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The Use of Locally Available Materials Towards Urban Planning for Sustainable Construction: The Case of Gondar-Ethiopia

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ABSTRACT

The city of Gondar in northern Ethiopia has a rich history that is connected to urban planning and construction. From the era of the Fasiledes that built masonry castles, Italian colonialism that zoned the city on racial boundaries and the post-colonial planning that wanted a more global standard, Gondar has been subjected to different planning and construction methods. This evolution however, has brought about challenges related to the sustainability of the construction industry and the communities within the city. This paper analyses the relationship between urban planning and use of local construction materials to attain sustainable development of the city. The results show that the current urban planning policies as well as the rules and regulations governing the construction industry in Gondar do not support the use of locally available construction materials but instead focus on the use of cementitious materials for construction. Apart from marginalizing the lower-income communities, these policies are also against the tenets of Sustainable Development Goals. As a solution, systemically integration of locally available materials into urban planning policies and strategies as well as developing construction standards and guidelines for their use is recommend.

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INTRODUCTION

Cities of the Sub-Saharan Africa (SSA) are experiencing unprecedented urbanization coupled with climate change and growing socio-economic disparities. The rapid urbanization among SSA cities is attributable to rural-urban migration, population growth and reclassification of city boundaries due to extended urbanization (Farrell, 2017). The United Nations Department of Economic and Social Affairs (UNDESA, 2019) projections show that up to 58% of cities in SSA will have their population doubled by the year 2035 from a 2020 base population. With this rapid urbanization, comes a growing need for housing (United Nations, 2018).

In countries such as Ethiopia, where there is a relatively high urbanization rate, the demand for inclusive (ADB, 2017), safe and sustainable housing and infrastructural development is alarming, and does not meet the current needs. Although rapid construction of housing is desirable, the construction sector, especially

residential buildings, is responsible for around 40% of greenhouse gas emissions from both erection and operation over a buildings' life cycle (Peng, 2016), and therefore, sustainable construction strategies are needed. One such strategy is the use of appropriate construction materials. Sustainable construction materials can create resilient, equitable, and environmentally responsible cities for low-income and other members of the populations (EIABC, 2011). By considering local context, engaging stakeholders, and prioritizing sustainability in material selection and policies, urban planners can contribute to global sustainable cities. The 2015 Sustainable Development Goals (SDGs) and the 2030 Development Agenda have placed a strong emphasis on promoting social inclusion (United Nations, 2023). Each of the seventeen SDGs encompasses the concept of social inclusion, with six of them directly addressing it while others provide support in various ways. Out of the 17 SGDs, goal 11 concentrates on making cities and human settlements inclusive, safe, resilient and sustainable (United Nations, 2023).

Despite the general understanding in regard to locally sourced construction materials, there seem to be lack of appropriate consideration for the use of locally available construction materials in the housing development industry. The construction regulatory body in Gondar and other cities in Ethiopia discourages the society especially in the city centre and newly built areas, in the use of local traditional construction materials. In this article, contemporary built environment, urban planning and urban planning strategies of Gondar, Ethiopia, in the context of sustainability are analysed and critically evaluated.

MATERIAL AND METHODS

This paper presents the analysis of reviewed documents collected from the city municipal and urban development offices, as well as information gathered by semi-structured interviews with some officials working in the mentioned offices. It should be noted that a broad literature review was also conducted albeit with a limitation on availability of published data. This paper works on the hypothesis that urban planning strategies do not support the use of locally available construction materials, and this could negatively impact the sustainability of prospective city of Gondar. The conceptual framework of this paper is given in Figure 1.

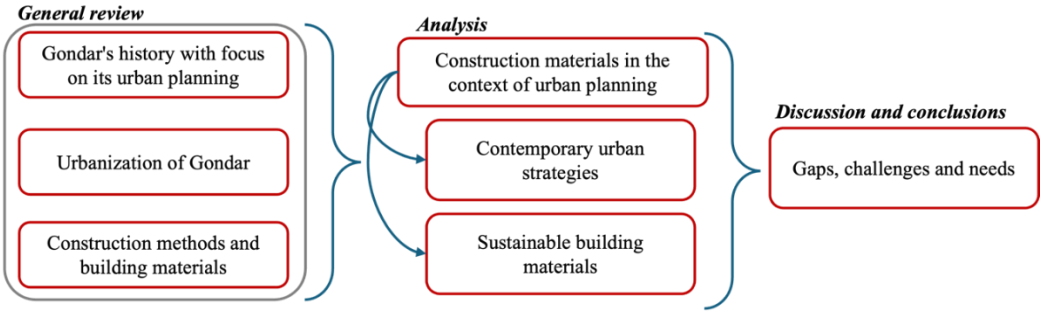

Figure 1: Conceptual framework of the paper.

General Information and History of Gondar

Ethiopia has a long and illustrious history that dates back thousands of years (Pankhurst, 2001; UN-HABITAT, 2008, 2016). In its long history, several cities and provinces were developed and flourished. One of these cities is the city of Gondar (Figure 2). Gondar, also known as a City of Castles, was founded in 1636 as Ethiopia's capital city by Fasiledes[1] and urbanized as an agricultural and market town (Haile, 2018; Wubneh, 2021).

