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Global Health

The Burundi Heart Centre: From concept to design

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ABSTRACT

Burundi is one of the world's poorest nations, which is also reflected in its relative lack of cardiac facilities, particularly those catering to young children and adults. The authors discuss current efforts to build "The Burundi Heart Centre" to help address this challenge. In particular, they highlight how the project can act as a case study for a sustainable architecture that involves local people and uses locally available materials in a contemporary and innovative way.

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BURUNDI COUNTRY PROFILE

Small, poor, densely populated and completely landlocked, Burundi lies in east central Africa bordering Rwanda, Tanzania and the Democratic Republic of the Congo (Figure 1). Bujumbura, the capital city, lies at the North Eastern end of Lake Tanganyika, the world's longest freshwater lake which is surrounded by fertile highlands. The country is situated on a high plateau with the altitude ranging from 2,532 feet (772 meters) at Lake Tanganyika to 8,760 feet (2,670 meters) at the highest point, Mount Heha. This elevation greatly moderates the country's tropical character and produces relatively cool temperatures, with an average of about 21°C throughout the year in the central plateau and slightly higher temperatures in Bujumbura (25°C). There are four seasons; the long dry season (June-August); the short wet season (September-November), the short dry season (December-January) and the long wet season (February-May). Total mean annual rainfall is 33.3 inches (848 mm).¹

