# The Manifestation of Sustainable Architecture in Urban Zambia

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11.22.2004

Contemporary Perspectives L 911.510

Seminar Paper

**Thesis Statement:**

Sustainable architecture is a trend that is sweeping the globe. It is currently almost exclusively addressing the environmental problems arising in developed nations. Globalization is bridging the developed and developing countries through the transfer of information and technology, bringing its burdens with its blessings. In the developing world globalization generally includes modernization, nearly synonymous with industrialization. As cities spring up around new industrial centers their environments need to be safeguarded. These urban situations are of particular importance because the balance between functionality and environmental responsibility is especially delicate. Not only are local inhabitants affected by environmental policy, but so is the entire world as globalization magnifies the consequences of environmental maintenance, degradation and restoration. And so, the urban center is where the need is greatest to enhance local and imported archetypes through an infusion of sustainable, high performance design strategy.

As a developing nation with inchoate cities, Zambia has an incredible opportunity to create a series of urbanities whose importance could rival contemporary metropolises and surpass them in comfort and quality of life through proper design. To progress sustainably, the architecture there needs to examine issues of appropriateness and scale. The same solutions instituted in North America, Europe or Asia may very well not work efficiently in a sub-Saharan African country. The basic premises may be the same or similar, but execution of the ideas needs to be dependent upon climate, soil conditions, resource availability and culture which all vary regionally. This will therefore be a study of the specific directions of high performance design in urban Zambia.

**Part II: Global Trend: Sustainability**

Of all the trends that scatter the globe, there are few whose scope is so large such that it transcends boundary and definition. Most deal with very confined fashions and issues. In select instances local subjects have significant bearing on politics, economics and society, bringing the matters under a more inclusive umbrella, which in turn gives them strength vis-à-vis the larger global population. Environmental sustainability demonstrates global impact of local decisions very clearly. It draws from nearly every major change in social, political and economic circles – outsourcing for example.

When jobs in the US are outsourced to other countries with lower overhead in the name of sustainable economic development the newly unemployed suffer economic distress, but it is justified through the generation of lower prices for the finished product, higher profits for owners, new jobs for people in foreign countries and the perpetuation of the global economy through assimilation of local economies. Although it appears very cut and dry, if one were to consider expanding the sphere of influence beyond socio-economic impact, it would become apparent how incredibly far reaching the effects of such an action are.

Ecological consequences of the decision to outsource are often disastrous since the places companies tend to move production facilities have little or no environmental protection legislation or enforcement. Without government mandate, costly pollution control measures are rarely instituted. When left unregulated, the scale of production dictates the scale of waste and environmental degradation begins immediately. Liquid effluents flow freely into rivers, lakes and the sea. Smoke billows out of factories and electricity generation plants. Over time, the effects compound and multiply in scope and

magnitude so that entire ecosystems are destroyed. Once the cost-benefit equation includes that temporal component, the ramifications compound exponentially with every generation and issues which are superficially local quickly are exposed as large scale waves and ripples in global economic, social and political patterns.

Now, three hundred years after the industrial revolution the world is in the middle of addressing the serious ecologic ill-effects of industrialization. Localized damage, a byproduct of the means of production, is generating widespread concern as weather patterns disperse toxic pollutant particles. An enormous brown cloud of Chinese pollution is routinely blown from the mainland over the Korean peninsula and Japan all the way across the Pacific Ocean in as little as four days. The fallout over Korea and Japan is significant enough to cause health problems there. By the time the sulfates and other pollutants reach the shores of the US they are still concentrated enough to acidify rain and contribute to the recent significant changes in weather patterns (Miller 1). Forest fires, whether begun by lightning or by farmers clearing land with slash and burn techniques can alter atmospheric conditions so severely that ash and soot reach levels of the atmosphere previously thought impossible (Perkins 1). That carries the pollutants further still, dispersing the damage they do to greater areas than ever imagined. Global quality of life is being adversely affected with the possibility of irrevocable damage. The poignancy of this awareness is emerging now, at the cusp of industrialization in the developing world. As high operating costs and stronger environmental protection laws prompt manufacturing to leave developed nations and relocate to countries with cheaper access to resources and lower overhead costs, developing nations have the opportunity to spare themselves the same contaminative consequences of modernization and

industrialization wrought upon the global north.. If leaders of emerging countries organize and plan for sustainable growth they greatly increase their odds of long term success. Sustainability is the key to that success, and it is easier to implement sustainable practices in the framework of a nation than to revisit and overhaul policies and practices after the damage is done.

