



Assessment of the architectural sustainability components of selected primary health care centers in Bauchi State

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Abstract

This research is conducted to ascertain the level of compliance of selected primary health care centers in Bauchi state to the principles of sustainable Architecture. The general idea is to determine the general acceptance in terms of usage to all (abled or disabled persons), environmental friendliness, and occupants comfort of the selected primary health care centers. For the purpose of clarity, the approach for this study is strictly qualitative, data are collected through case study by use of sketches, photographs and physical observation. Data collected are analyzed using cross case analysis. At the of the research, after careful assessment it was determined that the PHCCs visited and assessed do not conform to the principles of Architectural Sustainability.

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Introduction

Providing basic health care through preventive, curative and rehabilitative services is most regarded as primary health care (Eboreime, Eyles and Nxumalo, 2018; Olise, 2012) ^[6, 22]. This community based grass-root approach is solidly build up on the principles of essential health care, community participation, equity, sectorial collaboration and the use of appropriate technology (Aigbiremolen, Alenoghena, Eboreime and Abejegah, 2014) ^[1].

In a bid to provide basic health care to people at the grass-root and in lowest cost, the Christian medical Commission (CMC) introduced Primary Health Care (PHC) to the World Health Organization (WHO) in 1975 (Bryant and Richmond, 2008) ^[3]. The PHC system was officially lunched as a sustainable health care policy in 1978 at a conference in Alma-Ata, Kazakhstan in 1978 (Tejada, 2003; Litsios, 2004; Bryant and Richmond, 2008) ^[15, 3]. Ever since, the WHO has been the major force in ensuring the attainment of universal health coverage (UHC) through the provision of back up policies that ensure the attainment of UHC.

In Nigerian context, efforts have been made over the years to improve the quality of life and health status of Nigerians (NSB 2018). In 1985 about 52 primary health centers were established by the Federal Government (Aregbeshola and Khan 2017) ^[2]. The establishment of a national health policy in 1988 with focus on primary health care was a step in the right direction, later on in 2004 the national health policy was revised, all in a bid to improve and strengthen health service delivery (Federal Ministry of Health 2004). Another milestone towards strengthening primary health care in Nigeria was recorded in 1992 when the National Primary Health Care Development Agency (NPHCDA) was established to ensure the continuity and sustenance of the primary health care agenda (Fatusi 2015, Lambo 2015) ^[7, 13]. By the year 2005, primary health care facilities were found to make up over 85% of health care facilities in Nigeria (FMOH 2010). More efforts made by the Federal Government of Nigeria towards improving the health and standard of living is by embracing the MDGs and SDGs policies of the united nations through the establishment of the office of the senior special assistant to the president on MDGs/SDGs.

Bauchi state has recorded reasonable efforts in the aspect of health care delivery at the grass root through the establishment of the Bauchi State Primary Health Care Development Agency (BSPHCDA) in 2012 (NPHCDA, 2015), and other sister agencies such as the Bauchi State Agency for the Control of Aids Tuberculosis and Malaria (BACATMA) (Umar, 2016) [26]. The BSPHCDA is saddled with the responsibility of providing health care infrastructure such as health centers, health clinics, and dispensaries etcetera (Umar 2016) [26]. According to information from the BSPHCDA, there are over 1,300 primary health care facilities in Bauchi state and out of that number 363 of them are Primary Health Care Centers (PHCCs).

Sustainable Architecture in one hand is seen as an environmental responsive Architectural practice that envisages sensibility to social, cultural and economic belief of a region/ people which translates into religion, language, family structure, child raising methods, settlement patterns, land division and land-ownership system, symbolic traditional systems, social identity etc. (Marques and Loureiro, 2013; Okonkwo, 2013) [16, 21].

This study marries the concept of primary health care as the backbone of sustainable health service delivery (Fatusi 2015, Lambo 2015) [7, 13] and the practical application of sustainable architectural design in the improvement of primary health care infrastructure in selected local government areas in Bauchi state, especially in this contemporary society where access to health care service is limited due to poor and unavailability of health care infrastructure (Wanbebe, and Xiaoli, 2022; Arimoro, 2021) [27].