The first castle called Fasil Ghibbi, named after Fasil himself, was built around 1640 by an Indian mason and Ethiopian builders and craftsmen. Fasil progeny continued

[1]Fasilides: 1603-1667, emperor of former Ethiopia from 1632 to 1667

building castles, the last one being that of Empress Mentwab built in 1750 A.D., and today, Fasil Ghibbi is one of the world heritage sites declared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1979. Fasil Ghibbi hosts a variety of buildings, including seven castles built by five kings and one queen (Mentwab). Besides, there are smaller castle-like structures, such as the Wosheba Gimb (Sauna House) Shemanewoch Gimb (Weaver House) Duqet Bet (Granary house) and Anbesa Bet (Lions Cage). The imperial compound also encompasses three churches of historical and religious importance. Twelve gates served as entrance to Fasil Ghibbi, while there were four overpass bridges that linked the compound to the outside as shown in Figure 3 (Koot *et. al*, 2019). Nowadays, many of the latter constructions are severely damaged.

Figure 2: Map of Ethiopia showing location of Gondar City (Gondar Development and Cooperation Organization, 2018).

Figure 3: Castles and other significant buildings in Fasil Ghibbi (Koot *et. al.*, 2019).

Overall, a period of some one hundred years of building castles, bridges, and other structures testifies to a Gondar era in Ethiopian history marked by relative prosperity and stability, and durable set of values by which the ruling dynasty abided. The Fasiledes governed the society and managed the steady increase in population and growth of non-agricultural activities, especially the trade in agricultural products, honey and other merchandize. Religion, especially the orthodox church, was centrally positioned in the administrative system. During this period, monumental buildings were built using stones and lime.

In 1936, Gondar was invaded by the Italians who established a colonial capital that lasted to the year 1941. Here the colonialists shaped the urban growth and architectural style of Gondar.

Today, the city is located in the North Gondar Zone, Amhara regional state at 727 km from Addis Ababa, the capital city of the Federal Government of Ethiopia, and 120 km from Bahir Dar, the capital city of Amhara National Regional State (The Federal Democratic Republic of Ethiopia, 2005, 2008, 2009). Gondar is the centre of political and economic activities of the North Amhara region and it is the main city of the North Gondar Zone (UN-HABITAT, 2008). Initially, Gondar city had 21 Kebeles[2], but was restructured in 2014 to 12 sub-city administrations, one sub-municipal administration (locally known as Teda) and 11 rural kebeles bounded within the city administration (Figure 4). The city had fertile soils, which were cultivated for agricultural production. They were later developed and incorporated into city boundaries leading to an increase in the number of urban populations, together with new fertile areas on the city periphery (Gondar Development and Cooperation Organization, 2018).

Review on Urbanization of Gondar

Gondar has one of the largest urban populations in Ethiopia. According to the Central Statistics Agency (CSA), the population of Gondar was 450,000 by 2018 and projected to be 560,000 in 2022. Since Gondar is a major destination for urban-rural migrants in Northwest Ethiopia,

[2] Kebele: Amharic käbäle, neigbourhood. The smallest administrative unit in Ethiopia, often consists of only one village. The administration in a käbäle is organized by local councils.

migration highly contributed to population growth in the city. From a historical perceptive, urbanization in Gondar can be periodized into three eras: (i) Fasiledes (started in 1636), ((ii) Italian colonialists (between 1936-1941), and (iii) modern-day Gondar (1950 to today).

Urbanization during colonialism

The city of Gondar had an urban plan for the first time during the Italian period, between 1935 to 1940 developed by the famous Italian architect, Gherardo Bosio, who installed a masterplan that would restructure the land use and design of the city and also give Italy an increased international prestige. The Italian administration saw great value in using the long history and status of Gondar as an imperial capital that would enhance the great power of Italy (Figure 4).

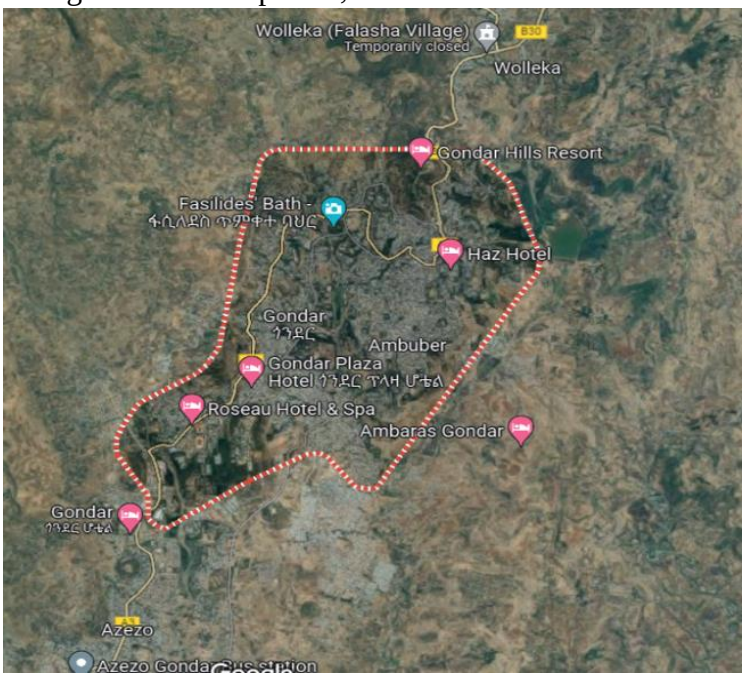

Figure 4: Satellite map of Gondar (Google Earth, 2023)

