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## ***Toward the Production of Contextual Built Environments: Unfolding Building Materials' Sociocultural Meanings in a Maasai Community***

*Hacia la creación de entornos contruidos conforme a su  
contexto: La revelación de los significados socioculturales de  
los materiales de construcción en una comunidad maasai*

*Rumo à produção de ambientes construídos contextuais:  
Revelação dos significados socioculturais dos materiais de  
construção numa comunidade maasai*

### **Keywords | Palabras clave | Palavras chave**

Environmental behavior studies, Innovative building techniques, Indigenous communities, Meanings, Building materials

Estudios de conducta medioambiental, Técnicas de construcción innovadoras, Comunidades indígenas, Significados, Materiales de construcción

Estudos de comportamento ambiental, Técnicas de construção inovadoras, Comunidades indígenas, Significados, Materiais de construção

### **Abstract | Resumen | Resumo**

Is it possible to analyze building materials' culturally specific meanings? How can understanding such meanings be useful in the integration of sustainable building practices in local communities? Our research explores this question with the objective of informing future pathways in the transition to a carbon-neutral built environment including locally sourced materials. Relying on environmental behavior studies and using Rapoport's methodology for three-tier categorization of meanings, our study examines sociocultural perceptions and behaviors around the use of building materials. It focuses on the case of a Maasai rural community in northern Tanzania with a view ultimately to shedding light on specific practices and innovations in building materials, such as compressed earth blocks, whose use should be considered by architects and designers in preference to counterproductive or non-contextual techniques.

¿Es posible analizar los significados específicos desde el punto de vista cultural de los materiales de construcción? ¿Cómo puede contribuir el conocimiento de esos significados a la integración de las prácticas constructivas sostenibles en comunidades locales? En nuestra investigación exploramos esta cuestión con el objetivo de documentar las futuras vías de transición hacia un entorno construido neutro en carbono que incluya materiales de origen local. A partir de los estudios de conductas medioambientales y utilizando la metodología de Rapoport para la categorización de los significados en tres niveles, nuestro estudio examina las percepciones y conductas socioculturales sobre el uso de los materiales de construcción. El estudio se centra en el caso de una comunidad rural masái del norte de Tanzania con el fin último de arrojar luz sobre

prácticas e innovaciones específicas en materiales de construcción, tales como los bloques de tierra prensada, cuyo uso debería ser tenido en cuenta por arquitectos y proyectistas en lugar de otras técnicas no contextuales o contraproducentes.

Será possível analisar os significados culturalmente específicos dos materiais de construção? Como pode a compreensão de tais significados ser útil na integração de práticas de construção sustentável nas comunidades locais? A nossa investigação explora esta questão com o objetivo de informar os caminhos futuros na transição para um ambiente construído neutro em termos de emissão de carbono, incluindo materiais de origem local. Baseando-se em estudos de comportamento ambiental e utilizando a metodologia de Rapoport para a categorização de significados em três níveis, o nosso estudo examina as percepções e comportamentos socioculturais em torno da utilização de materiais de construção. Centra-se no caso de uma comunidade rural massai no norte da Tanzânia, com vista a elucidar sobre as práticas e inovações específicas nos materiais de construção, tais como os blocos de terra comprimida, cuja utilização deve ser considerada por arquitetos e projetistas como preferível face a técnicas contraproducentes ou não-contextuais.

## I. Introduction

At the last United Nations Framework Convention on Climate Change (COP25), a group consisting of social movements and civil-society and grassroots organizations advocated the use of local building materials as follows:

*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).*

With globalization and the growth of the construction industry (Foroudi 2020), which in 2018 accounted for 39% of global greenhouse gas emissions (IEA 2019), such an approach is essential in combating climate change and in achieving the eleventh Sustainable Development Goal, for “inclusive, safe, resilient and sustainable” dwellings and settlements (United Nations 2015).

Several authors have remarked upon the decontextualization undergone by architecture. Hassan Fathy, for instance, claimed that Egypt was forgetting its indigenous “identity” and that its new houses had lost all sense of character (Bertini 2020). The architect Demas Nwoko writes likewise that preferences for “modern” building forms and materials in Nigeria reflect an architectural colonization (Nwoko 2020, as cited in Croyle 2020).

Preferring the trappings of modernity and the imagery of material wealth, many local communities have forsaken their traditional buildings and vernacular techniques, thereby losing valuable knowledge needed to manage natural resources (Low 1988). This has led to the disintegration of sociocultural interactions with the environment and a resultant failure in the promotion of resilient and sustainable communities (Nwoko 2020).

However, an adapted, updated vernacular architecture has begun to gain traction in the fields of architecture and anthropology (Bonell and Van Geert 2009). In 2019, in *Lo-TEK, Design by Radical Indigenism* the academic Julia Watson highlighted “ignored local wisdom and indigenous innovation” (Taschen review: 1) as a way of putting into perspective the values and ethnological heritage of “non-pedigreed architecture”. This is in turn a way of challenging Western intellectual hegemony in architecture in favor of what Pietro Belluschi defined as “communal architecture” (Rudolfsky 1964: 3).

Unfortunately, many efforts to revitalize vernacular architecture fail to win the approval of locals, as external influences and new social values bias preferences toward standardized building materials (Rapoport 1983; Kaitilla 1994; Magutu 2015). The complexities of the built environment make it difficult to homogenize the intertwined socio-political, environmental and economic structures influencing the choice of building materials. Hence the challenge lies in supporting the use of locally sourced building materials that are culturally acceptable (Grierson 2009).