For comprehension, sustainable Architecture and its principles/ performance indicators must be well understood as discussed below.

The Images of Sustainable Architecture

Sustainable Architecture is a broad topic of discussion which is simplified, categorized and presented in six logics – Eco-technic logic, Eco-centric logic, Eco-aesthetic logic, Eco-cultural logic, Eco-medical logic and Eco-social logic (Ryan, 2012) [24]. In another development, sustainable architecture is further reduced to three basic images – Natural image, Cultural image and Technical image of sustainable architecture (Williamson, Radford and Bennetts 2003) [28].

The natural image: This is the most closely related to nature and the resulting buildings are integrated in the landscape. Architectural designs of this category are highly affected by environmental factors such as sun path, local microclimate and often result into soft and organic curves. Finishes used are natural, which can result into intelligent and healthy buildings but there may be danger when the shapes are only defined by environmental issues and the functionality of the spaces is neglected. In that case, the buildings will not be appreciated by the users and sustainable architecture might be regarded as impractical.

The Cultural Image: The cultural image results into buildings which are inspired by local tradition, and which use local materials, it is also a good way to successfully integrate new buildings into existing communities. Even though not all local materials might be able to serve as appropriate and resilient building materials, only materials that are certified as safe and healthy can be used. This image of sustainable architecture also incorporates features that go in cognizance with the culture and tradition of the intended user, it introduces features that promote social cohesion and

communal participation.

Technical Image: The technical image shows proficiency by using the materials of contemporary architecture such as glass, stainless steel and cladding panels in alloys or aluminum.

In line with the views expressed by Williamson, Radford and Bennetts (2003) [28], the principles of sustainable Architecture if properly utilized should be seen to project clearly any of the images of sustainable Architecture.

The Indicators of Sustainable Architecture

It is known that sustainable Architecture is the creation of man-made sustainable environment (Damirchi and Mahdaveinejad, 2018) [4], through the incorporation of practices that is aimed at creating a healthy environment today without the tendency of jeopardizing the environment in the future, to achieve this, social development strategies must be adopted to improve the quality of life. Social development strategies pay attention to welfare needs, cultural and psychological needs, the need for adaptability, the need for growth and the need for development (Nastaran, Ghasemi, HadizadehZargar, 2013) [18]. Indicators of sustainable Architecture are classified into two – social indicators and environmental indicators. While on one hand, the social sustainability indicators are:

Architectural Identity: Architecture has inherent dynamic identities deeply rooted in the culture and history of the society. The sense of Architectural identity can be increased by creating spaces with social identity and stand to represent certain features that are unique through the protection of historic sites, buildings, parks and reduce imported Architectural design features that are not in line with the culture and customs of the people (Kefayati and Moztarzadeh, 2015) [14].

Social Interaction: Social interaction in sustainable Architectural design practice is a very significant feature that Architectural designers must consider. This entails that the designer should consciously and deliberately incorporate features that promote social cohesion through the design of spaces that bring people of diverse culture, religion and social status together. Such architectural features can increase the level of social interaction and can bring about an increase in social capital (Davoodi, Falah, Abadi, 2013) [5].

Social Security: Creating social security in sustainable Architectural practices entails the creation of space which makes the users feel secure and protected. This can be done through the design of spaces that enhance the sense of controllability in the users of the space, the design of safe urban facades, and design of defensible spaces (Davoodi, Falah, Abadi, 2013) [5].

Flexibility: Flexibility is dependent on socio-psychological and economic performance; and the physical spatial organization of the building must be in harmony with the natural and cultural environment, manmade environment, economic and political environment and the livelihood of the community. Flexibility can emerge in three forms - diversity, adaptability and variability. Diversity means having a multifunctional space where it is possible to change the function of the space proportional to requirements. Adaptability means functional and functional-spatial flexibility, in which mobility is possible between sectors and spaces, proportional to change in time and season. The most important features of a flexible architecture are usability for a longer time, compliance with the experience and

intervention of the user, benefits of technical innovations, economic and ecological endurance, and re-use of all or part of the building structure and components (Owliya, Taghdiri, and GhanbarzadehQomi, 2010).

