<i>1973</i>	<i>2019</i>
<i>Nomadic lifestyle</i>		<i>Period of sedentarisation</i>	
<i>Locally-available resources</i>		<i>Dependance on external resources</i>	
<i>Walls</i>	<i>WATTLE AND DAUB 100%</i>	<i>WATTLE AND DAUB 20%</i>	<i>WATTLE AND DAUB 2%</i>
		<i>ADOBE BRICK 80%</i>	<i>ADOBE BRICK 30%</i>
		<i>CONCRETE BLOCK 11%</i>	
		<i>FIRED BRICK 56%</i>	
<i>Roofs</i>	<i>THATCHING 100%</i>	<i>THATCHING 35%</i>	<i>THATCHING 12%</i>
		<i>CORRUGATED ROOF SHEETS 65%</i>	<i>CORRUGATED ROOF SHEETS 78%</i>
CULTURAL MEANINGS			
<i>High level Cultural schemata</i>	<i>High level Worldviews</i>	<i>High level -</i>	
<i>Middle level Identity</i>	<i>Middle level Wealth</i>	<i>Middle level Status / Power</i>	
<i>Low level Availability / Cost / Investment of time</i>	<i>Low level Durability / Thermal comfort / Maintenance</i>	<i>Low level Standards</i>	

4.3 Findings

Comparative analysis of current building techniques' cultural meanings

Through the chronological analysis described in the chapter above, one of the clearest takeaways is the progressive neglect of locally-sourced building materials. In fact, in Maji Moto, 78% of houses were already covered by CIS rooves by 2019, and more than 56% have used fired bricks.

Two main reasons are claimed to be drivers of such change. The first relates to the shift in land tenure which forced Maasai communities to settle permanently (De Vries and Fortmann, 1979; Munei, 1991). Another reason is the sudden contact with other cultures and societies that the Maasai experienced, leading to a process of syncretism between different cultures (Coast, 2000). As a consequence, building materials that were supportive of the nomadic lifestyle have been relegated to a peripheral position. New values have taken precedence over traditional ones, and so the meanings that some materials encode are now obsolete or forgotten.

According to Rapoport's three-tier categorisation of meanings, middle level social meanings are considered less important in defining the characteristics of a culture (Rapoport, 1990). However, sedentary Maasai communities, new middle level meanings have become more important than old high level meanings (Fig. 3). This is further exacerbated by the arrival of social media and the notions of individual social identity that it emphasises (Baird, 2017).

Ironically, in nearby cities such as Arusha or Moshi, buildings which offer services to tourists as bars or hotels are covered in thatched rooves that look similar to the traditional hut, marketing the otherness and distinct identity of these designs. Also, in some European contexts, thatched roofs demonstrate status (Rapoport, 2001) through the perceived ownership of history.

The increased importance of mid-level social meanings has also influenced values attached to instrumental and behavioural meanings (low level meanings). In the past, requirements such as availability and low cost (with far less impetus on time) were essential requirements. The Village Museum in Dar es Salaam notes that a nomadic lifestyle allows for little time to be spent in the houses. A house is a place to sleep, to prepare and partake of food during rainy weather. It is a place to be born, to be ill, to make love and ultimately to die' (Edström and Nyman, 2017).

On the other hand, factors such as maintenance and durability have proven to be highly relevant (Fig. 3). Earthen walls, if they are not properly protected, will deteriorate rapidly during rainy seasons. In Maji moto, some old women still carefully repair the surface cracks of their adobe brick houses when they appear. This action is seen as pointless and outdated by younger generations whose purchasing power enables them to build concrete houses. Now only 30% of houses in Maji Moto have adobe walls, while the 2% of houses have used wattle and daub.

Another influential factor that is driving the shift towards concrete blocks and CIS, is standards. The Tanzanian government is encouraging rural dwellers to adapt their houses to standardised materials (Kasilima, 2008) and they see that by their measures, housing is broadly speaking 'improving' (ibid.). In this way, the authority's disapproval of using locally-sourced materials is increasing the notion that these constructions are backwards and poor (Croyle, 2020).

According to the National Population Census of 2002 in Tanzania, only about 17.9% of rural dwellers have built their houses with concrete blocks or fired bricks, and about 32.5% of the rural population lives in houses with CIS rooves (Kasilima, 2008). Compared to Maji Moto's percentage of CIS rooves use (78%), and of fired bricks use (56%), it appears evident that a change in the building tradition has moved faster in the village if compared with the national rate. Probably this is due to its proximity to Arusha Town, whose influence on the village has become visible. Despite concrete blocks being the most expensive among the walling solutions, their resistance and approval from authorities makes them an increasingly desirable choice, accounting currently for around 12% of houses in the village.

