

AUTONOMOUS NEIGHBOURHOODS: AN APPROACH TOWARDS ACHIEVING SUSTAINABLE URBAN PLANNING OF SUDAN

Ghada Ahmed Elashi*

*Heriott Watt University,
Edinburgh, UK*

Email: ghada.ashi91@gmail.com

ABSTRACT

Purpose: Planning autonomous settlements as a strategy to alleviate the poverty of Sudanese citizens and allow them to become active contributors towards sustainable economic growth of the country.

Methodology: Addressing the existing housing problems in Sudan in relation to its preparedness towards the impact of climatic change, disasters and political instability. The literature review defines the concept of autonomous settlements, emphasising the importance of planning settlements at the urban level rather than as individual entities. Case studies will be presented to gain understanding of what can be learned from previous experiences, adopting similar concepts of autonomous settlements.

Findings: Conventional methods of planning settlements in Sudan are not suitable solutions to break out of poverty. The built environment should be perceived as an interlaced matter; multiple disciplines should be considered for sustainable development.

*Corresponding Author

Value: The urban politics formed by autonomous settlements can be an actor towards the emancipation of Sudanese citizens, enabling them to stand stronger against autocratic authorities.

Keywords: eco village; urban poverty; sustainable cities; Sudan urban development

INTRODUCTION

Settlement patterns in the city of Khartoum have expanded significantly over the last three decades, but were mostly developed in an unregulated manner. The regime of Omar Al-Bashir ruled the country for 30 years until was ousted on 2019, did not endorse urban knowledge, rather organic planning was implemented. In addition, political instability, conflicts and civil wars impacted the development of sound urbanism in Sudan. Lack of acknowledging the importance of urban planning minimised the opportunity for the fast growing population to build adequate settlements. According to a study led by UN-Habitat, approximately 60% of the residents of Khartoum are considered urban poor (Murillo et al., 2008). This means that a large percentage of Sudanese settlements are on the brink of collapsing because they are vulnerable to the impact of climatic changes, are economically fragile, and exposed to higher health risks. The exploration of inclusive urban approaches fitting the Sudanese context is needed more than ever for the sustainable transformation of communities to enable improvement of living conditions.

The philosophy of sustainability is diverse. Brundtland et al. (1987) defined sustainable development as:

“humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Sustainability is not only narrowed to dealing with the environment it embraces, social and economic factors. Tackling and understanding these triple factors is essential to move towards achieving sustainability. The built environment of today's societies holds a mirror of their sustainability values; it reflects the policies shaping urbanisation growth, the quality of inhabitants, and level of wisdom at using natural resources. Failure of planning the built environment threatens economic, social and environmental prosperity. Planning has now been recognised by the World Economic Forum in their Global Risk Landscape as a Risk Factor. Quoted from Rafael Tuts (Edx, 2019), director of the programme division of UN-Habitat: “In Africa, there is an average one planner per 100,000 population”. Lack of planning leads to the sprawl of squatter settlements, usually in hazardous peripheral locations that are not connected with infrastructure services, which limits their access to water supply, electricity and drainage systems; eventually this contributes to deprivation of living standards and rise of mortality rates.

Conscious planning and designing of built environments from neighbourhood level up to macro level is a key factor in achieving sustainability goals. The World Bank (2009), suggests that the Africa region can overcome its spatial limitations and low density by using its land and people well and by concentrating resources in urban agglomerations. Policies and schemes based on cooperation systems between governmental authorities and local citizens are vital instruments for the effective operation of sustainable urbanism. The strong communal bond existing in Sudanese culture was evident at several times of hardship. Demon-

stration of the tight communal bond is ‘Nafeer’ organization, which is a crowd sourcing initiative operated by volunteering youth whom deliver aid during the annual floods that strike Sudan, (Kushkush, 2013) and during Sudanese revolution on 2018–2019, a ‘doctors’ association’ (Goldstein, 2019) was formed, erecting tents to function as clinics at the protest sit-in; also, members of the association became core players in the toppling of the Omar Al-Bashir regime.

If guided by a robust system, can the reputable unity found in Sudanese culture be the answer to engage in a faster pace towards sustainable neighbourhoods: delay is no longer an option to save these communities and reduce poverty. This paper aims to explore the frameworks, supported by case studies of planning autonomous neighbourhoods as a ‘bottom up’ tool to empower local citizens through design considerations. These designs encourage economic stability and consequently help to drag themselves out of poverty.

LINKAGES BETWEEN SUSTAINABLE BUILT ENVIRONMENT AND ECONOMIC GROWTH

Lynch (1960) describes cities as urban eco-systems, a metaphor used to perceive the complexities involved in settlements and the need to make sense of them. Cities have become the attraction of production, consumption, knowledge and employment; they are basically viewed as the centre of economic activity, containing wider opportunities and services offering an individual various possibilities to make themselves valuable. Automatically in cities, places of residency are constructed by those willing to participate and benefit from this wealth. For a city to operate, produce and eventually advance economically, multi-layered aspects has to be considered. These should be mainly focused on improving building standards for human residents who themselves are the work force engines for an economically stable nation. In the long run, building non-resilient residential zones burdens an economy with the cost recovering neighbourhoods over long periods.

In northern parts of Britain, areas suffered from floods; it was found that the amount spent on helping residents and businesses to recover from the floods was an in-appropriate use of public funding. Instead, firmer building regulations considering resilience and resistance should be enforced (Heaslip, 2017).

In Lagos Nigeria electronic industry has grown in the last few decades. While this has provided job opportunities, an adverse effect was caused due to tonnes of e-waste that are not properly discarded has affected air, water and soil quality of these industrial sites (Sullivan, 2014), which are necessary components for humanity to remain healthy and productively strive towards economic growth.

Embracing a steady state of economy requires incentivising and adapting urban methods that follow cyclical rather than linear consumption at production of metabolic mechanisms (see Figures 1 and 2). A holistic manner is essential to avoid sprawl and environmental externalities and impacts that hinder economic growth.

Achieving sustainability on neighbourhood scale consists of complex in and out flows. A strategy tackling the following points allow cyclical consumption and the production of resources for incremental and beneficial changes in terms of reducing environmental degradation, economic deprivation and social exclusion (see Figure 3).