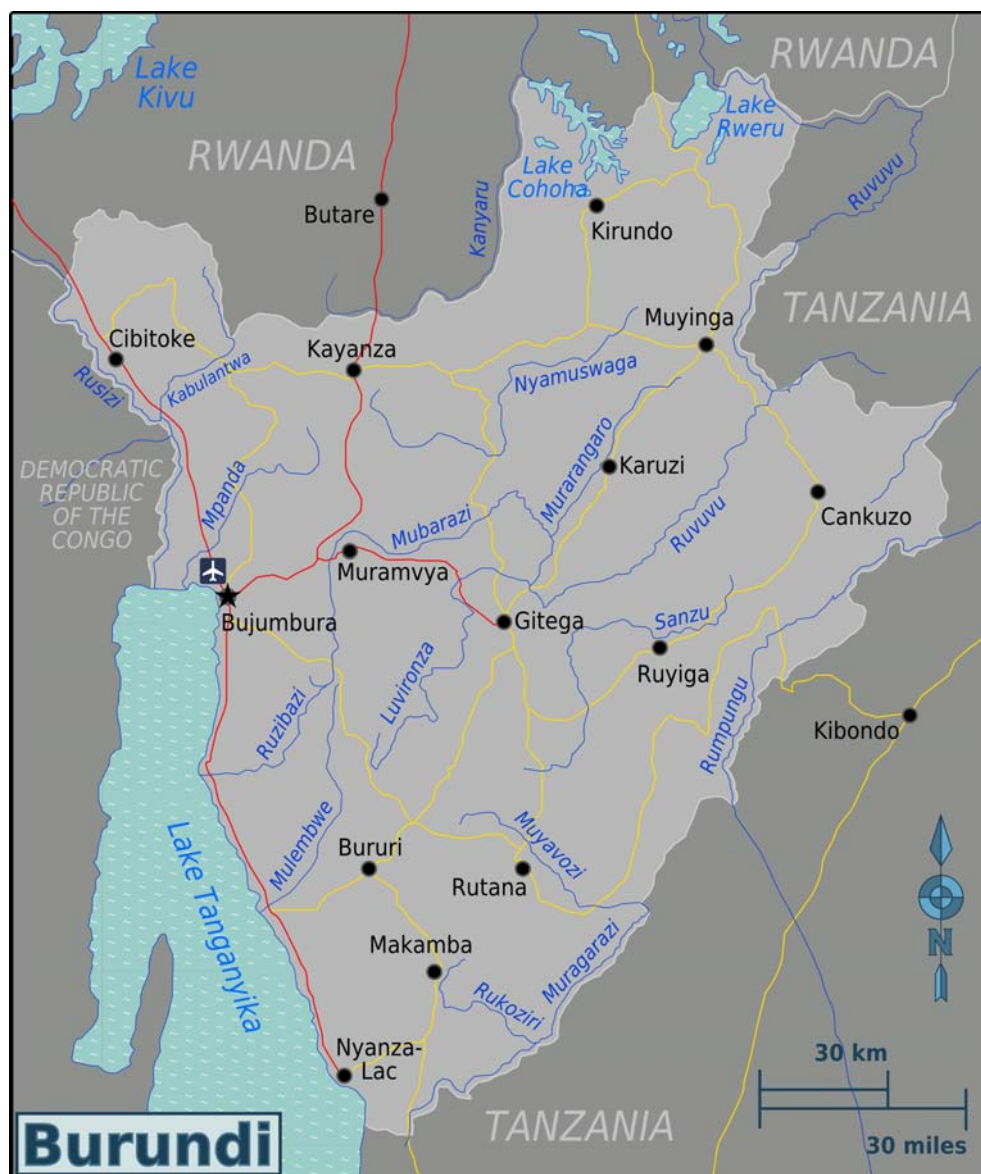


Figure 1. Map of Burundi regions (reproduced from Wikimedia Commons from user:Burmesedays http://commons.wikimedia.org/wiki/File:Burundi_Regions_map.png).

For centuries, the Hutu, Tutsis and Twa people have coexisted in the area. Historically, their differences were occupational in nature; Hutus were agricultural people while the pastoralist's elite was identified as Tutsis. The numerically and socially marginal group of pygmies was known as Twa. At the start of the 20th century, Belgium and Germany occupied the area and Rwanda and Burundi were part

of a European colony called Ruanda – Urundi. After World War II, this mandate was superseded and both countries gained independence in 1962 - Rwanda as a Republic and Burundi as a constitutional monarchy. Since independence Burundi has suffered from a long history of political unrest and armed ethnic conflict, marked by two major events: The brutal massacre of an estimated 150,000 Hutus by the Tutsi-dominated army in 1972, and the 1993 mass killings of Tutsis by Hutu militia. An estimated 200,000 people from both groups died in the 12 years of low intensity warfare that followed the 'Burundi genocide' of 1993, before the signing of a peace agreement in 2005. The peace accord was further legitimized through the voting of a new national constitution by the population, and the establishment of a mixed Hutu/Tutsi army, incorporating elements from the previously warring factions. Presidential elections were also held at this time, issuing in an era of relative peace and stability.^{2,3}

With a total population of an estimated 10.6 million people, the country is listed as one of the five poorest nations worldwide. Although recent political stability has proven beneficial, poverty remains extremely prominent⁴ The World Health Organisation (WHO) recognizes that there is a strong link between poverty and health, and that public health is critical for economic growth. In Burundi, there are 0.03 physicians per 1,000 people.⁵

Although free primary education has been introduced, according to the CIA world fact book only one in two children go to school. Less than 2% of the population has electricity in their homes and food and medicine are in short supply. The end of the civil war has improved aid flows and economic activity has increased, but underlying weaknesses – a high poverty rate, poor education rates, a weak transportation network, and overburdened utilities – handicap planned reforms. Burundi remains heavily dependent on foreign aid, which currently represents 42 percent of its national income.

CASE OF NEED

According to WHO, life expectancy is 54 years compared to 78 in the UK. This is contributed to by a variety of causes, including non-communicable diseases, such as heart disease which, up until recently has been largely neglected. Heart disease continues to be the leading cause of death and disability world wide, with 80 percent affecting low and middle-income countries. This is particularly true in Burundi. Currently there are no dedicated facilities in Burundi to deal with this problem, both in terms of prevention or care for the large number of affected individuals. This has led to the idea of establishing a state-of-the-art centre (the Burundi Heart Centre) in an attempt to start dealing with this massive problem. Strategies of how to address this global challenge and how to establish cardiac surgery programs in the developing world have previously been discussed.^{6,7}

MISSION STATEMENT

Offer state of the art treatment to children and young adults with heart disease, free of charge at entry, in a purpose built heart unit.

Conduct research aimed at defining the size and type of heart disease in Burundi to guide prevention programmes.

Train local health care professionals to ensure sustainability.

DESIGN PRINCIPLES

The ambition for the pediatric heart centre is two-fold: firstly, it is to provide state of the art cardiac facilities to a country in high need for decent cardiac services. At the same time it is the intention to use inspirational architecture as a tool to improve lives, highlighting the fundamental values of healing and preserving the life of children and young adults in an environment that mitigates the sensation of stress and worry.

Engaging with Africa comes with a potent cocktail of sentiments: sorrow, fascination, hope, and the nagging question whether outside help can avoid being patronising. From the early concept stages of the project it was therefore paramount to actively engage Burundians in the project with the vision that they will become the future owner- operators of the center. Following a 'bottom up' design process, this not only applies to medical training but also to the construction process and maintenance of the building.

In Burundi, the palette of local materials is limited to compressed earth bricks, concrete, corrugated steel and natural stone- and these are typically associated with regress. Therefore, the use of these materials in an innovative and contemporary way is a critical part of the design process, not least to

provide some inspiration and living proof of their value to the local population (Figure 2). Another intention through the use of local materials was the strengthening of genius loci and cultural context: Chinese building companies now dominate and propel the construction sector in Africa and most materials in Burundi are – if the budget allows – Chinese imports, mainly of low quality. This tends to not only weaken local building companies but also domestic expertise and skills.