Social Participation: This component suggests that buildings should be designed to be accessible to people with all forms of disabilities (Häkkinen, 2012) ^[11]. And they should as well include features that promote participation and interactions in social roles and activities (Kefayati, and Moztaarzadeh, 2015) ^[14]. Participation in customary activities can increase a person's connection to the values and norms of society in this way the customary values and norms are internalized during the activities, and thus the internal adaptive features are reinforced, which contribute to the socialization of people. (Montgomery, 1994) ^[17]. On the other hand, the environmental sustainability indicators are:

Understanding the Environment: Sustainable design starts with understanding the environment. It helps to determine design process including orientation relative to sun path, and arrangement of the building(s) on the site, preserve the surrounding environment and system access to vehicle and pedestrian (Damirchi and Mahdavinejad, 2018) ^[4].

Having Relationship with Nature: Having relationship with nature entails that the building should be designed to interact and blend with nature, irrespective of the location of a building (either in urban, semi urban or rural area), linking nature with will enliven the environment. This can be achieved through the planting of trees, shrubs, grasses etc (Damirchi and Mahdavinejad, 2018) ^[4].

Realizing the Existing Mechanisms in Nature: This deals with realizing the internal chain and operations of nature, in this existing system there is no any waste. Corpse (body) of an existing organism will be a food for another (Damirchi and Mahdavinejad, 2018) ^[4].

Understanding Environmental Effects: Sustainable design makes an effort to realize environment effects through site evaluation and analysis, evaluation of energy consumption, the toxicity of materials and construction techniques. So that, negative environmental effects can be reduced through the use of sustainable building materials, non-toxic materials and recyclable building materials (Damirchi and Mahdavinejad, 2018) ^[4].

Research Methodology

Research Ethics

This study is guided by research ethics from planning, conducting and reporting the results of the research. To ensure that the research ethics are properly adhered to, this study follows the four ethical principles of research – truthfulness, thoroughness, objectivity and relevance. Proper approvals were sought through relevant authorities (Bauchi state Primary Health Care Development Agency). All participants and respondents engaged in this study are assured of confidentiality and none was forced, or unduly engaged without his/ her consent.

Data Presentation

Six case studies are conducted across the 3 senatorial zones of the state (Bauchi), two local government areas are selected from each senatorial zone and one PHCC is selected from each local government considered. The local governments selected are – Dass, Bogoro, Ganjuwa, Warji, Gamawa and Zaki. Information received from the Bauchi State Primary Health Care Development Agency reveals that there are 1300

primary health facilities across the 20 local government areas of Bauchi state, out of this figure 363 are primary health care centers that are supposed to cater for the over 9 million population of the state (National Bureau of Statistics, 2017). Out of the 363 primary health care centers in Bauchi state, Dass LGA have 13 PHCCs, Bogoro LGA have 13 PHCCs, Ganjuwa LGA have 19 PHCCs, Warji LGA have 14 PHCCs Gamawa LGA have 18 PHCCs and Zaki LGA have 20 PHCCs, the rest are scattered across the other local government areas of the state.

Case Study One: Sabon Garin Burgel Primary Health Care Center, Dass LGA

Dass local government area, according to the Independent National Electoral Commission (2015), has 10 local government electoral Wards. There are a total of 13 PHCC's across Dass local government area (Federal Ministry of Health, 2021). Sabon Garin Burgel PHCC was constructed by the Association of Local Governments of Nigeria, and commissioned on the 23rd April, 2013 by the then governor of Bauchi state Mal. (Dr). Isa Yuguda. The PHCC is currently managed with support from the Nigeria State Health Investment Project (NSHIP). Building premises covers an area of 3144.418 square meter (sqm). The building adopts a simple form comprising of rectangles and squares harmoniously fused together, and provides space for functions such as: Immunization section, Male and female wards, Offices for staff, Labour room, Laboratory, Conveniences and stores etc.