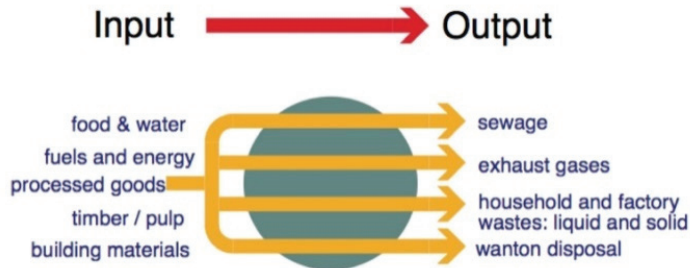


FIGURE 1 Linear consumption flows

Source: Giradet, 1992

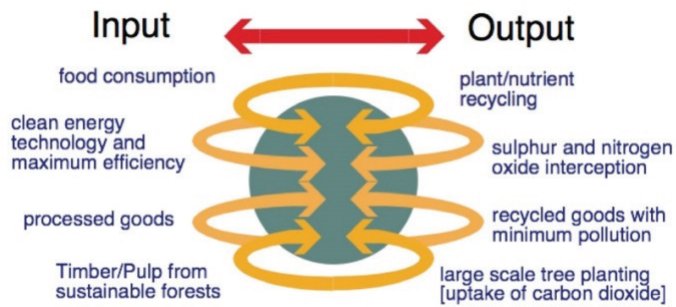


FIGURE 2 Cyclical consumption flows

Source: Giradet, 1992

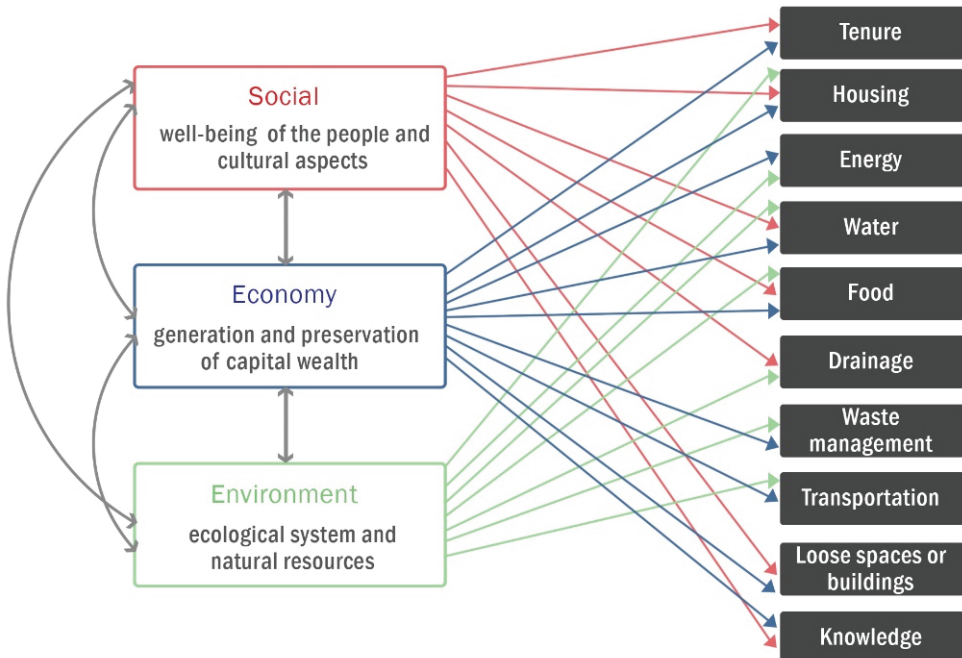


FIGURE 3 Linkages between listed points and triple factors of sustainability

Source: DeVised by author, 2019

- **Tenure:** legalised ownership of lands in non-hazardous locations form a strong sense of security and reduces the urban inequality gap; this increases the sense of belonging and motivates people to participate and assist in making their areas pleasant places to live in;
- **Housing:** new design concepts adapting to the needs of the 21st century and coming generations. Designs that utilise technological industrial innovations that can transform houses to work places and architectural solutions modernizing vernacular articulation to resist climatic shifts;
- **Energy:** renewable methods of energy production and fair distribution of energy is necessary to stop environmental degradation;
- **Water:** water is profoundly the source of life; contaminating it cause a series of ongoing health risks. Security of water is important, and its scarcity can be a reason for conflict and even warfare. Schemes for harvesting rainwater, recycling water, and preserving water resources, ensures continuity of life;
- **Food:** introducing continuous productive urban landscapes (CPUL) is transforming urban landscapes into agricultural land; it should be seen that these landscapes are important so the intake of processed food, packaging waste, carbon footprint of delivering food can be decreased;
- **Drainage:** infrastructural systems that deal with human faeces to avoid public health crises;
- **Waste management:** negligence on how waste is disposed affects the food, water and air we consume every day; if not managed well, it can cause serious health issues across the whole eco-system;
- **Transportation:** responsive transportation methods and networks that can move large numbers of people from one point to another, and arranging close connectivity between nodes of urbanisation to reduce the amount of carbon from purchase of vehicles per head;
- **Empty spaces or buildings:** these facilitate juxtaposition, accommodating different age groups and classes. For example, public spaces containing activities addressing youth needs can encourage a positive attitude, protecting them from drug abuse or getting involved in destructive behaviour. Such spaces that help youth well-being build great human assets for future progress;
- **Knowledge:** democratising knowledge opens endless outlooks and innovations that promote diverse ways to a better life.

AUTONOMOUS SETTLEMENTS

Autonomous is defined as “freedom from authority”. Autonomous settlements can be defined as settlements that are detached from the infrastructural support, and experience challenges of providing their settlements with energy in a collectiveness manner. Pickerill and Chatterton (2006) define the notion of ‘autonomy’ as a social-spatial strategy, providing hope ‘that there are many alternatives’. These autonomy settlers seek to build themselves a sustainable life style of living that is integrated with the environment with respect to cultural and communal aspects. Such societies have visions beyond the aims of just economic growth, and even aspire for economic independence. There are now thousands of eco-villages transition town initiatives around the world; these are places where people

strive to live in human-scale communities, characterised by human, environmental, economic and spiritual co-existence (Bohm et al., 2014).

The evolution of autonomous settlements

Autonomy has been a concept performed by groups from the beginning of time, motivated by common ideologies or fundamentalists such as Marxism, social anarchism, anarcho-syndicalism, regional separatism, national socialism, anarcho-primitivism, Zapatismo, ecologism, and anti-capitalism (Pickerill and Chatterton, 2006). This paper discusses groups who chose autonomy as means to save ecology.

The phenomenon of globalisation has opened endless opportunities for trade, exchange of information and cultures. This has led to an economic growth that is fed by encouraging huge increases in human consumption, resulting to immense increases in the emissions of carbon foot print. Uncontrollable escalation in carbon footprint is associated with dramatic climatic shifts, resource depletion, land degradation, and loss of biodiversity, these changes on the biosphere are endangering ecology and humanity.

As stated by Bohm et al. (2014), attention to nature began in the 16th and 17th centuries during the European Enlightenment. This movement emphasised the fact that humanity should be viewed as a thing apart from nature. It is capable, through reason and intellect, of modifying the world to suit its own ends; this means that humans should nurture the environment and harness it according to their needs. The European Enlightenment movement also put forward particular praxis of social, economic and resource “management”, meeting the demands of efficacy, technological feasibility without compromising economic performance, and “management” of a huge and expanding “world system” by simplifying and rationalising life itself (Dussel, 2013).

Nevertheless, practice of such movements as promoted by European Enlightenment and similar advocates were rarely applied; instead, a lifestyle that is focused on economic rationality was the driving agent and these movements were viewed as primitive or romanticised. Governments began sensing great stress on their resource infrastructure and realised that the continuation of such behaviour would put economies at great risk in the future. It was then that policies were set to force environmental awareness by societies for the sake human and environmental well-being.

The world's cities are directly or indirectly responsible for 80% of global energy consumption, generating more than 70% of the total waste and more than 60% of greenhouse gas emissions for the planet (Ash et al., 2008). Present urban policies and management of the building industry have a huge impact on the environment; it is important to change living habits and lifestyle to reduce this impact, using fewer resources, wasting less, and using more renewable energy.