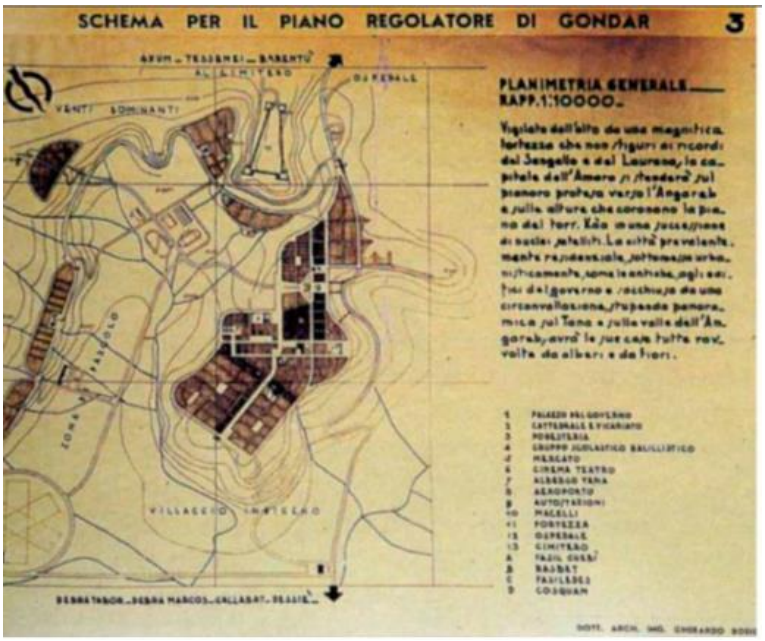

Figure 5: Bosio's plan of Gondar (Wubneh, 2021).

At the time, the Gondar plan was guided by Fascist colonial principles that translated political ideology into the built environment by maintaining segregated schools, hospitals, and neighborhoods; glorifying Italy's supreme political power; and creating an environment that would be appealing to new Italian settlers (Campbell, 2019). For instance, the hospital for whites was located at Che-chela (where the current Gondar Hospital is located), while the hospital for blacks was located at Samuna Ber, near the Maraki area. The Fascist plan believed that racial segregation was a "natural phenomenon," and that city plans should reflect this reality (Rifkind, 2008, 2011, 2013). For Fascist Italian planners, zoning was about ethnicity rather than land use (Figure 4).

As a result, the plan designated the Fasil Castles in the town's center as a dividing line, with the northern half of the town designated for colonial authorities and the southern half of the town designated for locals. The Fasil castle was expected to be included in the plan as a major landmark that should be preserved and incorporated into the new city design. Finally, the plan had to consider how major service providers, such as water and sewerage, should be structured to meet the needs of new migrants (Wubneh, 2021). Generally, urbanization during the colonial era was guided by the master plan prepared by Gherardo Bosio – Italian urban planner in 1938. Intra-urban expansion that was driven by implementation of urban development projects such as the city administrative core, provincial office of technical services, streets and other buildings, proliferated urban growth during Italian rule (Tagliani, 2018). However, Italian colonialists used urban planning and design to reinforce racial and class segregation, and to instill fascist identity on the local inhabitants.

On the other hand, during post-colonial period, there were a number of newly developed and revised city plans that had been prepared by the city administrators at different times in history. For instance, Figure 5 shows one of the development plans which was planned to extensively renovate the city to fit into the global model of urbanization. In the Figure, the breakdown of developmental plans with the various segregations (mixed use zones, historical zones and services and industrial areas) are shown. It can be said that this plan was developed to distinctly allocate different places for business centers and other service facilities at the city center piazza. However, the plan came with a huge displacement. Several people were uprooted from the city center and driven to the south east of the imperial castle and to the eastern cliff of the town (Fikadie *et. al*., 2018). By the time of the resettlement, the community members that were displaced to the new places were unsatisfied by their new locality because of the remoteness from the central business district, the absence of roads and street lights for security.

Contemporary urbanization plans

In the contemporary urbanization, the city expands horizontally towards suburbs. Increased population numbers, ‘soft’ regulations on land acquisition, zoning, construction, economic development policies, and investment are driving low-rise, outward urban expansion (Ethiopian Ministry of Urban Development and Construction, 2014). The city's rapid growth has resulted in the formation of informal communities and slums (Nayak, 2013), which lack basic infrastructure such as roads, water supply, health, education, housing, and sanitation. Thus, when it comes to urban planning, Gondar, like many other cities and towns in Ethiopia, confronts considerable obstacles including growth of informal land markets, undermining the formal land acquisition processes and adherence to urban development plans (Ministry of Urban Development and Housing, 2018). The growth of informal land markets and mushrooming of informal settlements in

Gondar seem to suggest that there is lack of serviced and zoned land that can be accessed by the majority of the city dwellers who are the urban poor.