Fig 1

Observations from Case Study One: This health care center has adequate and well defined solid and liquid waste collection and disposal point, the facility has an incinerator for proper collection and disposal waste. Building orientation is not properly done (building facing east), openings are not

properly protected from sun glare, soft landscape element such as trees and shrubs are not provided, hard landscape elements are provided (increase urban heat island), ramps and handrails are not provided to aid access to people with disability.

Case Study Two: Primary Health Care Center Kurum, Bogoro LGA

Bogoro local government area has a total of 10 local government wards (INEC, 2015), and 13 PHCC's (FMoH, 2021). Primary health care center Kurum is located in Kurum Kasuwa, Bogoro local government area of Bauchi state, it was last renovated by UNICEF and European Union and renovation contract was handled by GYLAM NIG LTD. The facility sits on 886.663 square meter of land. The building adopts a simple form comprising of rectangles and squares carefully fused together to produce a bigger form. The building houses the following functions: Staff offices, Ward, Laboratory, Conveniences and stores.



Fig 2

Observations from Case Study Two: Some of the observation made on the case study conducted which are considered to be demerits are: No defined refuse collection and disposal point, soft landscape elements not provided, building orientation is poor, shading devices not provided to control solar radiation, cultural values and social cohesion elements are not provided, one ward is provided to serve as male, female and pediatric ward, Principles of sustainable architecture not adhered to, facility not adequate to be used as primary health care center.

Case Study Three: Miya Model Primary Health Care Center, Ganjuwa LGA

There are 11 electoral Wards and 19 PHCCs in Ganjuwa Local Government Area (INEC, 2015. FMoH, 2021). Miya primary health care center is a model primary health care center, information about the year of construction, contractor,

and client was not provided as at the time of the visit. Information gathered reveals that the management and control of the PHCC lies in the local government with support from state government and other non-governmental organizations. The primary health care center is located on coordinates 10°54'20" N 9°49'52" E and cover an area of 2334.655 square meter. Model primary health care center. Miya adopts a simple form comprising of rectangles and squares harmoniously fused together, and provides space for functions such as:

Immunization section, Male and female wards, Offices for staff, Labour room, Laboratory, Conveniences and stores etc.



Fig 3

Observations from Case Study Three: Some of the observation made on the case study conducted which are considered to be demerits are: No defined refuse collection and disposal points, no landscape elements provided, adequate shading devices not provided, Principles of sustainable architecture not adhered to.

Case Study Four: Primary Health Care Center Baima, Warji LGA

Warji LGA has a total of 10 electoral Wards and 15 PHCC's (INEC, 2015. FMoH, 2021). Baima primary health care center is located in Baima community Along Baima Warji road. It was constructed as primary health care clinic (maternity), later on its status was changed to Primary Health Care Center with the introduction of the idea of one PHCC per local government ward. Information about the year of construction, contractor, and client was not provided as at the time of the visit, but the management and control of the PHCC lies in the local government with support from state government and other non-governmental organizations.

Baima primary health care center adopts a simple form comprising of rectangles and squares harmoniously fused together, and provides space for functions such as: Immunization section, Male and female wards, Offices for staff, Labour room, Laboratory, Conveniences and stores etc.



Fig 4

Observations from Case Study Four: observation made on the case study conducted which are considered to be demerits - Total land area provided is not up to the required standard of 4200 square meter, no perimeter fence, no defined refuse collection and disposal points, no landscape provided, no shading devices not provided, Principles of sustainable architecture not adhered to, Building not accessible to persons with disabilities, Social interaction spaces not provided, window openings don't provide 100 percent ventilation, Poor building orientation.