Accordingly, individuals aiming to live healthier and prosperous lives through sustainable living started forming autonomous settlements, also known as eco-cultures or co-housing. They realised tackling these issues as individual entities was not as effective as tackling them as a community for the following reasons:

- energy produced for one household was either little or too much, therefore energy production for individual use was not efficient;
- expenditure on installations that produce renewable energy is expensive for an individual;

- qualitative use of land that can be utilised for farming;
- a cluster of units forms micro- and macro-climatic effects that improve thermal comfort and lessens dependency on cooling mechanical systems;
- the planned densification of neighbourhoods dramatically reduces the embodied energy and cost of providing infrastructural networking;
- shared centres that are flexible and adaptable to decrease running costs of facilities;
- a collective movement towards a common aim forms a communal sense that motivates individuals to proceed and commit to these lifestyle changes;
- reduction of the produced carbon foot-print when town oriented developments took place and the communal attitude encourage car-pooling;
- re-use and recycling of materials without having to wait for city services to pick it up.

Methods of achieving durable sustainable communities

Town and country planning associations (TCPA), collaborating with communities and local government, produced a worksheet summarising the process of achieving eco-towns to advise promoters and planners. This worksheet states the following (TCPA, 2008):

- mapping existing services and groups: find local authorities and social/voluntary services who can make decisions faster and can later become promoters of sustainable communities;
- involving local people in eco-town planning decisions: involving locals will ensure that these settlements are meeting their needs and wants, which will increase their loyalty to maintain and care about the future of these settlements;
- the formation of trust holding investment: they recommended that this is in the form of land; when the community starts expanding, this land should be used for investment, benefitting the community;
- completing facilities on time: provision of vital services, such as educational institutes, before residents move in;
- setting a realistic budget: this depends on the size of the community, how much the authority is willing to support the community, and the complexity of services offered. Setting realistic budgets and complying with it is important to develop trust;
- making an inclusive built environment: creating an inviting community combining existing and new movements that can accommodate different types of people who can then feel secure;
- building a central resource centre for the community: centres that support the development of human self-esteem by providing jobs, learning facilities that improve skills, and a space for communities to gather;
- supporting community development: activities and interactions encouraging forming bonds between individuals, support collectiveness to make social changes possible, and communication to decide what is best for their welfare;
- providing open spaces: pleasant open spaces for children and adults to enjoy, raising the aesthetic, cultural and spiritual value of space;
- making use of schools for joint provision: schools can host students during the day and at evening host adults for communal awareness about the environment;

- harnessing the energy of faith groups: members of faith groups have energy and commitment that can be used to develop civil society;
- meeting the needs of particular groups: to integrate and be accepted as a part of a community, incorporating groups from different ethnicities is recommended for the positive development of eco-neighbourhoods.

Features of sustainable autonomous settlements

- resilient to climatic changes;
- family structure;
- selected design and materials are eco-friendly and easily repaired and maintained;
- self-dependent in terms of generating energy;
- a strong sense of community;
- food production is a collective process;
- units and facilities are clustered close to each other.

OVERVIEW OF URBANISATION IN SUDAN

Sudan is a federal country formed of 16 states (*wilayat*), where each state elects a governor. At national level, a president is elected, and every five years democratic re-election takes place. Unfortunately, between 1989 and 2019, the country was dominated by a single president, Omar Al-Bashir. He took control through a coup supported by the National Islamic Front; he was ousted by a fierce revolution driven by the Sudanese citizens, demanding that he and all his related parties step down. Before and during Omar Al-Bashir's rule, Sudanese politics were always in turmoil, caught in civil wars, destructive regional diplomacies that caused sanctions, poor land and natural resources management, eventually leading to drought, famine and annual floods sweeping communities.

The unstable political scene in Sudan influenced urban policies. The country was neglected and policies were not even considered a matter of importance. Organic development took over in an unguided and unplanned manner; this was a ticking bomb that was expected to explode into a housing crisis, and indeed it did. There is 34.37% urbanisation in Sudan; this is formed by three main cities, Khartoum, Port Sudan and Niyala, the most prominent being Khartoum (Pantuliano et al., 2011). Urbanisation and the neighbourhoods of Khartoum are the focus of this research paper due to the availability of data and previous academics from which information can be derived.

The Greater Khartoum area (i.e., Omdurman, Khartoum and Khartoum North) is the largest urban centre in Sudan with a population of 4.3 million people in 2008, accounting for over a quarter of the urban population and a tenth of the total population (Sarzin and Mehta, 2011). Relatively, Khartoum is the most equipped city; this is why it is currently facing a rapid increase in urban population. Local and governmental authorities are unable to keep up with housing supply meeting with the rising demand from an increasing population. This population influx is due to the three following reasons:

1. natural increase: there are more births than deaths in Khartoum; natural increase is the main reason for the increase in population;

2. internally displaced people (IDPs): continuous conflicts and environmental disasters, such as drought and famine, happening in other states mean that people move to Khartoum seeking safety. It is likely that many of the IDPs will remain and settle in Khartoum; they have invested their resources on permanent dwellings in the camps (Sarzin and Mehta, 2011);
3. net migration: the flow of people from rural to urban areas in search of better job opportunities, better services to do businesses, and knowledge.

Lack of planning under the political and economic turmoil forced people in need of a shelter to self-build informal settlements in the peripheral regions of Khartoum. Of all households in Greater Khartoum, 80% are classified as being of low income: the cost of housing is unaffordable for the vast majority of households (Hamid and Elhassan, 2014). The Central Bureau of Statistics estimates that 46.5% of the total population falls below the official poverty line, and about 27% of urban dwellers live under the poverty line of US\$2 per day (Sarzin and Mehta, 2011). Figure 4 is a map of settlements, categorised from first to third class and squatter settlements. First class represents a high standard, completely finished concrete house that is fully serviced, while third class is low income houses of lower structural standards and services access.