If we observe thermal comfort across several building techniques, standardised materials are less climatically suitable (Fig. 3). This is especially the case with CIS rooves, as its thermal conductivity causes high temperatures inside buildings. By contrast, the use of traditional thatched rooves results in lower indoor temperatures (Svard, 1980) whilst walls that use earthen techniques such as adobe bricks and rammed earth have low heat-conductivity (Foroudi, 2020; Synder, 2020). CIS rooves and concrete blocks are less comfortable climatically, yet despite this, status and the ability to remain waterproof is more important. Only around 12% of dwellers in Maji Moto still have a thatched covering roof, though the majority of dwellers are saving so to replace thatched roof for CIS as soon as they can afford it.

Cultural schemata and worldviews have changed in a short period of time but what seems clear is that the image of the traditional hut is still a key cultural symbol. Despite new construction trends that have progressively neglected the use of vernacular building techniques, Maasai people see the values of their past nomadic tradition reflected in the Maasai hut or enkaji. Also, with the expanding interest of tourists in the Maasai tribes, there has been a growing acknowledgement of their culture values and sense of belonging in relation to the vernacular constructions (Koot et al, 2019). Very often, olmarei are visited by groups of tourists, becoming a new source of income for Maasai communities. As such, 'Maasainess' has a valuable meaning for both constituent members and non-member of that group, both in the past and present (Coast, 2000).

This is not to say that Maasai ethnicity has a static meaning (ibid.). The current picture of sedentary Maasai settlements like Maji Moto represents in part the local desire for change and progress, in which local inhabitants value the access to education infrastructures and health services (Rukwaro et al, 2001). For instance, after the implementation of villagisation policies, the government managed to

provide schools for a larger number of children (Wanjala & Were, 1987), which enabled Maasai to converse more freely with other people, further modifying their values and expectations (Rukwaro et al, 2001).

Despite present constructions not representing the traditional beliefs and values of Maasai, these new built forms, often a combination of old and new techniques, communicate multiple identities and desires. New worldviews and cultural schemata represent 'the many different affiliations of an individual with other kinds of groupings such as gender, region, class, and religion (Coast, 2000:28), created by a high level of syncretism between ethnic groups in Tanzania.

Comparative analysis of selected building techniques' socio-environmental meanings

Most Maasai settlements such as Maji Moto are facing the effects of climate change as a result of uncontrolled deforestation. Such widespread damage is driven partly by the high demand of firewood needed for the production of fired clay bricks (Lafarge Holcim, 2016). The population of the village is growing, and many more houses are required, so fired clay bricks are the most viable solution for the majority of the population (García, 2020).

In response to this, during 2018, C-re-a.i.d. NGO promoted the construction of a local health centre with an innovative sustainable technique; Compressed Stabilised Earth Blocks (CSEB). After a study of the area, a group of local workers was trained to carry out the production of bricks by pressing them with a manually operated machine. Production consists of 70% clay from the site, 15% sand and between 7% and 10% of a stabilising agent, which can be cement or lime (Nambatya, 2015).

The fact that they do not need to be fired, but are instead water-cured, avoids using firewood to bake clay bricks. The use of CSEB instead of concrete blocks prevents the degradation of the natural environment due to sand and gravel extraction (Brown, 2019) and by reducing the use of cement. As they are compressed, they are much more durable than traditional adobe bricks. CSEB have 80% higher compressive strength than fired bricks, which is similar to concrete blocks (Nambatya, 2015).

A skilled group of four produces around 500 blocks in an eight-hour working day, whilst the time required to build one linear meter of wall is very similar to concrete and fired bricks one (Pérez-Peña, 2009).

Whilst 500 concrete blocks cost around 200 GBP, to produce this amount of CSEB 4 cement bags are needed at a cost of 8 GBP each. Even with additional costs such as sand and labour, CSEB is still a much affordable option than concrete blocks (García, 2020). One disadvantage in the use of CSEB relates to the need for skilled workers to produce a quality product, which if not done properly can ruin the final product. Also, compared with the very popular fired bricks that can be produced for free, it is acknowledged that the cost of production can be demanding and maybe restrictive for some, although overall cost is still accessible when compared to other techniques.

The use of CSEB might be a potential alternative solution to the use of fired bricks and concrete blocks in Maji Moto. Unfortunately, if we look at the social meanings of CSEB compared with the other two walling solutions used currently (fig. 4) it can be observed that this building technique embodies negative social values. This is because, despite CSEB being an innovative technology, the fact that it uses raw earth means that is viewed as poor, low quality and backward. Important embodied meanings of wealth, status and power achieved by concrete blocks and fired bricks are not currently met by CSEB.