Focusing specifically on environmental behavior studies (EBS) and cross-cultural theories of architecture, the following questions are proposed:

1. How do sociocultural conditions influence the choice of building materials? Is it possible to analyze this influence in a constantly changing society?
2. How can an understanding of building materials' culturally specific meanings be useful in the promotion and integration of sustainable design practices including locally sourced materials?

## 2. Sedentary Maasai Communities and Cultural Syncretism

With rapid globalization, conflicts between tradition and “modernity” are inevitable worldwide. Indigenous communities under pressure to modernize 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 inevitable, but “radical, abrupt and frequently excessive rapid cultural change” (Rapoport 1983: 254). In order to understand how such pressure might be alleviated, it may be helpful to examine the socio-political pressures that modern indigenous societies face.

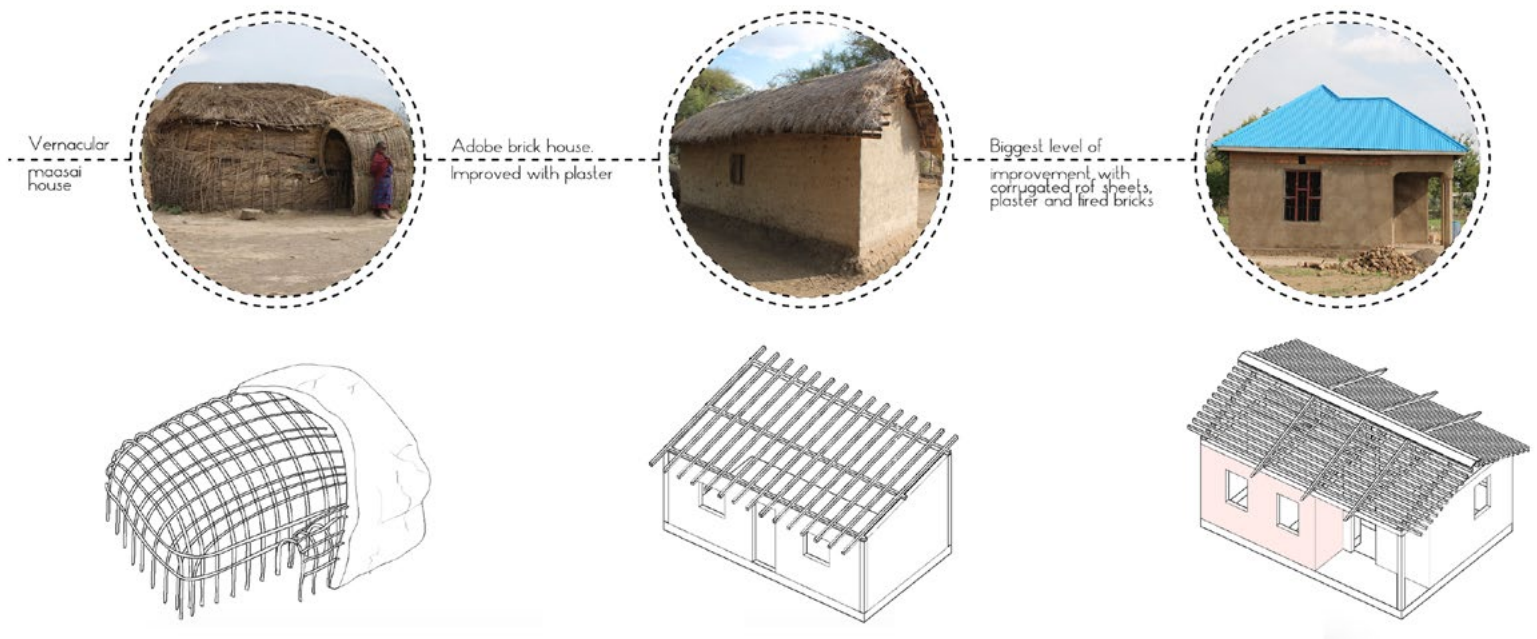
The idea of a “self-contained European culture” relies on the notion of “uncontaminated” (Bhabha 1994: 52) non-European cultures. This is of course not a reality,

given the heterogeneous nature of culture and the problematic portrayal of different traditional practices as “other”. Cultures are by nature plural and thus can be conceptualized only in relation to their environments and everyday practices. Furthermore, indigenous communities such as the Maasai have been subjected to the influence of colonial regimes, in this case German and English. For this reason Bhabha (1994) spoke of “cultures in-between”. By apprehending culture as a construct made of different influences with no delimited area, today’s anthropological theories explore blurred cultural boundaries and view them as active and alive rather than passive and static. The term fits with Andersen’s definition of indigenous cultures as “dynamic societies, in a continual process of adaptation, choice, and constraint” (Andersen 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 are gradually integrated into everyday life.

The result of this process is not the copying of Western models (as could seem from a glance at a present picture of sedentary Maasai settlements); rather the change appears 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 spatial-temporal evolution of built forms (Fig. 1). In this process of synthesis (and the reasons for it) within design, what needs to be considered is which elements are new, changing, or being replaced, and why.

Figure 1: Building types over time



### 3. Analytical Framework: Three-tier Categorization of the Cultural Meanings of Building Materials

Rapoport posited a three-tier categorization in order to apprehend how cultural meanings influence human-environment interactions. He aimed thereby to develop an empirical method through which to deconstruct and examine sociocultural influences on the built environment.