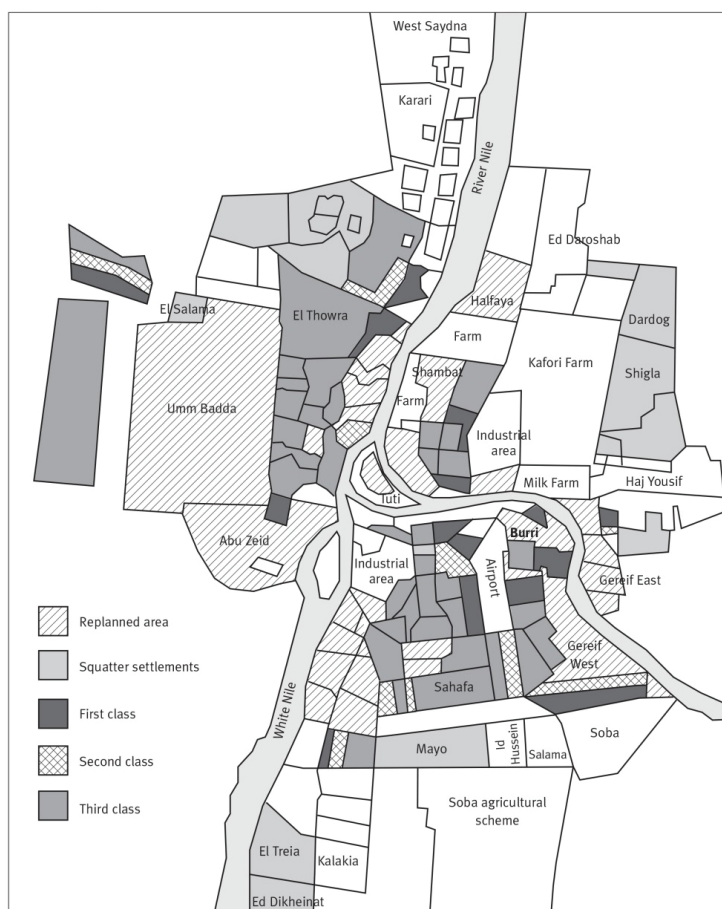


FIGURE 4 Map of Khartoum categorising pattern of settlements

Source: Pantuliano et al., 2011

CHALLENGES HINDERING SUSTAINABLE NEIGHBOURHOODS IN SUDAN

- national urban visionaries are ignored: MEFIT and CENTECS Khartoum Regional Development Plan (KPP5) was the last urban development plan, due to run for 30 years from 2008–2033. KPP5 plans appreciated the importance of agriculture in Khartoum; however, implementation per guided plans fell short, maybe related to lack of governmental will power and participation of locals;
- absence of robust finance schemes for housing and land: the lack of comprehensive plans to financially support the marginalised hampered the ownership of adequate housing. Sending a family member abroad to a rich country is a trending solution to finance legal housing ownership;
- sanctions: since 1994, sanctions and embargoes were imposed on Sudan, which is an obstacle towards sustainable development. These sanctions prohibit the importation of new equipment and technologies for water purification, sanitation, clean and sustainable energy sources, such as solar and wind power and transportation means. Unless these sanctions and embargoes are lifted, the suffering of Sudanese urban dwellers, especially the urban poor, will continue unabated (UN-Habitat, 2014). On the other hand, these sanctions could have been a motive to look for innovation using local materials, therefore reducing the carbon footprint produced from importation;
- provision of basic infrastructure in a horizontally sprawling urbanisation: Sudan is characterised by low urban density where communes are developing further apart from one another. There are more wasteful lands that require substantial financing of infrastructure that extends over long distances. Adherence to strategies that limit expansion and increase densification will reduce pressure on costs to deliver infrastructure;
- inclusive cooperation: Sudan is rich with multiple ethnical tribes and languages. Finding a way of communicating between the different segments to build inclusive neighbourhoods can be a challenge, but will bring advantages of coherence between all levels and celebrate diversity;
- acknowledging the importance of the natural environment and sustainability ideology: floods, droughts and desertification are both natural and man-made disasters facing Sudan. They have great negative social and economic impacts at both the individual and national level. Large numbers of Sudanese depend on their lands for food; depletion of natural pastures and agricultural lands can cause a state of starvation and malnutrition. More research is needed in clean energy methods of transportation and building to reduce the pollution that embraces the Sudanese context: it should no longer be perceived as an option;
- weak urban-rural linkages: the sharp rise in the urban population is due to the high contrast of services and opportunities provision between urban and rural areas. The concept of segregation between rural and urban, rather than extensions of a unified community, leads to disrupted progressive urbanisation;
- emphasise gender equity and youth needs: women are usually perceived as care takers; the social and work culture complicates their formal employment, lowering their chances to receive loans as means to improve their living. It is estimated that 92% of women

in developing countries are working in informal sectors (WIEGO, 2018). Youths below 18 years of age form 48.5% of the population, and 35% are in the age group between 18–35 (Sarzin and Mehta, 2011).

‘The numbers of street children in Sudan have increased substantially in recent decades, so that by 2002 there were estimated to be 70,000 working and street children (86% male and 14% female) in northern Sudan, most of whom were living in Khartoum State’ (Consortium for Street Children, 2004).

Street children of Sudan are involved in toxic environments, destructing their morals and capabilities. Catering to their needs is vital so they become great assets, contributing to the well-being of the country.

Existing opportunities that can strengthen the adoption of autonomous neighbourhoods

- federalism and the existence of local governments: movement towards de-centralising government ensures that the distribution of wealth can be balanced, and a broader representation of people identifies the right actions to be taken. Citizens can participate in governing their own affairs and mobilise resources according to their own needs;
- communal bond: aid and support is given by people within a society to those who are in need, even if they possess little. In Sudanese culture it is considered obligatory to help; if properly structured under ‘self-help’ programmes, these habits will give local entities more empowerment for grass-root changes;
- financing: A large number of Sudanese working in the private sector also feel burdened by the social responsibility of giving back to their communities, and they support the construction of public healthcare facilities and schools (Sarzin and Mehta, 2011). Private Public Partnership (PPP) initiatives to help finance and maintain low cost housing projects should be considered in serious frameworks;
- water taxis: As Figure 4 shows, the Nile cuts through the city of Khartoum; this could be a route for water taxis. Using asphalt, which becomes heat islands that increase temperature, can be reduced and more spaces can be vitalised for landscaping. This would protect neighbourhoods from seasonal floods, desertification and help to absorb pollution;
- edible landscaping: ‘Sudan is considered as one of the three countries in the world that can contribute in the international food security’ (Mohamed, 2010). Realising and experimenting with the potential to cultivate their surrounding local streets and spaces as landscapes for food production instead of being left vacant or used as garbage dumps, can help neighbourhoods to become self-sufficient and fight climatic changes;
- high literacy rates of women: in Sudan, the percentage of literate women is higher than men. Involving professional women more in formal sectors of work to benefit from their education, and facilitating flexible work spaces that adjust to cultural practices, will generate production and raise household income (see Table 1);

TABLE 1 Gender based indicators, 2008

<i>Indicator</i>	<i>Men</i>	<i>Women</i>
Percentage of the total population (%)	51	49
Life expectancy (years)	52.5	55.5
Overall illiteracy rate (%)	42.7	54.6
Head of the household	71.4	28.6

Source: Central Bureau of Statistics (UN-Habitat, 2014)

- hopeful active youth despite the harsh circumstances: it was youths who drove the revolution in Sudan, striving for non-militant ruling. The previous political paradigm was thought impossible to remove, but it was the youth who proved many critics wrong. Awareness of the power of digitalisation and its utilisation efficiently connected Sudanese youth efforts around the globe and led to a phenomenal revolution. With national goals admitted to involving the youth, an undeniable force leap-frogging towards achieving sustainability is possible.

The next chapter represents case studies of actual projects by self-empowered residents, determined to overcome living issues through sustainable solutions and in the long run were valuable contributors in achieving steady economic growth. Inspiration can be conceived from these examples to discover new approaches for constructing Sudan's neighbourhoods.

CASE STUDIES

Case study 1: Lynedoch Eco-Village, Stellenbosch, South Africa

Lynedoch Eco-Village is the first mixed-income eco-village in South Africa (see Figure 5). It was formed to escape the apartheid inequality practiced in South Africa and building a healthy environment for their children's future, who were caught in drug abuse, gang abuse, over-consuming lifestyle, teenage pregnancy and an alcoholism. Children's well-being in the village was interlinked with the land's quality; agricultural landscaping was the core of the project. From this, they produced their own food and the rest was sold for income; however, the land was damaged due to inappropriate farming methods. To restore this land for farming, the sustainability institute (SI) in Lynedoch devised a method combining their practice insight and knowledge from different disciplines. The following was achieved:

- soil fertility was restored by collaborating with local organic farmers, and agro-ecological farming was being performed;
- Lynedoch Earth School was formed; this is an institute providing free education and vocational training for junior and senior students, teaching them childhood development, sustainable communities and youth sustainability skills, including agro-ecological farming;



FIGURE 5 Lynedoch EcoVillage, Stellenbosch, South Africa

Source: Sustainability Institute (no date)

- twenty-four houses were built, of which half were subsidised to ensure affordability. The houses were built on sustainable infrastructures that were:
 - biolytic sanitation system;
 - vertically integrated wet land;
 - biogas digester;
 - recycling of toilet flushers, solid and water waste that was used for irrigating lands;
 - solar roof tiles and solar water geysers for each street reduced coal generated power by 60%;
 - chimneys and rock stores, together with orientation and design considerations to cool houses;
 - storm water harvesting and re-use mechanism reduced water consumption by 40%;
 - monitors watching usage of energy and water;
 - materials used for the houses were adobe brick, sand bags and recycled bricks, reducing carbon footprint.