Sustainability, in environmental terms, is a catch word that has only really been popularized in the last decade or so. As an idea in western traditions (often considered modern traditions), it first began appearing in popular vocabulary in the 1970s as industrialized countries finally began to pay attention to the environmental and health consequences of their industrialization. Broadly defined, sustainability is "…development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Grierson 3). The application to environmental issues is straightforward: human development and activity must be guided so that it addresses the needs of the here and now without destroying environmental balance and integrity so as to hinder utilization of natural resources by future generations. Contamination of rivers like the Hudson has kept people from fishing them, drinking their water and swimming in them. Smog from automobiles in Mexico City has gotten so bad that there are oxygen bars popping up all over the city (Fainaru 2). Eastern Europe's air is so badly polluted that rain often has the same acidity as vinegar (Williams 2). The ecological impact of decisions is especially important because all of human existence is ultimately dependent upon the environment. The collapse of a global economy would not wipe out all human lives. Massive social upheaval would not extinct the human species. Without natural resources, however, there is no hope of sustaining any life on the planet,

least of all human. Existence would be short and miserable. These problems need to be addressed and redressed so that the desired long term results are realized while the solutions are beneficial in the short term in order to convince people to work toward them.

Perpetuation of the theory behind sustainability is the first step. There have been several global conferences, mostly in Scandinavian countries, and the UN has passed resolutions to foster sustainable growth strategies (Agenda 21). The Kyoto protocol outlines a series of steps to create an environmentally sustainable global situation through a reduction in greenhouse gasses ("What Is The Kyoto Protocol?" par. 1). A key component of their strategy is to illustrate the short term and immediate benefits of sustainability, because without them there is little motivation to change established patterns.

Immediate cost recovery and lower operating costs are prompting some multinational corporations to acknowledge the impact of their practices on the planet and its inhabitants. Andrew Bonfield of Bristol-Myers Squibb, the pharmaceutical conglomerate, points out that many of the changes for sake of sustainability can be calculated as immediate or short term savings through reduction in energy consumption, increased employee safety measures that reduce insurance claims and reduction of waste generation for hauling and storage, while they provide long term benefits to the environment and the economy. FedEx Kinko's has realized that the centers it operates in the global south are potential markets, but not without investment by the company toward creating the social environment it would thrive in (Banham 1). Without that, they

have limited themselves to the markets they already participate in, effectively capping their own potential for expansion.

In its most basic form sustainability is the execution of ideas that consciously consider and respond to the short and long term environmental effects of an action. The best chance for meaningful change as a species is a gradual introduction of means for mass cultural efficiency. Opportunities abound in endless situations to implement strategies geared at improving efficiency in energy consumption and waste elimination. Low consumption toilets have been on the market for years in the US, and have been in fact mandated by the federal government since 1995 (Toiletology 101). Hydroelectric dams, wind turbines and photovoltaic cells were developed in the 20th century to generate electricity without burning fossil fuels. At last, decisions are being made that take into consideration the possibility of massively disrupting patterns of life in the developed world. These tangible realities of the abstract of sustainability begin to bring humankind into the world of "high-performance design."

**Part III: Impact of Sustainability on Architecture**

Sustainability, as it relates to architectural design, brings fundamental principles of design back to the forefront of consideration. Questions of the environmental impact of constructing and operating a building come into play when the industry realizes that buildings consume 30% of the world's raw materials, use 36% of all energy in the US and account for 30% of the waste in landfills while emitting 30% of greenhouse gases (Pennsylvania's First Green Buildings). As populations expand, resources and space become more valuable so that architects need to seriously address issues of building density, utilization, appropriateness and performance.