Drawing on this categorization, our study seeks to reinterpret this technique in order to explore the significance of building materials as an essential component of the built environment. Thus we contend that this three-tier system of meanings may be applied as follows (Fig. 2):

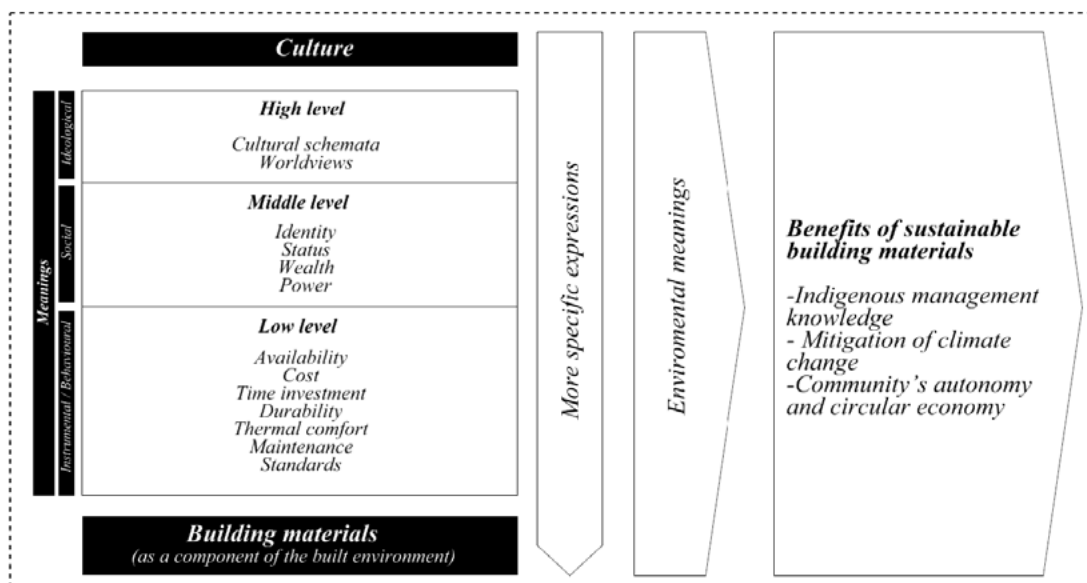
1. High-level or ideological meanings: These relate to the most spiritual and symbolic level of meaning, and therefore are the least specific. But two meaning types may still be useful in the exercise of unpacking the cultural dimensions of building materials: “cultural schemata”, i.e. mental structures containing knowledge about culture and social interactions, often created through shared experiences (Garro 2000), and “worldviews”, i.e. the particular way in which certain groups see the world, intimately linked to the values of a society.
2. Middle-level or social meanings: This set of meanings concerns social expressions of culture highly relevant to understanding the way in which indigenous communities relate to building materials. Of particular interest are: “identity”, i.e. how a group maintains a view of itself over time; “status”, i.e. key indicators of reputation in a certain social context; “wealth”, expressed through sought-after and expensive materials used in facades and roofing; and “power”, i.e.

building materials used by influential groups that may be associated with authority.

3. Low-level or behavioral meanings: These sets of meaning are the most straightforward signifiers to be seen in the use of building materials. Low-level meanings in built forms are found in patterns such as practicality, accessibility, privacy, and the like, analyzable in relation to behaviors (Rapoport 1990). By focusing on these instrumental meanings, we can apprehend mundane, day-to-day interactions with building materials. Transparency, texture, warmth, etc. all impact on daily behavior and navigation through space. To circumscribe our study’s scope, only specific indicators were analyzed in detail: “availability”, measured in relation to the quantity of a material available locally and the distance users need to travel to access it; “cost”, i.e. a material’s affordability; “time investment”, i.e. the time needed to complete a building using a specific material or technique; “durability”, referring to resistance to the elements and aging; “thermal comfort”, concerning the capacity of a material or technique to maintain comfortable temperatures inside a building; “maintenance”, referring to the repairs or adjustments that a material or technique may need over time; and “standards”, concerning policies and norms as to the quality and suitability of building materials.

We should note that Rapoport has argued that this classification of meanings requires flexibility on accounting for shifting meanings (Rapoport 1990). A precondition for such a three-tier classification is that a theory of cross-cultural architecture must also be able to explore how meanings may vary over time, along with the variables influencing change.

Figure 2: Analytical framework



#### 4. Analysis of Maasai Communities' Building Techniques: The Case of Maji Moto

##### Methodology and Limitations

We grant that our findings might not be representative or applicable to a wider context given the singularity of Maasai culture and our narrow field of study, a Maasai village called Maji Moto (Arusha), as we analyze the different sociocultural meanings that have influenced the choice of building materials in this Maasai settlement. Yet our research could help to understand future changes and to influence the design outcomes of architectural projects in other sedentary Maasai settlements, given similarities with the case-study village.