The 15 family child well-being units centred in Lynedoch eco-village set an example for self-dependent neighbourhoods willing to empower themselves with no need of external funding. Sanitation, waste, water and energy are usually provided by the government or professionals to structured formal settlements, and provision of these services differs between formal and informal settlements. Settlers in Lynedoch eco-village accepted the challenge to provide their dwellings' needs by themselves. This was an attempt to build a decent life for them and their children through sustainable building approaches, earning a living and their food through farming, and continuously learning about efficient agro-ecological farming. In addition, there is communication about 'ecopreneurs' and agro-ecology with youths who do not find jobs in the formal sector, offering wider outlooks for youths to make use of their strength and fight poverty.

The Sustainable Institution (SI) had a ripple effect within the community; one third works for the institution and are encouraged to do voluntary work, directing movements to solve racism problems, and activities to regain trust and encourage tolerance between

parties. These actions play a vital role in reforming the social fabric and increasing safety and productivity of the neighbourhood.

Policies and management are key for the sustainable growth of neighbourhoods. In Lynedoch Eco-Village, a constitution is signed by each homeowner and institutional partner to contribute to a democratic system where trustees vote and make decisions concerning governance, infrastructure, home building and social justice. This method can be vulnerable if leadership is poor, and decisions for the well-being of the community can be made to favour or satisfy benefits of certain individuals.

Case study 2: Springhill Cohousing, Stroud, Gloucestershire

In collaboration with Architype, a developer (David Michael), delivered a ‘radical self-build’ co-housing scheme offering settlers the flexibility to be their own developers (see Figures 6 and 7). The housing is inhabited by a mix of old and young members, and aims to establish positive communal relationships between its members instead of being a mere house to live in. Members can enjoy the benefits of group finance, shared facilities and interchange between activities to support each other. This saves fees on services, such as childcare, cooking, gardening and administration, and instead a sort of favour bank between people was established.

Spatial organisation features of the built units:

- sensible clustering: for a stronger sense of unity, dwellings are clustered close to each other, and each cluster has a public green space encouraging interaction between neighbours and avoiding the usual introverted housing units;
- orientation: rooms in some dwellings face south, enjoying a sunny and cheerful atmosphere; unfortunately, however, some other dwellings did not have south facing rooms, meaning that the dwellings became dull;
- outdoor spaces: green spaces with dual functions were provided as places for enjoyment, as well as being a sustainable drainage system;



FIGURE 6 Exterior of the housing units and shared kitchen in Springhill Cohousing

Source: Nash, 2016



FIGURE 7 Sketch showing the master plan of Springhill Cohousing Scheme clusters arranged to integrate with the green space

Source: Nash, 2016

- community kitchen and eating: there is an open plan kitchen where members cook and have meals together three times a week; this helped to develop positive social bonds with each other.

To reach agreement on aesthetic features and design qualities, there were twice-monthly meetings between the 35 directors. This raised costs when the intention of co-operating during the design process was to keep costs down; if decisions had been made by individuals, costs would have remained low.

The materials used for construction were renewable and re-cycled, and the homes received a Building User Survey (BUS), earning the 99th percentile in the UK for comfort and satisfaction. In addition, the houses consume less gas and electricity than average.

Even though some neighbours complained about the appearance of the units, likening them to 'prison blocks' and lacking green space, the neighbourhood has a waiting list of people wanting to live in Spring hill co-housing because it is the sense of community and belonging they want.

Case study 3: Obtaining tenure operation, Santiago, Chile

Land ownership is a huge obstacle standing in the way of sustainable development. With the fear of eviction and insecurity, marginalised people are forced to occupy settlements illegally on unwanted lands that are subject to floods, pollution, landslides, etc., and usually have little or no access to infrastructural network. These people put their lives at risk for the sake of decent living. In Santiago, Chile, in 1960, a bold movement named ‘Operation Site’ was implemented by the state to solve the housing crisis; this movement was about facilitating land ownership at low prices affordable by the poorest of Santiago (see Figure 8). Before the state launched Operation Site, the conventional method of providing houses was followed until they realised they were unable to meet the high demands of housing. Instead, they gave away small plots of land on the outskirts of Santiago at knock-down prices. These plots were linked to the electricity grid and, in some cases, they built a kitchen and bathroom with plumbing and the people had to build the rest around it. As much as it was criticised at the beginning, over time the project has shown signs of success; it was a ‘top down-bottom up’ strategy that genuinely wanted to transform people’s lives. The operation stopped when a military coup occurred in 1973.

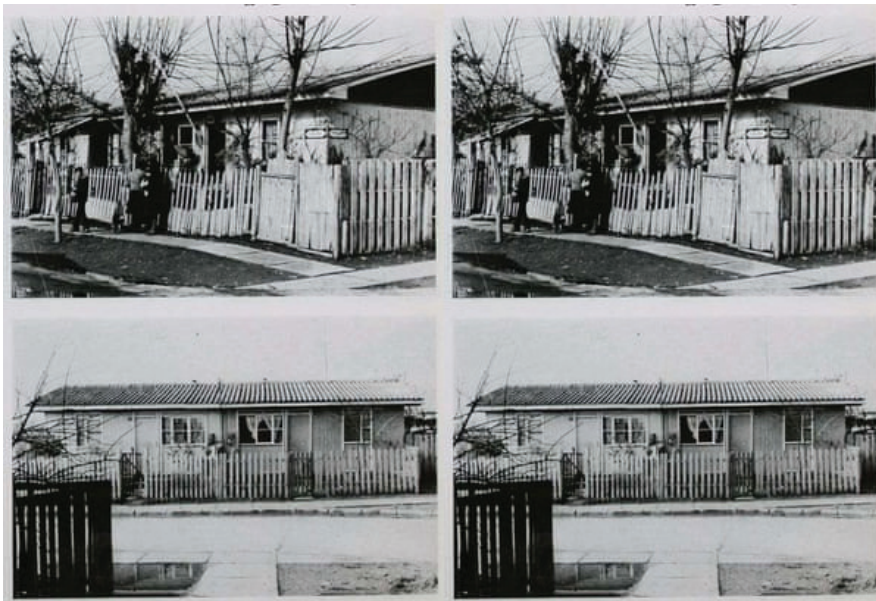


FIGURE 8 Newly constructed houses, built as a result of Operation Site, in 1965

Source: The Guardian, 2004

Case study 4: Housing units

Sustainable development goals (SDG) connected three particular problems that make housing difficult. These are:

1. affordability: rationalising the price of houses according to the ratio of income received by the urban poor;
2. adequacy: what minimum is considered enough for the housing to be habitable;
3. viability: connecting the house to basic services to become capable of habitation.

The case studies below describe housing projects that rethought the definition of housing, where the three particulars given above were considered in an attempt to find ways to better living standards for their inhabitants.