Case Study Five: Primary Health Care Center Kore, Gamawa LGA

There are 11 electoral Wards and 18 PHCC's in Gamawa LGA (INEC, 2015. FMOH, 2021). Primary health care center Kore is located in Kore community Along Azare Hadejia road. Information about the year of construction, contractor, and client was not provided as at the time of the visit, but the presence of a signage by the entrance of the premises suggest that the PHCC was recently renovated with collaboration from NPHCDA, NSHIP and the World Bank. the management and control of the PHCC lies in the local government with support from state government and other

non-governmental organizations. The facility covers a total of 2466.782 square meter. Like many other PHCC's visited, this primary health care center adopts a simple form comprising of rectangles and squares harmoniously fused together, and provides space for functions such as immunization section, ante natal, male and female wards, offices for staff, labour room, laboratory, conveniences and stores etc.



Fig 5

Observations from Case Study Five: The observation made on the case study conducted which are considered to be demerits are; Total land area provided is not up to the required standard of 4200 square meter, no defined refuse collection and disposal points, no proper landscape provided, adequate shading devices not provided, principles of sustainable architecture not adhered to.

Case Study Six: Primary Health Care Center Tashena, Zaki LGA

There are 11 electoral wards and 20 PHCCs in Zaki LGA (INEC, 2015. FMOH, 2021). Primary health care center Tashena is located in Tashena community Along Katagum-zago- mamajo road. Information about the year of construction, contractor, and client was not provided as at the time of the visit, but the presence of a signage by the entrance of the building suggest that the PHCC was recently renovated with collaboration from UNICEF and European Union. the management and control of the PHCC lies in the local government with support from state government and other

non-governmental organizations. The PHCC sits on an area of land covering 2,258.434 square meters. Like many other PHCC's visited, this primary health care center adopts a simple form comprising of rectangles and squares harmoniously fused together, and provides space for functions such as immunization section, male and female wards, offices for staff, labour room, laboratory, conveniences and stores etc.



Fig 6

Result Discussion and Conclusions

The sole purpose of conducting this study is to determine the architectural design sustainability compliance of existing primary health care centers in Bauchi and in a bid to attaining this objective, the key principles of sustainable Architectural design were outlined and used to determine their manner and mode of application in the existing facilities. The principles used for this study are:

1. Universal accessibility (access to both abled and disabled people using ramps, handrails, circulation patterns)
2. Improved social interaction (use of healing gardens, canteens/ cafeteria, public lounges etc.)
3. Design to promote cultural and Architectural identity (building configuration/ arrangement of units of building to enhance functionality and promote cultural practice)
4. Improving indoor and outdoor air quality (application of shading devices, soft landscape elements, building orientation)
5. Use of locally sourced materials
6. Efficient energy use (green energy alternative)
7. Effective waste management.

The result of the case study conducted is presented on in the table 1 below. From table 1 below the indicators used to assess the architectural sustainability of the selected PHCCs visited are either not provided or in cases where provisions are made they are grossly in adequate or wrongly place and so cannot be used effectively. For instance, ramps are provided at PHCC Miya and PHCC Tashena but are not accessible at entry point to those intended for because they are too steep at the access point, disabled persons need to be assisted/ lifted to have access to them. Healing gardens, public lounges and canteens that are supposed to serve are spaces for social interactions are completely absent all the facilities visited.