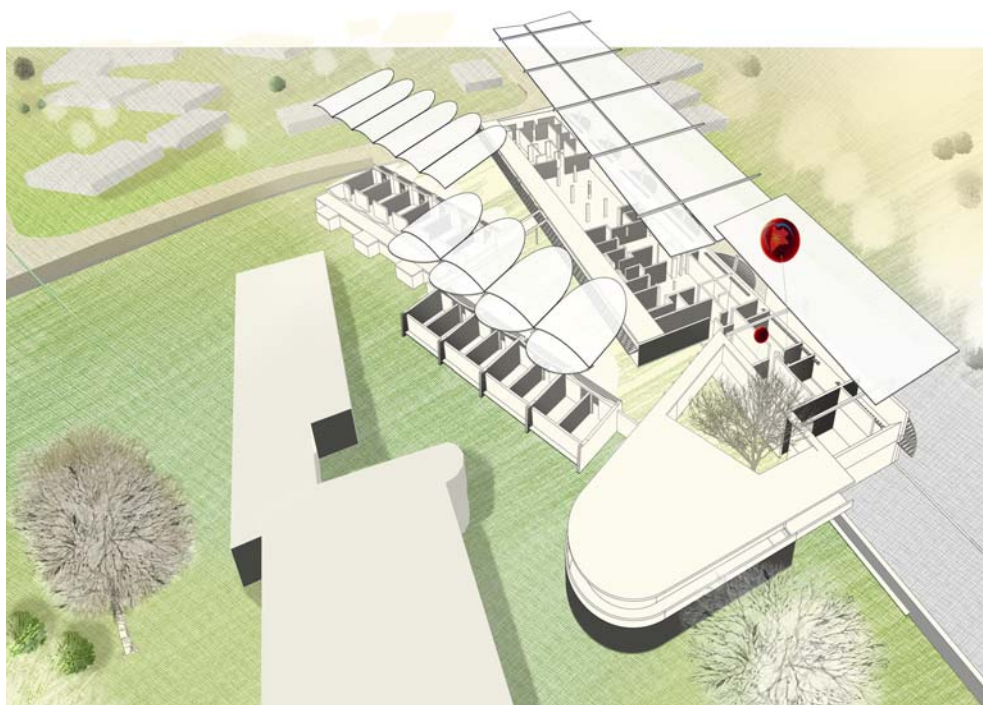


Figure 2. Schematic drawing of proposed Burundi Heart Centre.

In designing the hospital it is the desire to find an architectural language that manifests the principles of care and healing and at the same time creates a contemporary vernacular architecture from local materials from Burundi for Burundians.

The design follows three guiding principles:

- Create a vibrant and inspiring building that is not only functional but harmonious in its design, structure, technique and use of materials.
- Create a sustainable architecture that involves the local people and uses locally available materials in a contemporary and innovative way.
- Use architecture to improve lives.

ARCHITECTURE

The cardiac facility will be situated on the grounds of the Prince Louis Rwagasore hospital (Figure 3). It is one of the oldest hospitals in Burundi and was built in 1945, its architecture revealing a strong European influence.

The layout of the heart centre takes inspiration from an African village where the traditional hut, the ‘rugo’ (meaning many huts) is surrounded by a courtyard, and several houses are grouped together inside a wall (Figure 4).

Whilst the surgery and ICU block follow a rational layout, the wards and outpatient facilities are loosely arranged around two central spaces. The hospital buildings have been designed as single story structures to avoid being over- imposing and to provide a sense of intimacy, especially for young children (Figure 5). The proposal works with a modular system that addresses budget constraints, allows for building techniques that can be more easily accomplished and at the same time provide for welcoming, social and enlivened spaces.



Figure 3. The Prince Louis Rwagasore hospital.

The soul of the building is two inner sanctums (green courtyards) to which all public areas and surgery facilities have direct access, optimising the building's microclimatic and healing properties.⁸

The roof of the surgery ward acts as the building's battery, providing sufficient area for the installation of solar panels. The overhanging vaulted roofs of the smaller modules provide shade to waiting areas and protect the low-density brickwork during the rainy season.

Demarcation walls form a strong part of Bujumbura's cityscape, and a 2.5 m high brick wall secures the site for the heart centre. Given that security of equipment and medication will be paramount, there is the desire to turn external facades and demarcation walls into social spaces, without losing their



Figure 4. Typical 'rugo' layout of huts surrounding a courtyard (Le Burundi, collection Architectures traditionnelles by Jean-Louis Acquier).