Digitalisation: Loloma 5 Town homes - Scottsdale, Arizona, United States

The 21st century witnessed extremely rapid technological advancements, the latest is known as Industry 4.0. Defined as the Internet of Things (IoT): the digitalisation of communication eased connection between people around the globe just using a swipe of the finger. Digitalisation changed the pre-conceptions of houses from being units used only for dwellings to becoming places of work from home. The re-invention of dwellings transformed the intensity of the business involved, and company growth can now occur from outside the work place. Digitalisation can link people working from home to global markets directly instead of being at the end of the global supply chain and receiving small amounts of the profit made from their products. Furthermore, houses connected to broadband communication connect residents to e-education training programmes and courses offered from prestigious universities globally for free or at affordable prices. Knowledge is empowerment and enables more people to join the work force, raising the country's GDP.

Houses utilising digital innovations suggests the following advantages:

- less unpredictable journeys to school and work place;
- dynamic time management to adjust between other responsibilities;
- waste avoidance and qualitative use of land plots that were used to construct large office buildings;
- reduction in carbon footprint;
- lighter use on transportation vehicles;
- diversifying financial income routes into a household.

A complex designed by Will Bruder Architects is formed by five live-work units (see Figures 9 and 10). The living units are not only used as shelters but also as work spaces. They contain two work spaces; on the ground floor is a space that can be used as a car port or a work shop. A room is dedicated on the first floor to work space, with a terrace overlooking the shop.



FIGURE 9 Front and back facades of the houses

Source: ArchDaily, 2011

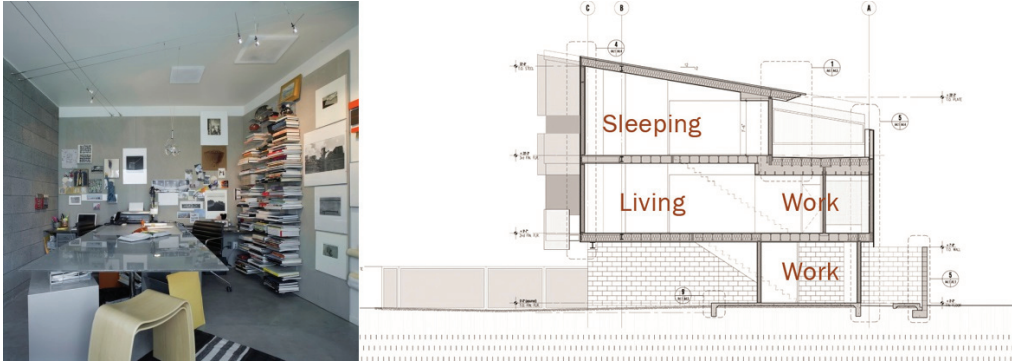


FIGURE 10 Section and interior showing the work spaces in the house

Source: ArchDaily, 2011

Financing: Self-Employed Women's Association (SEWA), India

Squatter settlements built on unauthorised plots of land are inhabited by people working in informal industry sectors, known as the 'shadow economy'. These settlements are not granted financial loans from banks or other formal financial institutions to consolidate their household needs or business ideas. Therefore, they are forced to seek financial support from informal sources that are more rigid and incompatible with their capabilities to repay these loans; this is because they have an irregular and unstable income. The Self-Employed Women's Association (SEWA), based in India, was able to provide finance under the Mahila Housing Trust (MHT) (see Figure 11). MHT supports women working in the shadow economy who have no mortgageable houses by securitising their assets. MHT is an organisation part of the cooperative bank, Shri Mahila SEWA Sahakari Bank (SEWA Bank in short), founded by SEWA to intervene and break the debt-poverty cycle women fall into. They do this by providing financial services tailored to the women's lifestyle, charging fairly low interest starting from 2% (see Figure 12). SEWA financed the provision of basic services, such as toilets, electricity in households, and water pumps, to encourage the steady increase of financial productivity.

Design: Architects Hassan Fathy and Alejandro Aravena

The housing industry is responsible for 40% of the carbon emissions produced, both from materials and operational energy requirements. New design paradigms that encourage self-help should attempt to design houses that best fit inhabitants' needs. Vernacular architecture is proof that inherited knowledge from tradition and culture in building homes was better at adapting to the local context without harming the environment, and even led to thriving economies, long before the interference of official architects and planners. It is recommended that builders take a step back to be inspired from traditional architecture, revive and combine traditional architecture with contemporary techniques, and give locals more freedom in manoeuvring spatial organisation.

Hassan Fathy, an Egyptian architect, spent his career expressing architectural direction that suggests construction methods that are 'built by the poor for the poor' (Fathy, 1973). Hassan Fathy derived his style from reflecting on typological determinants and Nubian

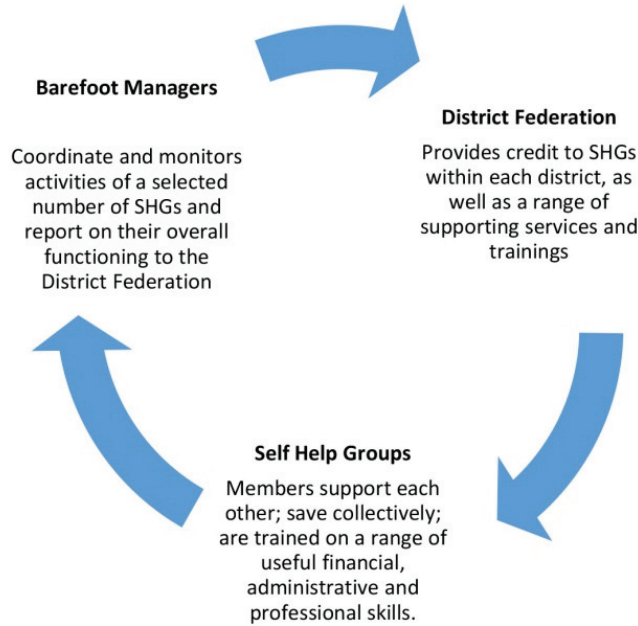


FIGURE 11 SEWA's financial provision system at district level

Source: Benni and Barkataky, 2018



FIGURE 12 Artisans using a solar lamp to work at night through a Hariyali loan

Source: Benni and Barkataky, 2018

traditional architecture; he was able to articulate styles that harmonise with their surrounding context. The design considered orientating houses towards a north-west prevailing wind that goes through wind catchers (*malkaaf*) into planted internal courtyards; creating convection current generate cool air flow around the house. In addition, thick walls and domed roofs all contribute to the passive thermal comfort of interior spaces. Figure 13 shows one Hassan Fathy's most important projects built in 1945, the first documented mud brick house in Cairo that is still standing today.