Table 1: Case Assessment

S/N	Principles	Area of application	Bauchi South PHCC S/G Burgel	Bauchi Central PHCC KURUM	Bauchi North PHCC Miya	Bauchi North PHCC Baima	Bauchi North PHCC Kore	Bauchi North PHCC Tashena	Remarks
1	Universal Accessibility	Availability of Ramp	1	1	1	2	1	2	The phccs visited are not designed to provide access to people with disabilities except warji and tashena and they are wrongly provided
		Availability of Hand rails	1	1	1	1	1	1	
		Separation of vehicular and pedestrian circulation	1	1	1	1	1	1	
2	Promoting social interaction	Healing gardens and therapy	1	1	1	1	1	1	All phccs assessed don't have facilities that promote social interactions.
		Public lounge	1	1	1	1	1	1	
		Canteen	1	1	1	1	1	1	
3	Promoting cultural Identity	Concept that promote cultural identity	1	1	1	1	1	1	Two of the health care facilities assessed have the same space provided as wards for male, female and children. All the phccs do not have specific design concepts that reflect the cultural identity of the people they are designed for.
		Separation of male and female wards	5	1	4	1	2	4	
4	Improving air quality	Proper building orientation	2	2	4	2	3	3	Two out of the six phccs assessed have reasonable trees planted around their premises which staff and visitors use as vehicle parking lot. The remaining have no trees at all, only trunks that suggest the existing trees are cut off.
		Appropriate application of shading devices	2	1	3	1	4	3	
		Use of trees and shrubs	1	1	1	1	2	3	
5	Use of local materials	Application of timber	3	3	3	3	3	3	The roof carcasses of all the facilities visited are made of timber, but other building elements such as walls and other structural elements are made of concrete, glass, aluminum or galvanized iron whose embodied energy is higher than materials like CEB and adobe.
		Use of materials with low embodied energy e.g. laterite	2	2	2	2	2	2	

6	Energy efficiency	Effective use of energy (green energy alternative)	2	2	1	1	2	2	National grid is the major source of power for the facilities in Miya and Burarana. The other four have both national grid and solar power which is inadequate. In some facilities like Tashena, the solar only powers borehole and doesn't provide power to building and that makes it inadequate for preservation of vaccines and other essential drugs.
7	Effective waste management	Solid and liquid waste collection point	4	1	1	1	3	3	Solid and liquid waste collection points are not adequately provided in Kurum, Miya and Burarana.
		Provision of Incinerator for collection and disposal of dangerous waste	5	1	1	1	1	2	

Key: 1 = Not provided, 2 = Not Adequate, 3 = Fairly Adequate, 4 = Adequate, 5 = Very Adequate

Conclusion

Sustainable Architecture is very important in global Architectural practice because it explores ways for efficient management of resources and promotes healthy construction practice. After assessment and subsequent presentation of result as seen table 1 above, this study thereby conclude its findings as follows:

1. The universal accessibility principle of sustainable architectural design practice is not applied in the design of all the PHCCs visited because ramps, handrails, and isolation of vehicular from pedestrian circulation are not provided to aid disabled persons.
2. The PHCCs assessed do not promote effective natural healing process for people with health challenges as they do not promote social interaction among the users, by creating healing gardens, lounges and canteens.
3. The features that promote cultural identity in some PHCCs are missing in some of the facilities visited thereby resulting to people deserting some of this facilities, e.g. combining male and female ward, citing male and female conveniences in the same place etc makes it difficult for users to access thereby limiting its functionality.
4. Creation of urban heat islands, poor building orientation and cutting of trees for construction purposes taunts the principle of improving air quality. And this practice is visible in most of the PHCCs assessed.
5. Apart from the use of timber for roofing all the PHCCs visited use materials with high embodied energy such as cement, galvanized iron, aluminum, glass etc.
6. Energy use is not efficient in the PHCCs visited, in cases where green energy alternative is attempted, it is not sufficient to power the building making it difficult for storage of vaccines and other essential drugs.
7. Generally, the waste management practice and provision is very poor in majority of the PHCCs visited.

Recommendation

In the process of conducting this study lots of issues have been discovered, although the study does not focus on managerial problems as they relate to PHCCs in Bauchi state. It is the constitutional responsibility of the local government to manage, control and finance PHCC with support from state governments, federal government and other non-governmental organizations. That notwithstanding, recommendations of this studies are:

1. This study recommends among other things that existing primary health care centers should be upgraded to incorporate the principles of sustainable Architecture, especially the universal accessibility principles to

provide easy access to people with disabilities.