##### Nomadism

According to the tribe's own oral history, the Maasai, originally from Lake Turkana, started migrating from the Great Rift Valley in the fifteenth century (Waller 1976). The extent of Maasailand has now been reduced to a region around the border between Kenya and Tanzania (Coast 2000) following numerous displacements undergone by the Maasai since 1896 (Homewood et al. 2009), due at

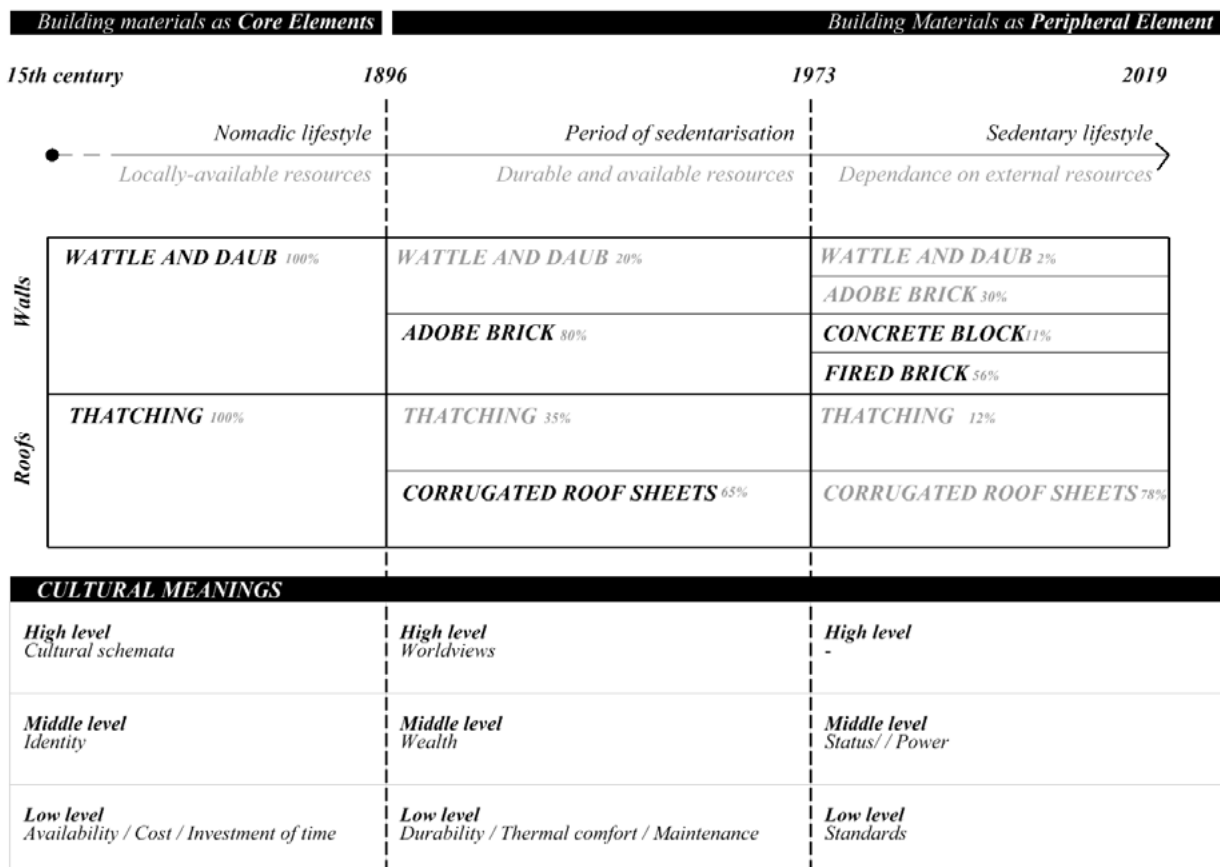
first to the wildlife control regulations introduced by the German colony and expanded as of 1940 by the British colony (ibid.).

These lands have historically been used by the Maasai for nomadic pastoralism, as cattle are their main livelihood (Sambu 2018). Given this nomadism (Fig. 3), shelter has generally been treated as temporary and consequently the materials used to build a traditional Maasai hut (*enkaji* in Maa language) must be readily available in a dry-savanna environment (Fig. 4). Thus, traditionally, non-intensive materials have been used and then discarded.

The walls of an *enkaji* are normally of wattle and daub, an indigenous construction technique consisting of a wooden framework smeared with a mix of cow dung and mud (Fig. 5) (Coast 2000). Similarly, roofs are made of thatch, consisting of layered dry vegetation such as straw, reeds, or rushes. On top, layers of cow dung and mud are applied to make a waterproof surface (Edström and Nyman 2017).

The traditional form of the Maasai hut is either circular (Figs. 6 and 7) or semi-rectangular, and normally the pastoralist Maasai move about in groups creating compounds called *Olmarei*: a "collection of houses about a communal gate" (Coast 2000: 38). In the nomadic Maasai culture, women own houses and are responsible for their construction

Figure 3: Chronology of building techniques





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Figure 4: Typical savanna landscape around Maji Moto

Figure 5: Derelict *Enkaji* currently used as kitchen

Figure 6: Traditional house self-built with adobe bricks and a thatched roof

Figure 7: Circular house built in 1978 with wattle and daub and a thatched roof

and upkeep. They build homes for themselves and their children, while their husbands stay only periodically. Talle (1987) describes women as the “head of houses”, with a degree of economic and domestic autonomy. Women’s role in construction, along with proximities and domestic responsibilities, is important in understanding the shape of houses and the choice of building materials (ibid.). The use of temporary materials to build *enkaji* enables pastoralist groups to move on when needed and at no cost, and so building materials are intimately linked to the lifestyle and activity forming part of the encoded symbols within nomadic Maasai communities. Thus, as Rapoport says (1983: 258), “highly supportive environments become essential” to maintain the lifestyle and practices of a given group.