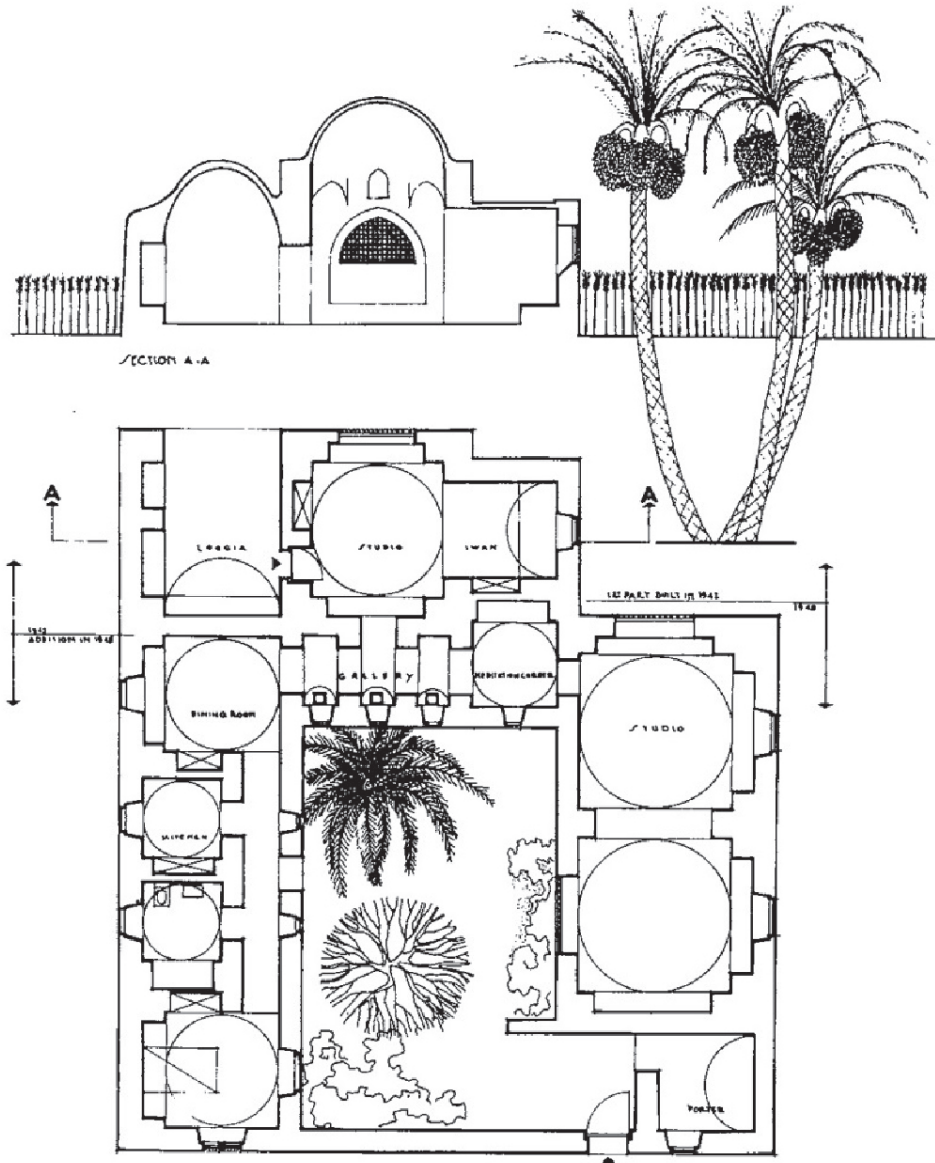


FIGURE 13 Said house designed by Hassan Fathy, 1945

Source: Serageldin, 2007

Quinta Monro is a social housing project in Chile, designed by Pritzker Prize winner architect Alejandro Aravena. The project was completed with subsidy amount of \$7,500; this budget had to cover the cost of land, infrastructure and construction. With such a tight budget to work with, Alejandro formed a cluster to join thirty families on the site, and built vertically instead of horizontally to spend less on land (see Figure 14). Only half the plot was built on, while the other half was left for the residents to slowly invest in its expansion themselves in the future. The unit was provided with only a bathroom and kitchen. The guided self-construction concept developed by Alejandro has gained a lot of value since it has been lived in; it helped people to break away from the poverty limbo.



FIGURE 14 Qunita Monro houses before and after inhabitation

Source: ArchDaily, 2008

DEDUCED ADVANTAGES AND DIS-ADVANTAGES OF AUTONOMOUS SETTLEMENTS

Advantages

- less fear of crime, as people take more care of each other;
- land is used in a more qualitative manner; the social fabric is more cohesive and achieves sustainable goals. These factors raise value and net worth of residential units and land;
- carbon footprint is reduced or avoided once and for all; this is because all required services and social gatherings are closer;
- more communal spaces allow positive interaction;
- energy bills, are lower than usual because it is more dependent on renewable energy;
- better decisions that are actually meeting the wants of the residents are made;
- less waste of energy, food and physical materials because more is shared;
- environmental conscious attitudes are developed and stronger human connections with earth are created.

Disadvantages

- a lot of interaction can cause friction between neighbourhood members;
- decision-making concerning the well-being of the community takes longer, also it requires a member with good leadership skills to ensure that the best decisions are made without being exploited for self-interest;
- initial cost and effort put into these settlements can be a heavy burden on some, enough to stop some from proceeding with the project;
- designs that can satisfy all members within the settlement can be a challenging task for an architect;

- too much dependency and liberation from authority and too many autonomous settlements can threaten the unity of a nation;
- the availability of all amenities and social gatherings within the settlement can isolate these settlements from the rest of the world.

CONCLUSIONS AND RECOMMENDATIONS

The intention of this paper is not to promote complete autonomy and form disconnected segregated neighbourhoods. On the contrary, it is an approach to renew meanings and ways of gaining freedom, and promote collectiveness at decision-making between governmental authorities and local citizens. Sudan's history of political instability and tyranny needs methods to empower local citizens to confront on stronger bases against bad decisions made by formal authorities and autocracy. Key of successful methods application are embedded within how built environments are sustainably planned. Autonomous settlements as an approach for sustainable development facilitate Sudanese citizens reclaim their dignity through decent living and economic independency through the architecting localized strategies. Carmen (1996) claims that autonomy stands on four corner stones: political ownership and control; cultural and media literacy; the self-determination of organisational forms; and economic self-reliance. Autonomy translated in the form of neighbourhoods suggests it can be a mediator to achieve sustainability goals.

The case studies discussed in this paper are an inspiration that explored solutions that can be applicable in Sudan. It was realised that according to specific context and situations, solutions are tailored. Millennium development goals (MDGs) measure urban poverty based on income and the ability to afford basic household needs. However, there are non-food needs that were not considered in the MDG measuring method yet are significant factors towards the alleviation of poverty. Benchmarking techniques measuring, specifically, Sudanese urban-poverty and the needs of citizens in urban neighbourhoods and updating typography are essential to set accordingly effective and responsive plans.

Sudan has to realise and utilise its full potential to achieve sustainable goals; poor urban policies over decades have left land in an obsolete condition. Arguably, with the current political reformation Sudan is enduring, there is now hope. Sudan is urged to train and retrieve urban planners, architects, civil engineers and whatever professionals willing to share their knowledge and experience concerning sustainable construction of built environments, set frameworks at regional level and regulate urban policies in Sudan. Produce affordable sustainable housing prototypes as reference for builders of all types by funding groups and technologies for efficient data collection, research and experimental architecture exploring sustainable standards fitting Sudanese context. Forming neutral organisations focused on monitoring progress and Regulations follow-up to assure serious actions are happening on ground and assess the situation to amend and modify planning policies until things are right. Autonomous settlements is a top down bottom up approach for sustainable development in Sudan promoting inclusive planning of neighbourhoods uniting towards saving our biosphere.