Figure 5. Single-storey buildings provide a sense of intimacy which do not overwhelm children.

protective function. Therefore external walls will incorporate shaded sitting facilities to connect the building with its immediate surroundings, creating public or semi-public space that can be shared by both hospitals on site.

TECHNOLOGY

Integral to the center's philosophy is environmental sustainability. The use of contemporary cooling systems implies a large electrical or fossil fuel energy consumption. To mitigate CO₂ emissions there is a necessity to exploit renewable energy sources for cooling, heating, lighting and ventilating a building, creating a bioclimatic architecture.

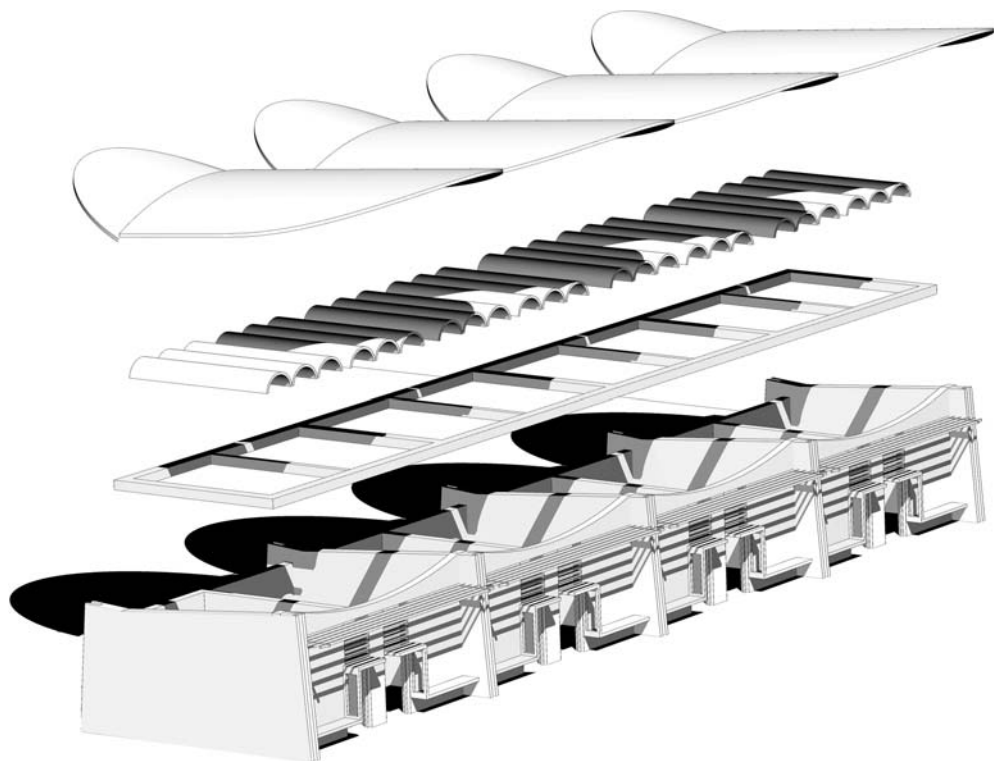


Figure 6. Roof design maximizes passive cooling of outpatient areas.

Thick walls made of interlocking compressed clay brick will provide an appropriate thermal mass to cool the interior temperature during daytime. Windows with operable shutters will block direct sunlight entering the rooms.

The roof structure of the outpatient and ward facilities consists of an outer vaulted skin that protects from rainfall and keeps the sun out. The inner roof structure is made of compressed clay bricks and forms a series of smaller perforated vaults to allow for warm air to enter a plenum that sits between these two roofs. Natural convection is used to produce a breeze that simulates air conditioning. In addition, plants in the courtyards will help cool the air and maximize comfort levels (Figure 6).

Solar power is a relatively new concept in Burundi. Bujumbura's excellent climatic condition means that the sun can be a potent and a clean energy source that allows for a fairly constant energy generation capacity throughout the year.

In order to provide warm water and to cool down the areas that cannot be subject to natural ventilation (operating theatre, cath labs/, ICU) PVC (photo voltaic) panels will be incorporated into the design to provide for the necessary energy.

CONCLUSION

To empower local people and to make them part of a solution is paramount in finding a way to improve lives in an underdeveloped country. The guiding principle is that a sustainable cardiac hospital model is not 'delivered' by professionals but that the project involves a social commitment, where both medical training and the construction of the building reconnect locals with skills and knowledge to provide for a sustainable and possible future.

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