#### Transition from Nomadism to Sedentism

Until 1896, the Maasai communities of Tanzania had been able to practice nomadism with no great difficulty, as all land was managed and owned communally (Sambu 2018). But during the colonial period and in particular in the 1940s, individual land ownership began to be imposed over Maasailand (Coast 2000), and as a result, nomadic territory shrank and land use changed, drastically reducing the extent of their territory (De Vries and Fortmann 1979). Another factor that has contributed to a progressive decline in the nomadic Maasai lifestyle is conservation policies, through which large tracts of land have been expropriated for national parks and wildlife conservation.

Yet the most significant policy was introduced in 1967 when the Tanzanian government led by Julius Nyerere implemented its so-called “villagization” policy (Cannon 1999), aimed at encouraging nomadic communities to shift to a sedentary lifestyle by settling in official villages. By 1973, villagization became compulsory and within three years many nomadic groups were obliged to settle in villages (Raikes 1978). Thus the traditional Maasai hut built with wattle and daub and thatch ceased to be suitable for their lifestyle (though in some cases the Maasai still practice semi-nomadism).

The first villagers arrived at Maji Moto around 1976, according to several elders interviewed, i.e. when the Tanzanian government completed the villagization process. Villagization has continued to have a profound impact on the culture of Maasai communities (Sambu 2018) and has been partly responsible for a great loss of traditional knowledge.

### Sedentary Lifestyle

From 1976, Maasai villages experienced a drastic transformation of their built environment. The decline in livestock farming and the introduction of agriculture have visibly changed local architecture (Bryceson 1990). Sedentism has also led to a loss of traditional knowledge, resulting in a reliance on external resources and building materials. These are expensive, which has impoverished village inhabitants, and men have migrated to towns in order to be able to provide for their families. Adobe bricks are largely neglected in favor of more recent building materials, and the most popular walling solution is fired clay bricks (Fig. 8).

These are an “improved” version of adobe bricks, namely mud-clay bricks that bake for 48 hours in a stacked hand-made kiln (Fig. 9) (Edström and Nyman 2017). The main problem with their use is the desertification associated with their production. According to the Holcim Foundation, fourteen trees need to be felled 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 thatch as a roofing system has almost disappeared, and the few vernacular houses with thatched roofs are now derelict or used as kitchens (Fig. 10). And whereas corrugated iron sheets (CIS) once had to be purchased in Arusha City, 40 km away, they are now widely available in nearby settlements.



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Figure 8: Neglected house currently used as a kitchen detached from the main house

Figure 9: Hand-built brick kiln

Figure 10: House built with fired bricks for an orphan by the NGO Dorcas

Comparative Analysis of the Cultural Meanings of Current Building Techniques

The above chronology reflects a progressive neglect of locally sourced building materials. Indeed, in Maji Moto, 78% of houses had CIS roofs in 2019, and more than 56% had fired bricks (Figs. 11 and 12).

Two main drivers of this change are discernible. The first is the shift in land tenure with the forced settlement of Maasai communities (De Vries and Fortmann 1979; Munei 1991). The second is the sudden contact with other cultures and societies experienced by the Maasai, leading to a process of syncretism (Coast 2000). As a result, building materials that supported the nomadic lifestyle have been relegated. New values have taken precedence over traditional ones, and so the meanings encoded by some materials are now obsolete or forgotten.

According to Rapoport's three-tier categorization, middle-level social meanings are less important in defining the

characteristics of a culture (Rapoport 1990). But in sedentary Maasai communities, new middle-level meanings have become more important than old high-level ones. This trend has been accentuated by the advent of social media and the notions of individual social identity that they highlight (Baird 2017).

Ironically, in nearby towns such as Arusha or Moshi, buildings offering services to tourists as bars or hotels have thatched roofs similar to those of traditional huts, making a selling point of otherness and distinct identity. Moreover, in some European contexts, thatched roofs denote status (Rapoport 2001) through a perceived ownership of heritage.

The greater importance of mid-level social meanings has also influenced values attached to instrumental and behavioral meanings (low-level meanings). In the past, requirements such as availability and low cost (with far less emphasis on time invested) were essential. As noted in the Village Museum in Dar es Salaam, a nomadic lifestyle



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Figure 11: Unfinished house of fired bricks and corrugated iron sheets in Maji Moto

Figure 12: Typical modern house of fired bricks and corrugated iron sheets in Maji Moto



allows for little time to be spent at home. “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).