BIBLIOGRAPHY

- ArchDaily (2011) Loloma 5 / Will Bruder and Partners, Available at: <https://www.archdaily.com/138295/loloma-5-will-bruderpartners/>, ISSN 0719-8884. Accessed: 7 November 2019.
- ArchDaily (2008) Quinta Monroy / Elemental. Available at: <https://www.archdaily.com/10775/quinta-monroy-elemental/>, ISSN 0719-8884. Accessed: 7 November 2019.
- Ash, C., Jasny, B.R., Roberts, L., Stone, R. and Sugden, A.M. (2008) Reimagining cities, *Science*, Vol. 319, No. 5864, p.739.
- Benni, N. and Barkataky, R. (2018) *The role of the Self Employed Women's Association (SEWA) in providing financial services to rural women*. Rome: Food and Agriculture Organization of the United Nations (FAO). 25 pp. Available at: <http://www.fao.org/3/CA2707EN/ca2707en.pdf>. Accessed: 07 November 2019.
- Böhm, S., Bharucha, Z.P. and Pretty, J. (Editors) (2014) *Ecocultures: blueprints for sustainable communities*, 1st Edition. London and New York: Routledge.
- Brundtland, G.H., Khalid, M., Agnelli, S., Al-Athel, S. and Chidzero, B. (1987) *Our Common Future*, World Commission on Environmental and Development, Oxford University Press, New York. Available at <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>. Accessed: 15 December 2018.
- Carmen, R. (1996) *Autonomous Development: Humanising the Landscape: An Excursion into Radical Thinking & Practice*. London: Zed Books.
- Consortium for Street Children (2004) A civil society forum for North Africa and the Middle East on promoting and protecting the rights of street children: 3–6 March 2004, Cairo, Egypt. London: Consortium for Street Children.
- Dussel, E. (2013) Agenda for a South-South Philosophical Dialogue, *Human Architecture: Journal of the Sociology of Self Knowledge*, Vol. 11, No. 1, p.3.
- Edx (2019) Sustainable Development Goals Academy X, Sustainable Cities. Available at: <https://courses.edx.org/>. Accessed: 02 November 2019.
- Fathy, H. (1973) *Architecture For the Poor: An Experiment in Rural Egypt*. Chicago: The University of Chicago.
- Girardet, H. (1992) *The Gaia Atlas of Cities*. London: Gaia Books Limited.
- Goldstein, J. (2019) The revolutionary force behind Sudan's Protest Movement? Doctors. *The New York Times*, Available at: <https://www.nytimes.com/2019/04/20/world/africa/sudan-doctors-protest.html>. Accessed: 04 November 2019.
- Hamid, G.M. and Mohamed Elhassan, A.A. (2014) Policy Review, Incremental housing as an alternative housing policy: evidence from Greater Khartoum, Sudan, *International Journal of Housing Policy*, Vol. 14, No. 2, pp.181–195.
- Heaslip, M. (2017) Environmental cost of flooding. Manchester: URBED (Urbanism, Environment and Design) Ltd. Available at: <http://urbed.coop/>.
- Kushkush, I.I. (2013) As Floods Ravage Sudan, Young Volunteers Revive a Tradition of Aid. *The New York Times*. Available at: <https://www.nytimes.com/2013/08/30/world/africa/as-floods-ravage-sudan-young-volunteers-revive-a-tradition-of-aid.html>. Accessed: 15 December 2015.
- Lynch, K. (1960) *The Image of The City*. Harvard: Massachusetts Institute of Technology Cambridge.
- Mohamed, I.A.W. (2010) *Assessment of the Role of Agriculture in Sudan Economy*, MPRA Paper No. 33119. Munich: Munich Personal RePEc Archive. Available at: <https://mpra.ub.uni-muenchen.de/33119/>. Accessed: 30 October 2019.
- Murillo, F., Osman, S. and Mustafa, A. (2008) *Diagnosis Studies on Urban Sector*, Khartoum State, UN-HABITAT with the MPPPU.
- Nash, C. (2016) *Contemporary Vernacular Design: How British Housing Can Rediscover its Soul*. London: RIBA Publishing.

- Pantuliano, S., Buchanan-Smith, M., Metcalfe, V., Pavanello, S. and Martin, E. (2011) *City limits: urbanisation and vulnerability in Sudan*. London: Humanitarian Policy Group, Overseas Development Institute. Available at: www.odhpn.org.uk/hpg. Accessed: 3 November 2019.
- Pickerill, J. and Chatterton, P. (2006) Notes Towards Autonomous Geographies: Creation, Resistance and Self-management as Survival Tactics, *Progress in Human Geography*, Vol. 30, No. 6, pp.730–747.
- Sarzin, Z. and Mehta, B. (2011) *Sudan: Issues in Urban Development Phase 1 – Overview of the Urban Landscape*. Washington, DC: World Bank. Available at: <http://documents.worldbank.org/curated/en/231021468119365554/Sudan-First-phase-of-the-issues-in-urban-development-overview-of-the-urban-landscape>. Accessed: 15 October 2019.
- Serageldin, I. (2007) *Hassan Fathy*. Alexandria: The bibliotheca Alexandria.
- Sullivan, J. (2014) Trash or Treasure: Global trade and the Accumulation of E-waste in Lagos, Nigeria, *Africa Today*, Vol. 61, No. 1, pp.89–112.
- Sustainability Institute (no date) *Lynedoch Eco Village*. Available at: <https://www.sustainabilityinstitute.net/about/lynedoch-ecovillage>. Accessed: 05 December 2017.
- The Guardian (2004) Story of cities #33: How Santiago tackled its housing crisis with 'Operation Chalk'. Available at: <https://www.theguardian.com/cities/2016/apr/29/story-cities-33-santiago-chile-housing-crisis-operation-sitio-operation-chalk>. Accessed: 5 November 2019.
- The World Bank (2009) *Reshaping Economic Geography*. Available at <http://documents.worldbank.org/curated/en/730971468139804495/pdf/437380REVISED01BLIC1097808213760720.pdf>. Accessed: 12 November 2018.
- Town and Country Planning Association (TCPA) (2008) *Eco-towns Community Worksheet - Advice to Promoters and Planners* London: Towards Sustainable Communities. Available at: www.tcpa.org.uk. Accessed: 09 November 2017.
- UN-Habitat (2014) *Sudan's Report for United Nations' Third Conference on Housing and Sustainable Urban Development*. Khartoum: UN Habitat and Ministry of Environment, Forestry and Urban Development National Council for Physical Development. Available at: <http://habitat3.org/wp-content/uploads/Sudan-National-Report.pdf>. Accessed: 2 November 2019.
- WIEGO (2018) *Counting the World's Informal Workers: A Global Snapshot*, Statistical picture. Available at: <https://www.wiego.org/informal-economy/statistics/statistical-picture>. Accessed: 6 November 2019.

BIOGRAPHY

Ghada Ahmed Elashi entered professional architectural practice since 2012, that started in Egypt as a landscape architect and currently as a lead architectural engineer based in Saudi Arabia. She was involved in variety of projects ranging from housing to hospitality projects located in the Middle East and Africa. In the fragmented construction industry several challenges face the efficient performance at delivering projects, to mitigate these challenges Ghada is part of management team responsible to structure work-flow systems, supervise design schemes and procure technologies relevant to context of operation. Academic research in parallel with practice affirmed her that decent settlements is a human right. Beside her career in the private sector she is dedicated to find solutions and methods to deliver adequate settlements to the urban poor and vulnerable. Ghada earned a Bachelor and Post graduate degree in Architectural engineering and environmental design and a Master degree in Architectural Project Management.