To understand the community's concern with earthen building techniques, regular meetings were held with women's groups, local government and community representors. It was also proposed by the local government to organise campaigns to tackle environmental problems related to the use of fired bricks. Several participatory workshops were also organised, as well as training sessions for young workers that wanted to learn CSEB technique. During the construction process many people were curious about the compressing machine and were also surprised by the strength of CSEB. Finally, some neighbours inquired how to rent the compressing machine and showed interest in the technique.

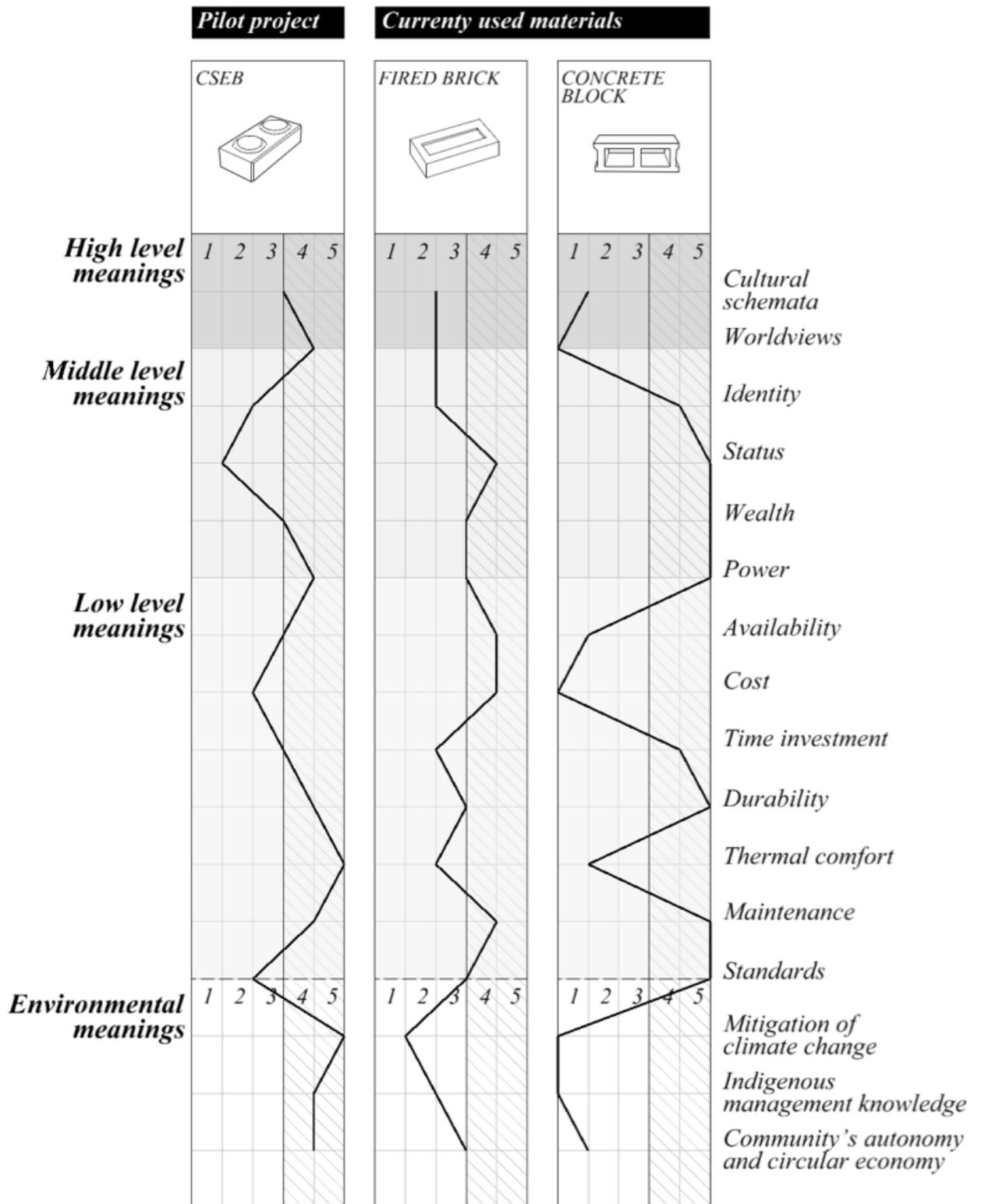
An impactful transition towards the recognition and normalisation of the use of locally-sourced materials should start from the awareness about its personal and environmental benefits. Education about the benefits of such materials is an essential component in the fight against climate change. The use of CSEB can considerably contribute to mitigation at the local level by avoiding deforestation (Fig. 4). Its use also contributes considerably to protecting indigenous knowledge about resource management, which is essential in the protection of the environment. In this case, also local governments should be responsible for implementing policies against the uncontrolled felling (García, 2020).