2. Green energy alternative should be adopted as the major source of power for PHCCs in Bauchi state especially those in rural areas to help in preservation of vaccines and other essential drugs.
3. Incinerators and other waste collection and disposal options should be adopted for use in existing PHCCs that don't have efficient waste collection points.
4. Soft landscape elements such as trees and shrubs should be used be heavily used in existing PHCCs to improve air quality and reduce micro climate conditions.
5. More PHCCs should be designed using the principles of sustainable Architecture to achieve Architectural design sustainability.

References

1. Aigbiremolen AO, Alenoghena I, Eboreime E, Abejegah C. Primary health care in Nigeria: From conceptualization to implementation. *Journal of Medical and Applied Biosciences*; 2014:6(2). Available from: <http://www.researchgate.net/publication>. Accessed 06 July 2018.
2. Aregbeshola BS, Khan SM. Primary health care in Nigeria: 24 years after Olikoye Ransome-Kuti's leadership. *Frontiers in Public Health*; c2017. Available from: <http://www.doi:103389/fpubh.2017.00048>. Accessed 19 June 2018.
3. Bryant JH, Richmond JB. Alma-Ata and primary health care: An evolving story. Elsevier Inc.; c2008. Available from: https://www.parthealth.3cdn.net/ea9818ff461c9fbd2c_89m6bh39v.pdf. Accessed 19 May 2019.
4. Damirchi LL, Mahdavinjad M. Analysis of design indicators of sustainable buildings with an emphasis on efficiency of energy consumption (energy efficiency). *Civil Engineering Journal*; c2018. Available from: <https://www.CivileJournal.org>. Accessed 14 Feb 2020.
5. Davoodi S, Falah M, Abadi M. Social sustainability and architecture, determining the indicators affecting the development of social sustainability in architecture. *Conference on Architecture, Urban Planning and Sustainable Development with a Focus on Vernacular Architecture to Sustainable City, Mashhad, Iran*; c2013.
6. Eboreime E, Eyles J, Nxumalo N. Strengthening decentralized primary health care planning in Nigeria using a quality improvement model: How context and actors affect implementation. *Health Policy and Planning Journal*. London: Oxford University Press; c2018. Available from: <https://www.researchgate.net/publication/325013254>.