Currently, there is an officially proclaimed plan for the city, developed for ten years, 2019 - 2029 by the Amhara National Regional State Urban Planning Institute, Gondar City Administration, Urban Development and Construction Department in collaboration with a consulting firm, Development Partners (Figure 6).

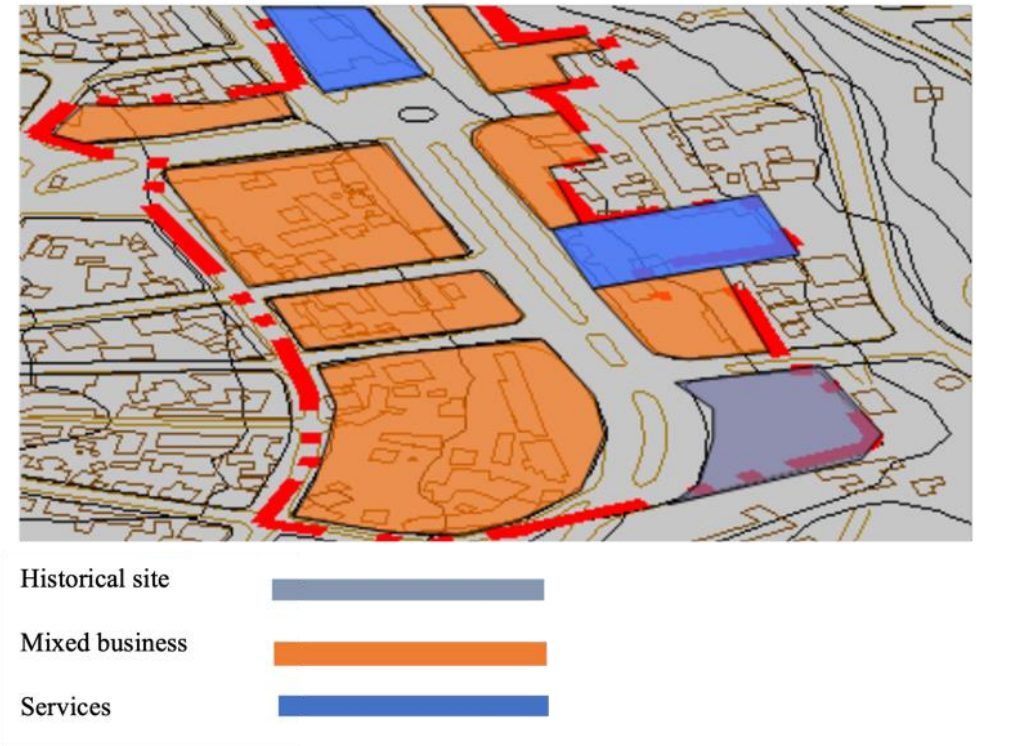

Figure 6: New city plan of Gondar in 2004 (Fikadie *et. al*., 2018).

In the creation of the strategic plan the existing conditions and potential of the city have been given due considerations. Some of the facts which were taken into account in the process of the plan development is the fact that Gondar is one of the biggest cities in Ethiopia, one of the largest trade centers, tourist destination, and the main North Western cities service center. As a consequence, several creative design concepts or ideas were considered to develop this master plan. The four conceptual frameworks that were developed by the planning team include:

1) Historical continuity greatness and grandness.
2) A town within a town within green frame.
3) Connectivity and linkage.
4) Green ribboned development.

The four conceptual frameworks were criticized and analysed by different stakeholders and urban planners. And finally, the combination of the four concepts which is called the hybrid concept gained the final acceptance (Gondar City Administration, 2020).

The masterplan developed by the hybrid concept has summarized the findings of the assessment made on the existing condition and put forward plans on things that need to be done within the coming ten years. Generally, the plan incorporates urban plans which contain proposed land uses, street (road) networks, building height regulations with the minimum plot area required for each building height category, electricity, telecommunication, drainage systems, urban agriculture, forest and greenery, administrative boundaries of

different sub-cities, long term development plans as well as proposed interventions. In Figure 7 (a) and (b) the existing land use in comparison with the proposed land use are presented.