But above all, the use of locally-sourced materials as CSEB contributes to the autonomy of local communities, boosting local economies and strengthening the social fabric, promoting social and environmental justice (HIC-LA, 2019).

Recognising the need to shift from the current building mainstream should however not be about imposing. Instead, it should be about proposing affordable and sustainable alternatives for all, especially for those who cannot afford high quality building materials. The use of locally-sourced materials is a viable solution as well as a crucial element in making the housing sector energy-efficient, during and after construction (UN-Habitat, 2019). The price of housing could be considerably reduced by utilising locally-sourced raw materials whenever such materials are largely available within the environment and renewable resources (RICS, 2008). Such shift should be encompassed by a growing acknowledgement of building material's impact from the construction market, leading to more viable and environmentally-sustainable building solutions that are affordable for all.

Figure 4. Comparative analysis including socio-environmental factors. The chart makes a comparison between the different meanings of specific building materials. It also makes a comparison of these building materials in relation to socio-environmental benefits. Source: Own Illustration.

With this in mind, the government needs to take steps to promote the integration of locally-sourced building materials by reviewing the regulations that prevent the use of such materials (Croyle, 2020). Furthermore, it has been argued by HIC LA that by giving financial and technical support to local dwellers from the governments, they could ensure the proper quality of building materials while promoting the autonomy and self-reliance of local communities (Comunal, 2020).



05

CONCLUSIONS

Current building material preferences in the village of Maji Moto are part of a complex cultural and multi-generational milieu that has been built over several decades and may require several more to be effectively challenged (Sadalla et al. 1993). In the present this study has shown that it is possible to see how years of forced cultural erasure by government policy have taken their toll on Maasai cultural norms (Cannon, 1999). Not only through the forced abandonment of pastoralism and nomadism, but also through implementing inflexible building standards based off of western hegemonic models; governance has hindered the ability of communities and grassroots organisations to adapt to change and re-contextualise architecture (Makenya and Nguluma, 2007). We can also see that architecture's previously somewhat peripheral status within Maasai culture has enabled a fast change in architectural culture (Coast, 2000) leading to a rapid intertwining of architecture and status and the deeming of traditional vernacular techniques as lesser (Croyle 2020). Policy makers and community activists however should take some comfort in the fact that this also makes these areas potentially more open to change which we experienced with the rapid build of interest in CSEB bricks.

Ignoring values and social expectations can be counterproductive and so the paternalism of the traditional architect needs to be challenged.

In an increasingly urbanised world the construction industry's substantial environmental impact (Rodgers, 2018) makes it essential for academics to understand societal behaviours that can inform better ways of promoting sustainable building practices. With a view to encouraging the integration of locally-sourced building materials into building practices in indigenous contexts, this dissertation has adopted Rappaport's (2005) three-tiers of cultural meanings to provide a new tool for social scientists and designers alike. Furthermore, this study highlights a couple of key areas for change in policy and praxis to help support the use of more sustainable materials.

Whilst this study offers only one potential building material solution to sustainable construction, this paper addresses key concerns for this particular Maasai community that may end up being mirrored (albeit with local differences) across other societies. Such local initiatives have great potential through their promotion of autonomous construction networks but as a result they are highly dependent on community uptake (Isasi, 2018) and thus flexible finance needs to be available for pilot schemes as well as a more sensitive set of building standards. For the Maasai who are still dealing with a rapid change in lifestyle, such activities could help act as a stabilising force, empowering communities to regain the connection with their own territory and their own lives (Marchand 2009) and encouraging inter-community interaction.

This study also highlighted the importance of reshaping the role of designers. Approval of new techniques only improved when participation in the construction process through demonstrations were implemented. This highlights the importance of participatory design processes in which the designer or expert acts predominantly as a facilitator (Freire, 1968). As this study has explored, ignoring values and social expectations can be counterproductive and so the paternalism of the traditional architect needs to be challenged. In doing so it also seeks to offer a decolonial critique of how regulations can be successfully challenged by offering viable, immediately workable solutions that recognise that standards are not universal (Khandwala 2019).

Larger firms need to push building solutions that rely on locally-available and sustainable resources.

Nevertheless, it should be noted that this study only offered a brief snapshot at one particular moment and therefore it is understood that to genuinely explore the efficacy of the introduction of new building materials, further visits will need to be conducted in the future to measure change over time as well as in new locations to understand how universally popular such new methods are. Furthermore, whilst it is tempting to place responsibility on designers and communities, responsibility must also be taken by the construction industry, which plays a major role in finding viable solutions in line with environmental sustainability and dictating what is considered acceptable. Larger firms need to push building solutions that rely on locally-available and sustainable resources.

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