- Accessed 06 Sept 2021.
7. Fatusi AO. Public health leadership, policy, and the Nigerian health system. A paper presented at the Induction Program of the Institute for Government Research Leadership Technology, Abuja; c2015. Available from: http://www.researchgate.net/profile/Adesegun_Fatusi. Accessed 06 June 2018.
 8. Federal Ministry of Health. National strategic health care development plan; c2010-2015. Available from: https://www.uhc2030.org/fileadmin/uploads/ihp/Documents/Country_pages/Nigeria/. Accessed 06 July 2018.
 9. Federal Ministry of Health, Nigeria. Nigeria health facility registry. Available from: <https://www.hfr.health.gov.ng>. Accessed 02 Aug 2021.
 10. Federal Ministry of Health, Nigeria. National strategic health development plan; c2010-2015. Available from: <http://www.health.gov.ng/doc/NSHDP.pdf>. Accessed 19 June 2018.
 11. Häkkinen T. Sustainability and Performance Assessment and Benchmarking of Buildings – Final Report. Tarja Häkkinen (Ed). Espoo2012.VTT Finland; c2012.
 12. Independent National Electoral Commission. Bauchi State Directory of Polling Units. Revised in January;c 2015. Available from: <https://www.inecnigeria.org/wp-content/uploads/2019/01/BAUCHI.pdf>. Accessed 27 July 2021.
 13. Lambo E. Primary health care: Realities, challenges and the way forward. A paper presented at the First Annual Primary Health Care Lecture, Abuja; c2015. Available from: http://www.nigeriahealthwatch.com/wp-content/uploads/bsk-pdf-manager/1160_2015_Primary_Health_Care_Presentation_Final_NPHCDA_1216.pdf. Accessed 05 July 2018.
 14. Kefayati Z, Moztaaradeh H. Developing effective social sustainability indicators in architecture. Bulletin of Environment, Pharmacology and Life Sciences; 2015;4(5). Available from: <https://www.beppls.com>. Accessed 14 Feb 2020.
 15. Litsios S. The Christian medical commission and the development of the World Health Organization's primary health care approach. American Journal of Public Health; c2004. Available from: <https://ncbi.nlm.nih.gov/pmc/articles/PMC1448555/>. Accessed 08 May 2019.
 16. Marques B, Loureiro CR. Sustainable architecture: Practices and methods to achieve sustainability in construction. LACSIT International Journal of Engineering and Technology; 2013;5(2). Available from: <http://www.ijetch.org/papers/547-A036.pdf>. Accessed 07 Aug 2018.
 17. Montgomery J. Space, Place and Gender. Polity Press: Cambridge; c1994.
 18. Nastaran M, Ghasemi V, HadizadehZargar S. Assessment of indices of social sustainability indicators by using analytic network process (ANP). Journal of Applied Sociology; 2013;24(13). In: Kefayati Z, Moztaaradeh H. Developing effective social sustainability indicators in architecture. Bulletin of Environment, Pharmacology and Life Sciences. 2015;4(5). Available from: <https://www.beppls.com>. Accessed 14 Feb 2020.
 19. National Bureau of Statistics. Demographic Statistics Bulletin; c2017. Available from: <https://www.nigerianstat.gov.ng/elibrary>. Accessed 05 July 2018.
 20. National Primary Health Care Development Agency. Primary health care under one roof implementation score card III report; c2015. Available from: <https://www.nphcda.gov.ng/Reports%20and%20Publications.pdf>. Accessed 05 July 2018.
 21. Okonkwo PC. Sustainable development in a developing economy: Challenges and prospects. African Journal of Environmental Science and Technology. 2013;7(8):738-747. Available from: <http://www.academicjournals.org/AJEST>. Accessed 07 Aug 2018.
 22. Olise P. Primary Health Care for Sustainable Development. 2nd ed. Abuja, Nigeria: Ozege Publications; c2012.
 23. Owliya J, Taghdiri A, GhanbarzadehQomi S. Structural adjustment of industrial systems for buildings. Scientific Journal of the Iranian Scientific Society of Architecture & Urbanism; c2010. In: Kefayati Z, Moztaaradeh H. Developing effective social sustainability indicators in architecture. Bulletin of Environment, Pharmacology and Life Sciences; 2015;4(5). Available from: <https://www.beppls.com>. Accessed 14 Feb 2020.
 24. Ryan A. Competing logistics of sustainable architecture in a New Zealand competition; c2012. Available from: <https://www.cmsl.co.nz/assets/sm/5939/61/2.PN062Ryan.pdf>. Accessed 18 March 2019.
 25. Tajada RD. Alma-Ata revisited. Perspectives in Health; 2003;8. Magazine of PAHO, Regional Office of WHO. Available from: https://www.medint.at/fileadmin/bilder/bildung_und_lehre/literatur/literatur_pdf/tejeda2003.pdf. Accessed 19 April 2019.
 26. Umar B. Assessment of the effort of Bauchi State Government in the implementation of the Millennium Development Goal 4. [MSc Dissertation]. School of Post Graduate Studies, Ahmadu Bello University Zaria; c2016. Available from: <http://hdl.handle.net/123456789/9845>. Accessed 25 Aug 2019.
 27. Wanbebe NM, Xiaoli D. Health infrastructure deficit – Nigeria, the time to act is now. Central African Journal of Public Health. 2022;8(5):203-12. DOI: 10.11648/jcajph.20220805.13.
 28. Williamson TJ, Radford A, Bennetts H. Understanding Sustainable Architecture. Polity Press: Cambridge; 2003. Available from: https://books.google.com.ng/books?id=uQ7DWmCX_AQC&printsec=frontcover#v=onepage&q&f=false. Accessed 24 July 2019.