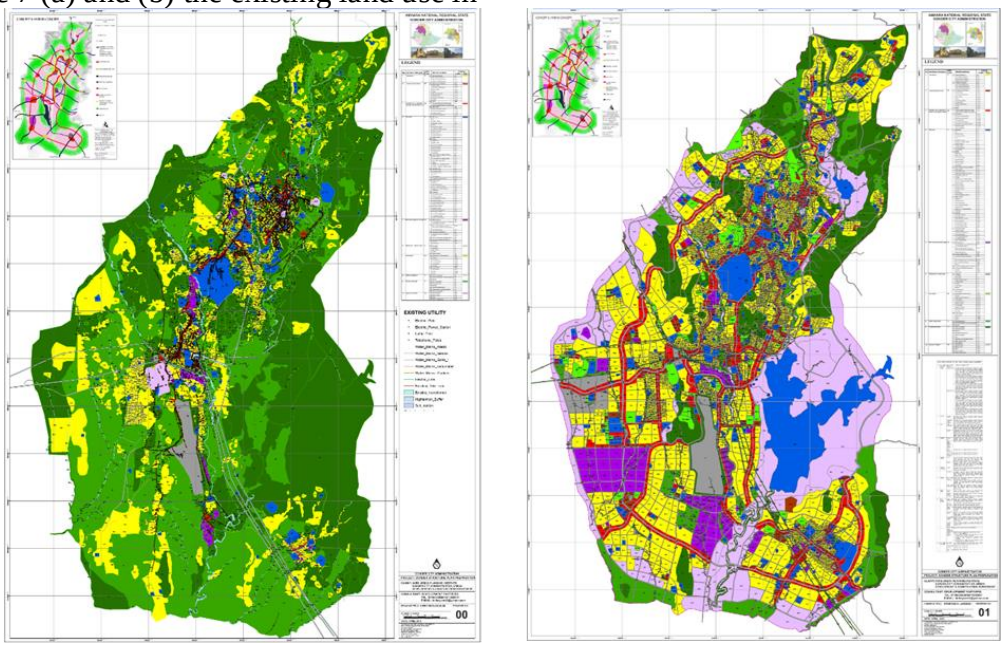

Figure 7: Gondar City plan (a) existing land use and utilities, (b) proposed land use (Gondar City Administration, 2020).

The office of urban and infrastructure in Gondar, which is under the Amhara National Regional State (ANRS) Bureau of Urban and Infrastructure, has its aim to strengthen infrastructural development that is in line with the masterplan of the city. Apart from this, the office has organized a task force with the responsibility to control and ban informal settlement, off-plan construction of houses, unlawful road side market, and other illegal constructions. However, to date, it can be said that the urban development of the city of Gondar is not strictly following the urbanization plan (Masterplan). Specially, in terms of residential areas development, there are a number of informal settlements, activities, construction, misuse of land and infrastructures which are not in compliance with the masterplan of the city. As a result of informal settlements, unplanned infrastructural developments take place and can take a toll on the residents, environment as well as service.

Building Materials and Construction Methods

Construction style and the choice of building materials in Gondar is closely related to its history in urbanization. Various types of construction materials and methods have been employed in the construction of different buildings in the city of Gondar, from the early seventeenth century to date. In the earlier times, during the seventeenth- and eighteenth-century, castles and churches were basically constructed out of basalt stone and lime mortar. Exemplary buildings of this time, which were built by masonry construction, are shown in Figure 8. The basic materials used were brown basalt and lime mortar, giving the castles their mottled appearance. The masonry method was frequently used with local materials and vernacular techniques. Portuguese immigrants brought with them the techniques for constructing with mortar, burning lime, and actual masonry. Around the same time, during the monarchical period, circular houses were constructed out of mud and again basaltic stone. These vernacular construction

methods are known not only in Gondar but also in the northern part of Ethiopia (Shitara *et. al*., 2002). They were meant to be houses for the nobles and clergy men living around the castle. Some of these houses still exist in the city centre outside of the Fasil compound (Figure 9).

Figure 8: Debrebrehan Selase Church and Fasil castle (left to right).

Figure 9: Circular house (Author, 2023).

The other construction material and method that have been practiced in Gondar are timber and mud, which results in the housing typology, known as traditional mud houses. In the construction process tree trunks are erected as a main framing system as shown in Figure 10a. Then the earth that is mixed with straw (see Figure 10b) and seasoned for several days or weeks is then plastered on the timber frame and gives the finished wall system (Figure 10c); the main structural system of the traditional housing. Such kind of mud and timber-based houses are known as "*yecheka bet"* in Amharic language, which literally means "a house made of mud".

This kind of houses have been, and still are, commonly constructed as villas or single storied residential houses. Historically, this building style was used to construct good quality houses. During the Italian period, buildings apart from those that existed within the royal enclosure, churches and those constructed as a service facility, were mostly constructed out of mud and timber.

However, currently, this construction method is mainly found among the lower-income communities (Shitara, 2006a, 2006b). Houses that are constructed using this method can be found in different parts of the city, however, a newly built construction of such kind, is mostly found in the outskirt of the city, more likely in informal settlement areas. On the other hand, aged houses of this type can be found in the city centre and even in the areas where they are deemed to be properly

planned.

Figure 11 shows condominium houses which are built by using reinforced concrete structures and hollow concrete block walls. According to Ethiopian Building Proclamation No. 624, any building or components of a building are required to be designed according to "acceptable" building design codes to ensure safety, comfort and unconstrained services (Gazeta, 2009). In the national level, building design and construction standards are only available for concrete and steel constructions (see, Ethiopian Building Code Standards), and therefore concrete is being widely used in the contemporary construction of any type of building, whether residential, commercial or mixed use.

Figure 10: Traditional mud house and its construction process (a) timber frame (top left), (b) mud and straw mixing (top right) (Ralph, 2017), (c) finished mud house or "yechika bet" (bottom).

Figure 11: Contemporary houses constructed by concrete.