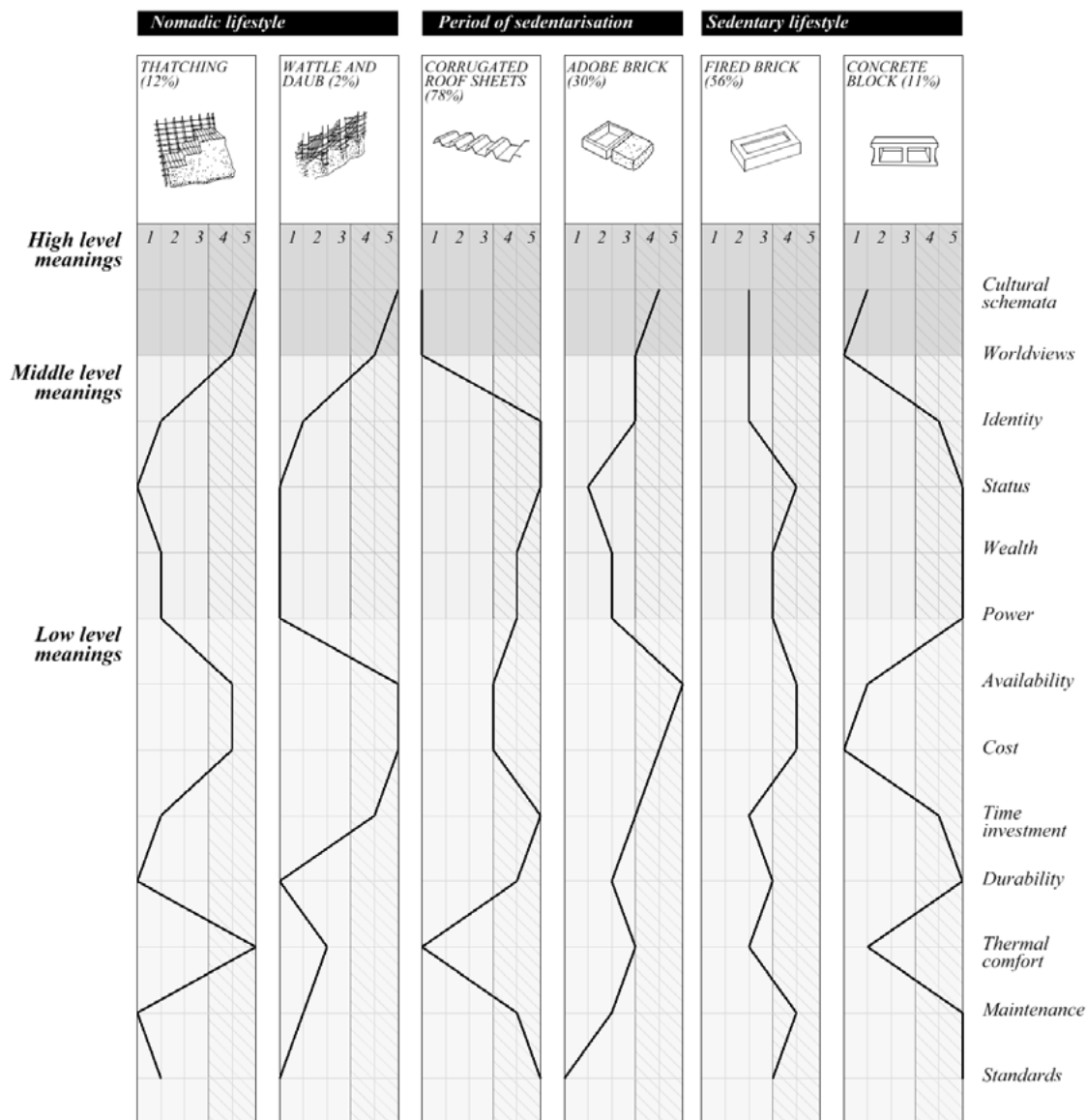
On the other hand, factors such as maintenance and durability have proven highly significant (Fig. 13). Earthen walls, if not properly protected, will deteriorate rapidly in rainy seasons. In Maji Moto some elderly women still painstakingly repair surface cracks in their adobe brick houses as soon as they appear, yet this practice is seen as pointless and outdated by younger generations whose purchasing power enables them to build concrete houses. Now just 30% of houses in Maji Moto have adobe walls, and just 2% have wattle and daub.

Another factor driving the shift toward concrete blocks and CIS is standards. The Tanzanian government is encouraging rural dwellers to adapt their houses to standardized

materials (Kasilima 2008) and claims that through these measures housing is broadly “improving” (ibid.). Thus the authorities’ disparagement of locally sourced materials is encouraging the notion that buildings made with them are backward and poor (Croyle 2020).

According to the 2002 Tanzanian National Population Census, just 17.9% of rural dwellers have houses with concrete blocks or fired bricks, and 32.5% have houses with CIS roofs (Kasilima 2008). In Maji Moto, 78% of homes have CIS roofs and 56% have fired brick, so the trend away from building tradition has been faster here than nationally. This is probably due to the proximity of Arusha City, whose influence on the village has become patent. And despite concrete blocks being the most expensive walling solution, their strength and official approval makes them increasingly sought after, and they are currently found in 12% of village houses.

Figure 13: Comparative analysis of cultural meanings



Regarding thermal comfort across the various building techniques, moreover, standardized materials prove less climatically suitable (Fig. 13). This is especially the case with CIS roofs, as their thermal conductivity results in high indoor temperatures. By contrast, the use of traditional thatched roofs results in lower temperatures (Svard 1980), while walls built with earthen techniques such as adobe bricks and rammed earth have low heat conductivity (Foroudi 2020; Synder 2020). CIS roofs and concrete blocks are less comfortable climatically, yet status and waterproofing take precedence. Only around 12% of Maji Moto villagers still have thatched roofs, and most of these intend to replace them with CIS once they can afford it.

Cultural schemata and worldviews have changed in a short period, but the image of the traditional hut is clearly still a key cultural symbol. Despite new construction trends neglecting vernacular building techniques, the Maasai people see the values of their nomadic tradition reflected in the Maasai hut or *enkaji*. Also, with increasing tourist interest in the Maasai, there has been a growing recognition of their cultural values and sense of belonging in relation to vernacular structures (Koot et al. 2019). *Olmarei* are often visited by tourist groups and have become a source of income for Maasai communities. Hence “Maasainess” has a valuable meaning both for group members and for non-members, in both 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 partly represents a local desire for change and progress, in which inhabitants value access to education and healthcare (Rukwaro et al. 2001). For instance, with the implementation of villagization, the government managed to provide schools for a larger number of children, enabling the Maasai to converse more freely with other peoples, further modifying their values and expectations (Rukwaro et al. 2001).