RESULTS AND DISCUSSIONS

Use of Sustainable Building Materials to Support Urban Planning Needs

Urban planning policies and strategies lay the foundation of sustainable cities. Policies that support aspects of sustainability including sustainable construction methods and materials are an essential part to sustainable development.

However, despite a sustainable approach of the previously introduced Gondar urbanization masterplan, one of its main limitations is the lack of appropriate consideration for the use of locally available construction materials in housing development. To the contrary, the construction regulatory body discourages, especially in the city centre and newly built areas, houses or component of houses, that are constructed by local construction materials including straw reinforced mud and timber frames. Although bungalows in hotels or resorts could be given a special consideration, regulatory authorities which control and legalize construction activities in Gondar, give approval for only concrete buildings, when it comes to residential complexes.[3] Thus, it can be said that only cementitious materials are standardized for residential purposes (Gupta, 2014).

Historic construction methods and materials can be a good indicator of sustainability potential in a local context, and their utilization and adaption to contemporary building purposes is one of the basic methods to have affordable and sustainable housing for most of the community members from different income categories (Prutha and Anant, 2009; Adam and Anna, 2018). In the case of Gondar for an instance, mud houses have shown a potential for bringing not only inclusivity to low-income communities, but bring the element of sustainability to the construction industry. Although Miyake et al (2011) generalized that mud houses are not durable, existing old traditionally constructed houses have proven their endurance and stand over decades under variable weather conditions. Additionally, these houses can easily be maintained and modified when there is an impending damage or as needed.

Some potential building materials with their sustainability and job opportunities are presented in Table 1 (Hall and Swaney, 2012; Vanova *et. al*., 2021). They can be evaluated for their applicability and adaptability to the local context of Gondar and can be employed in the construction practice.

The significance of transitioning to more sustainable building materials is found in selecting sustainable options based on their suitability for the building purpose. Appropriate material selection is critical in reducing a building's embodied energy and other environmental impacts. Materials with high compressive strength, such as supplementary cementitious materials (SCM) replacements in concrete, can be used for load-bearing applications, whereas straw bales are better suited for low-rise buildings or partition walls (Re-Alliance, 2021; Stürwald *et. al*., 2022). Because not all sustainable materials can meet the requirements for the building types, a combination of conventional and sustainable materials is advised (Stürwald *et. al.*, 2022). Depending on their particular areas of application, such as the insulation factor and compressive or tensile strength, sustainable alternative materials should be incorporated into the development. A suitable mixture made of sustainable materials can significantly reduce CO2 emissions. The performance of such kind of material can be enhanced by using different scientific methods and could be used for buildings at least for small-scale constructions.

Summarized, in terms of the growing housing demand due to urbanization, a combination between locally traditional building styles and durable mass

[3]Obtained from personal interviews and experience

constructions can be taken as a tool to enhance a sustainable city growth.

Table 1: Classification of sustainable materials available in Gondar for construction (Authors' Construct, 2023)

Construction material (cheap, local, traditional)	Sustainability opportunities	Employment opportunities
Supplementary cementitious materials; industrial by-products (fly ash; by-product of coal combustion). Agricultural by-products (rice husk ash, teff straw ash).	Cheap waste materials with no higher value for alternative use. Requires less energy than cement for its production. Cement replacing materials reduces the carbon dioxide footprint. Contribute to decreasing air pollution through controlled burning of the husks and benefits the environment from eliminating the disposal of wastes onto land.	Production of agro-based SCMs has positive impacts on local value chains. Great potential for additional incomes of a previous waste material (Paul et al., 2019). The production of SCMs does not require complex and technical machinery and could therefore strengthen local SMEs or even local farmers to generate more income.
Straw bale.	Provides better sound insulation than most materials. Creates a healthy and comfortable indoor climate (densely packed to keep warm air in yet permeable enough for humidity to escape). Easily and safely compostable (without harming the environment, given the right conditions).	Positive impact on local communities and gender equity. Enhanced community capacity building through increasing skills and income. The material is well-known and can easily be procured locally, and non-professional labor can support in the construction process. Contributes to the environmental, social and economic sustainability as well as to the affordability of housing.
Compressed earth blocks (CEB). Use of recycled bricks. Bamboo.	Eco-friendly and energy-efficient construction materials that can achieve great carbon savings Mirach and Hailu, 2014). CEB or rammed earth buildings have a very high durability as the materials barely deteriorate (more than 100+ years lifetime). Raw earth can be used, together with different types of reinforcements, to create safe, earthquake-resistant and thermally efficient buildings.	Cost-effectiveness, and low embodied energy, but to date raw earth buildings are limited by the lack of a technical reference standard. Since the processing does not require a lot of technical skill, it can be practiced by the local workforce, creating employment.

CONCLUSIONS

The problem of not using locally available materials, especially sustainable construction materials, is not only observed in the urban development plan of the city of Gondar, rather nationwide. Policies, standards, guidelines or scientifically proven methodologies that can support the use of sustainable and locally available materials even in small-scale constructions are lacking in the country and hence there are no assurance for the development of safe, serviceable and durable buildings from local construction materials. The lack of such standardization can be taken as a key reason for the prohibition of the local (traditional) timber framed mud houses (Figure 10).

However, there are still major opportunities in the sustainable development of Gondar since the city is still developing and urbanizing. By systematically integrating the current development and urbanization of Gondar and the three pillars of sustainability – environment, social and economy, the environmental impact of buildings can be greatly reduced through the utilization of locally sourced materials. Adopting a sustainable construction guideline could minimize the use of non-renewable resources, and the resulting environmental impact caused through non-sustainable and high-energy-demanding building materials. In the area of economic sustainability, the use of locally available building materials could even enhance the local economy through boosting local productions, and create jobs. Additionally, this strategy could lessen reliance on expensively imported building materials. Moreover, using local building materials is often consistent with local architectural traditions, which could help to preserve cultural heritage. Local communities might also be empowered during the construction process.

To encourage a sustainable construction and urbanization system, the recent construction scheme, which is highly dominated by the use of concrete, hollow concrete blocks for walls and reinforced concrete frames, can be replaced by the locally available construction methods and materials, at least for residential low-rise buildings and compressive strength load bearing structures. For the realization of this aim, the traditional construction materials and methods, need to be taught with advanced consistent research and knowledge transfer. Additionally, stakeholders in the construction industry should engage in research and development to standardize methods and technologies for working with local materials. Local authorities should put regulations in place that encourage the use of locally accessible materials in the construction practice.

In conclusion, it can be said that urban planning strategies are critical in promoting sustainable construction practices in Gondar, Ethiopia, particularly for the low-income communities. The case of Gondar, Ethiopia, exemplifies how there is a missed opportunity to reach sustainable urbanization through the use of locally accessible materials.

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REFERENCES

Abebe, A. (2010). Assessment of water supply in Gondar town, Ethiopia: Challenges and Prospects. *Journal of Social*

Science & Management – RJSSM. doi:10.20372/NADRE:1547201577.38

Adam, R., & Anna B. (2018). Architecture in the process of social inclusion of homeless. In *E3S Web of Conferences*, *49*: 00093.

ADB, A.D.B. (2017). Enabling Inclusive Cities: Tool Kit for Inclusive Urban Development. doi: 10.22617/TIM157428%0A

Assefa, B., & Koga, T. (2014). Urban Green Space Development in Addis Ababa, Ethiopia. *International Journal of Urban Sciences*, *18*(1): 59-75. doi:10.1080/12265934.2013.821276.

Berry, L. (1995). Architecture and Kingship: The Significance of Gondar-Style Architecture. *Northeast African Studies* *2*(3): 7-19. doi:10.1353/nas.1995.0003.

Campbell, I. (2019). 'Background', The Addis Ababa Massacre: Italy's National Shame. online edn, Oxford Academic, June 2019), 10.1093/oso/9780190674724.003.0002.

Ethiopian Ministry of Urban Development and Construction (2014). National Housing Policy. Addis Ababa, Ethiopia.

Ethiopian Institute of Architecture, Building Construction, and City Development (EIABC) (2011). Urbanization and Housing in Ethiopia. Addis Ababa, Ethiopia.

Farrell, K. (2017). The Rapid Urban Growth Triad: A New Conceptual Framework for Examining the Urban Transition in Developing Countries. *Sustainability*, *9*(8): 1407. 10.3390/su9081407.

Fikadie, M., Sahile, S., & Taa, B. (2018). Historicizing urbanism: The socio-economic and cultural pattern of the city of Gondar, Ethiopia. *Ethiopian Renaissance Journal Social Humanity*, *5*(1): 103-121.

Fuller, M. (1988). Building Power: Italy's Colonial Architecture and Urbanism, 1923-1940. *Cultural Anthropology*, *3*(4): 455-487.

Gazeta. (2009). Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia. Proclamation No. 648/2009.

Gebre, M. (2020). Sustainable Housing for Low-Income Communities in Ethiopia. *Journal of Building Engineering*, *31*: 101381. doi: 10.1016/j.jobe.2020.101381.

Gondar Development and Cooperation Organization. (2018). About Us Page. Retrieved from https://gondev.org/about-us/.

Gondar City Administration (2020). City Development Strategy 2020-2030. Gondar, Ethiopia.

Google Earth. (2023). Map of Gondar City.

Gupta, R. (2014). Characterizing material properties of cement-stabilized rammed earth to construct sustainable insulated walls. *Case Studies in Construction Materials*, *1*: 60-68. 10.1016/j. cscm.2014.04.002.

Hall, M. R., & Swaney, W. (2012). European modern earth construction. In *Modern Earth Buildings* (pp. 650-687). Woodhead Publishing.

Haile, G. (2018). "The Church of Ethiopia: A Panorama of History and Spiritual Life." Ethiopian Orthodox Tewahedo Church.

Koot, S., Hitchcock, R., & Gressier, C. (2019). Belonging, Indigeneity, Land and Nature in Southern Africa under Neoliberal Capitalism. *Journal of Southern African Studies* *42*(2). https://www.tandfonline.com/toc/cjss20/45/2?nav=tocList.

Ministry of Urban Development and Housing. (2018). National Housing Policy of Ethiopia. Retrieved from https://www.mudh.gov.et/web/guest/national-housing-policy.