And while their present buildings may not represent traditional Maasai beliefs and values, these new built forms, often a combination of old and new, communicate multiple identities and aspirations. 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), given the high degree of syncretism between ethnic groups in Tanzania.

#### Comparative Analysis of the Socio-Environmental Meanings of Selected Building Techniques

Most Maasai settlements such as Maji Moto are facing the effects of climate change, resulting partly from deforestation. One driver of this is high demand for firewood as required to produce fired clay bricks (Lafarge Holcim 2016). Maji Moto’s population is growing and many more houses are needed, and fired clay bricks are the most viable solution for most villagers (García 2020).

In response to this, in 2018, the C-re-a.i.d. NGO promoted the construction of a local health center with an innovative sustainable technique: Compressed Stabilized Earth Blocks (CSEB) (Fig. 14).

Following a study of the area, a group of local workers was trained to produce these blocks by means of pressing them in a hand-worked machine (Fig. 15). They consist of 70% clay from the site itself, 15% sand, and 7-10% of a stabilizing agent, which can be cement or lime (Nambatya 2015).

The fact that they are water-cured rather than fired means that no firewood is needed, and their use instead of concrete blocks avoids environmental degradation through sand and gravel extraction as well as reducing cement use. As the blocks are compressed, they are much more durable than traditional adobe bricks. CSEBs have an 80% higher



Figure 14: Health center built with compressed stabilized earth blocks in Maji Moto



Figure 15: Two skilled workers producing compressed stabilized earth blocks in Maji Moto

compressive strength than fired bricks, similar to that of concrete blocks (Nambatya 2015).

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

And while 500 concrete blocks cost around 200 GBP, making the same amount of CSEBs requires four cement bags at a cost of 8 GBP each. Even with additional costs such as sand and labor, CSEBs are still much more affordable (García 2020). Disadvantages of CSEBs are the need for skilled workers to produce a quality product, and that by contrast with the popular fired bricks that can be made for free, the production cost can be restrictive for some, although the overall cost remains affordable compared to that of other techniques.

CSEBs could be an alternative solution to fired bricks and concrete blocks in Maji Moto. Unfortunately, if we look at the social meanings of CSEBs relative to those of the other two walling solutions currently used (Fig. 16), we find that the technique embodies negative social values. This is because, despite CSEB being an innovative technology, the use of raw earth causes it to be viewed as poor and backward. The embodied meanings of wealth, status, and power achieved with concrete blocks and fired bricks are not currently offered by CSEBs.

To seek to understand the community's concern over earthen building techniques, meetings were held with women's groups, local government, and community representatives. The local authorities also offered to organize campaigns to tackle the environmental issues linked to the use of fired bricks. Several participatory workshops were also held, as well as training sessions for young workers wishing to learn CSEB techniques. During

the construction process many were curious about the block-making machine and were also surprised by the strength of CSEBs. Finally, some villagers asked about hiring the machine and showed an interest in the technique.

An impactful transition toward a recognition and normalization of the use of locally sourced materials should start with an awareness of personal and environmental benefits. Education about the benefits of such materials is essential in mitigating climate change, and the use of CSEBs can considerably contribute to mitigation at the local level by avoiding deforestation (Fig. 16). It will also contribute to protecting indigenous knowledge about resource management, essential to environmental protection. In this context, local government should also implement policies against uncontrolled tree-felling (García 2020).

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

A recognition of the need for a move away from the current building mainstream should however not be imposed. It should be about proposing affordable and sustainable alternatives for all, especially for those who cannot otherwise afford high-quality building materials. The use of locally sourced materials is a viable solution as well as crucial to making the housing sector energy-efficient, both during and after construction (UN-Habitat 2019). House prices could be considerably reduced with the use of such materials where they are widely available in the vicinity, along with renewable resources (RICS 2008). Such a move should be accompanied by a greater acknowledgement in the construction market of the impact of building materials, leading to more environmentally sustainable building solutions that are affordable for all.

With this in mind, the government should take steps toward promoting the integration of locally sourced building materials by reviewing the regulations preventing the use of such materials (Croyle 2020). Furthermore, according to the International Habitat Coalition for Latin America (HIC LA), financial and technical support for residents from government could ensure the proper quality of building materials while promoting autonomy and self-reliance in local communities (Comunal 2020).

### 5. Conclusions

Current building material preferences in the village of Maji Moto are part of a complex multi-generational cultural milieu built up over decades and that may require further decades in order to be effectively challenged (Sadalla et al. 1993). This study has shown how years of forced cultural erasure through government policy have taken their toll on Maasai cultural norms (Cannon 1999). Through both the forced abandonment of pastoralism and nomadism and inflexible building standards based on hegemonic Western models, the authorities have hindered the ability of communities

and grassroots organizations to adapt to change and re-contextualize architecture. Also, the previously somewhat peripheral status of architecture within Maasai culture has given way to fast change involving an intertwining of architecture and status and a view of traditional vernacular techniques as inferior. But policymakers and community activists should take some comfort in the fact that this also makes these areas potentially more open to change, as we found with the rapid growth of interest in CSEB bricks.