Mirach, T.H & Hailu, Y.M. (2014). Determinants of Household Saving in Ethiopia- the Case of North Gondar Zone, Amhara Regional State. *International Journal of Development and Economic Sustainability*, *2*(4): 37-47, accessed 14 February 2023, https://www.eajournals.org/wp-content/uploads/...

Wubneh, M. (2021). Urban resilience and sustainability of the city of Gondar (Ethiopia) in the face of adverse historical changes, Planning Perspectives. *Taylor & Francis Journals*, *36*(2): 363-391.

Nayak, B.K. (2013). The Plight of Slum Dwellers at Gondar City in Ethiopia, *International Journal of Management*

and Social Sciences Research, 2(10): 56-63.

Paul, S.C., Mbewe, P.B.K., Kong, S.Y., Šavija, B. (2019). Agricultural Solid Waste as Source of Supplementary Cementitious Materials in Developing Countries. *Materials, 12*(1112). doi:10.3390/ ma12071112.

Pankhurst, R. (2001). "The Ethiopians: A History." Wiley.

Peng, C. (2016). Calculation of a building's life cycle carbon emissions based on Ecotect and building information modeling. *Journal of Cleaner Production*, *112*: 453-465.

Prutha, P., & Anant, D.P. (2021). Use of sustainable green materials in construction of green buildings for sustainable development. *IOP Conference Series Earth and Environmental Science*.

Ralph, D. (2017) Construction rural style in Ethiopia Video, March 25, 2013 https://www.youtube.com/watch?v=V2KrZhAbrG0

Re-Alliance. (2021). Nepal's first straw bale house. URL: https://www.re-alliance.org/ nepal-strawbale.

Rifkind, D. (2008). The very model of a modern Imperial City: Gondar, Ethiopia. In *96th ACSA Annual Meeting Proceedings, Seek the City*, ed. Dietmar Froehlich and Michell Pride, Washington, DC ACSA.

Rifkind, D. (2011). Gondar. Architecture and Urbanism for Italy's Fascist Empire. *Journal of the Society of Architectural Historians, 70*(4).

Rifkind, D. (2013). Modern Ethiopia: Architecture, Urbanism and the Building of a Nation, Texas A&M's Architecture Lecture Series. Video, March 25, 2013. https://www.youtube.com/watch?time_continue=2098&v=h2ergh02CRk&feature=emb_logo

Miyake, R., Okazaki, R., & Hirohara, M. (2011). A study on the living condition and the housing problem in central Gondar, Ethiopia, *Bulletin of Fuji Women's University*, No. 48, Ser. II:23-33.2011, accessed 14 February, 2023 <https://fujijoshi.repo.nii.ac.jp/?action=pdf>

Shitara, T., Shoya, D., & Miyake, R. (2002). Analysis of Circular Houses in Historical Quarters: A Study on the Dwelling Condition of Historical Quarters in Ethiopia (4). *Summaries of Technical Papers of Annual Meeting*, Architectural Institute of Japan, F-2, pp.763-764.

Shitara, T. (2006a). Present Condition of Historical Italian Buildings in Gondar. *Journal of Ethiopian Studies*, 10(2).

Shitara, T. (2006b). Necessity of Research for Existing Condition of Italian buildings and Proposal for Conservation: Case Study in Gondar. Gondar City Service Office.

Stürwald, S., Mohamed, F., Schmidt, W., Reitz, J., & Maboea, D. (2022). Critical Indigenism as Approach for Sustainable Urbanization. In *IOP Conference Series: Earth and Environmental Science, 1078*(1): 012085.

Tagliani, M. (2018). Urban planning and architecture in the Italian colonial city: A case study of Asmara, Eritrea. *Planning Perspectives, 33*(4): 603-625.

The Federal Democratic Republic of Ethiopia (2005). Ethiopian Rural Land Administration and Land Use Proclamation No. 456/2005", Addis Ababa, Ethiopia.

The Federal Democratic Republic of Ethiopia (2008). Urban Planning Proclamation No. 574/2008, Addis Ababa, Ethiopia.

The Federal Democratic Republic of Ethiopia (2009). Ethiopian Building Proclamation No. 624/2009, Addis Ababa, Ethiopia.

UNDESA. (2019). UN DESA Annual Highlights Report 2019-2020. https://www.un.org/en/desa/highlights-report-2019-2020.

United Nations Human Settlements Programme (UN-HABITAT) (2008). Ethiopia Urban Profile, Nairobi, Kenya, <https://www.unhabitat.org>, accessed 14 February, 2023.

UN-HABITAT. (2016). Ethiopian Cities Prosperity Initiative: Country Profile. Retrieved from https://unhabitat.org/ethiopian-cities-prosperity-initiative-country-profile

United Nations. (2018). World Urbanization Prospects 2018: Highlights. Retrieved from https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf.

United Nations Human Settlements Programme (UN-HABITAT) (2013). State of Ethiopian Cities Report 2013. Nairobi, Kenya.

United Nations (2023) https://sdgs.un.org/goals accessed 06 December, 2023

Vanova, R., Vlcko, M., & Stefko, J. (2021). Life cycle impact assessment of load-bearing straw bale residential building. *Materials*, *14*(11): 3064.