In an increasingly urbanized world, the construction industry's substantial environmental impact (Rodgers 2018) makes it essential for academics to understand societal behaviors that may help promote sustainable building practices. With a view to encouraging the integration of locally sourced building materials into building practices in indigenous contexts, this study has adopted Rappaport's (2005) three tiers of cultural meaning so as to provide a new tool for social scientists and designers. Our study has also highlighted a couple of key areas for change in policy and praxis to help support the use of more sustainable materials.

While this study offers only one potential building material solution for sustainable construction (Fig. 16), we have addressed concerns for this particular Maasai community that may be mirrored (albeit with local differences) in other societies. Such local initiatives have great potential through the promotion of autonomous construction networks, although as a result they are highly dependent on community uptake, and thus flexible finance needs to be available for pilot schemes along with more sensitive building standards. For the Maasai, still coping with upheavals in their lifestyle, such activities could act as a stabilizing force, empowering communities to reconnect with their territory and their culture and encouraging inter-community interaction.

Our study has also highlighted the importance of reshaping the role of designers. Acceptance of new techniques improved only with participation in the construction process through demonstrations. This shows the importance of participatory design in which the designer or expert acts chiefly as a facilitator (Freire 1968). As this study has found, ignoring values and social expectations can be counterproductive, and so the paternalism of conventional architecture must be challenged. We have also sought to show how regulations can be called into question by offering viable, immediately workable solutions showing that standards cannot be universal.

Figure 16: Comparative analysis including socio-environmental factors

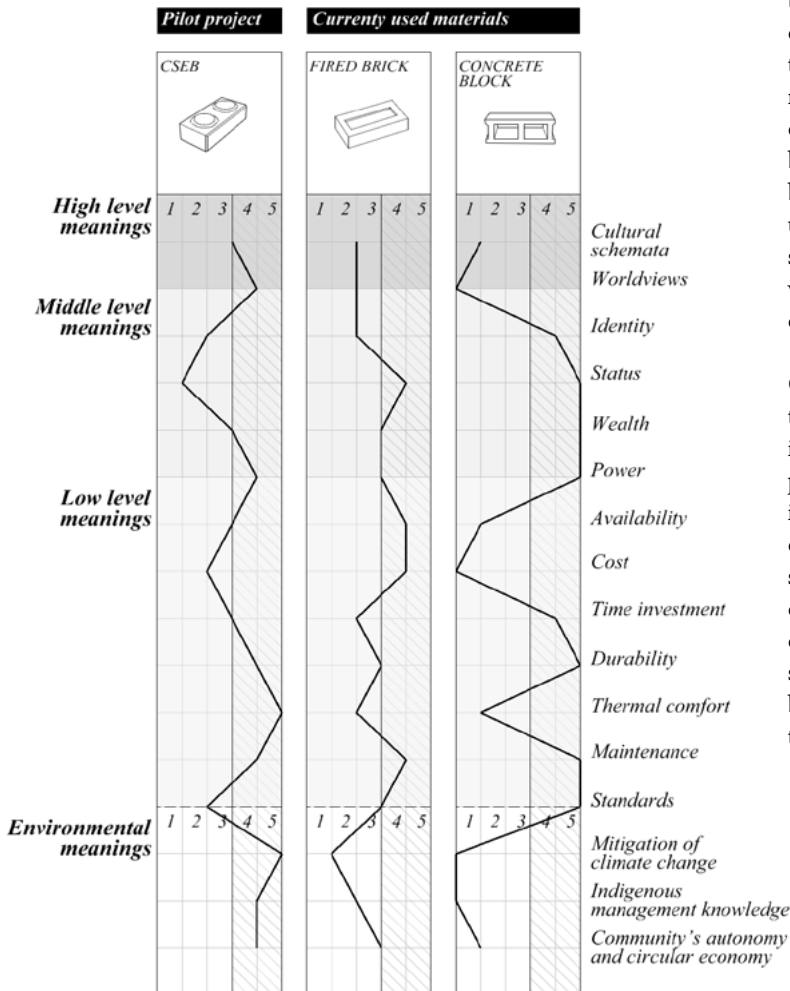




Figure 17: Compressed stabilized earth bricks stacked for use in Maji Moto

It should be noted that this study has offered only a snapshot, and so to properly explore the effectiveness of introducing new building materials, further visits will be needed to measure change over time as well as in other locations, so as to understand how popular such new methods may be. Furthermore, while it is easy to hold designers and communities responsible, responsibility must also be taken by the construction industry, which has a major role in finding viable sustainable solutions and in establishing what is seen as socially acceptable. Larger firms need to promote building methods that rely on locally available and sustainable resources.

#### List of abbreviations

CIS Corrugated Iron Sheets  
 CSEB Compressed Stabilized Earth Blocks  
 EBS Environmental Behavior Studies  
 GHG Greenhouse Gas  
 IPCC Intergovernmental Panel on Climate Change

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## Biography | Biografía | Biografia

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Laia is a PhD candidate in Architecture at the University of Ferrara. She holds an MSc in Building and Urban Design in Development awarded by the Bartlett Development Planning Unit. With over five years' experience in the urban and community development sector, she has taken part in various research and practice projects in East African countries and Europe. She has worked alongside community-based organizations to provide access to sustainable public facilities for indigenous and vulnerable communities through participatory processes. In 2018 she co-founded Un Refugio Colectivo, for promoting environmental justice through spatial interventions. Her research focuses on communities' sociocultural practices and perceptions of their built environment as a tool for promoting the use of locally available and sustainable building materials.