High performance design, as it applies to architecture may take on two forms: active or passive. Active high performance design utilizes high technology to support current societal demands with minimal disruption, generally through generating higher efficiencies relative to heat and energy transfer. Solar cells - either photovoltaic or hydronic, geothermal heat pumps, and wind turbines all fall under the category of active sustainable techniques. Unfortunately the high expense of employing active sustainable technology restricts its use to all but the most developed nations. Even there, the cost of the technology is often prohibitive, hampering further development and improvement. Photovoltaic solar cells in the United States are a case in point. Even with federal and state grants, the cost of purchasing and installing photovoltaic cells prevents the average homeowner from being able to remove him or herself from the fossil fuel-powered grid. Citibank, one of the nation's leading banking institutes, refuses to offer loans to homeowners that would make the solar cells instantly affordable to millions of Americans (Hogue 4). Should a situation like that ever become a reality, the massive influx of money into that sector of technology could fund massive research and development projects leading to a new generation of tools with higher efficiencies at lower costs.

For the moment, much of the interest in sustainable high technology is coming out of government entities and large nongovernmental organizations. In 1997 New Jersey created an official statewide Office of Sustainability, part of whose mission it is to work with state, county and local agencies toward building and renovation projects utilizing green practices (Young 2). The US Green Building Council has set up the LEED (Leadership in Energy & Environmental Design) rating system for buildings to quantify

and standardize the application of sustainable design and construction practices. Different levels of certification are based on site selection and preparation, water efficiency, energy utilization, material use, and indoor environmental qualities, and result in different levels of grant awards (LEED Green Building Rating System ver. 2.1 iii, iv). The certification system encourages use of high efficiency mechanical systems and innovative solutions to wastewater management and recovery of polluted sites (LEED Green Building Rating System ver. 2.1 v, vi). At present Arizona, Maryland, Missouri, Pennsylvania and Wisconsin all require state buildings to meet the minimum LEED criteria. Four more states have legislation pending to put requirements in place, and three others offer additional financial incentives for LEED certification (LEED Mandating Agencies). Beyond US national borders, there have been global summits within the last decade, sponsored and lent legitimacy by non-government organizations like the UN, to educate and encourage sustainable building practices around the world. A conference of the Global Alliance for Building Sustainability was held in Johannesburg, South Africa in 2002, at which US architectural organizations were noticeably absent. Regardless, the general tone was to guide architectural evolution in the direction of sustainability gradually rather than an overnight revolution (Mandell). After all, a major component of sustainability is widespread acceptance and utilization, which only comes with time and access.

If ideas and implementation of high performance design are to propagate beyond the most wealthy, technologically capable countries, there needs to be a recognition and celebration of low cost, low tech sustainable solutions. Passive systems utilize low technology methods of increasing building efficiency, and are often much more

affordable - if not outright cheaper to build, and which cost less to operate than conventional western building. These are typically methods employed previous to the introduction of precise artificial climate control. Most of the realm of passive high performance design seems as though it should be fundamental in building design. The basics are as simple as orienting a building to maximize sunlight exposure, deep roof overhangs to keep out the sweltering afternoon sun in hot climates, trombe walls to collect and re-radiate warmth from the sun in temperate or cold climates, operable windows to cross ventilate and cool, and even using local, rapidly renewable materials as major construction elements. These techniques are not difficult, and possess the ability to vastly improve the quality of a space without using electricity.

The initial choice to ignore these principle building conventions is only available in regions with regulated, reliable power sources, such as in developed nations. Otherwise, they are simply facts of design. Unfortunately, for two entire generations of formally trained architects, education has been left to want in the fundamentals of environmental design. After all, there is magnificence in the ability to transform conditions from inhospitable to comfortable at the flip of a switch - add the correct mechanical systems and nearly anything can be accomplished. That attitude among architects has resulted in buildings which consume extraneous amounts of power and generate absurd amounts of waste. Now, environmental sustainability is forcing the hand of educational institutions in terms of keeping their students competitive through knowledge of environmental responsiveness. The five institutions that perform varying roles in governing American architectural education (the National Architectural Accrediting Board, National Council of Architectural Registration Boards, Association of

Collegiate Schools of Architecture, the American Institute of Architects and the American Institute of Architecture Students) have all come to one form or another of the conclusion that sustainability needs to become incorporated into the design curriculum (Wright 2). They have three different basic ideas regarding the instruction of sustainable concepts: (1) Schools are to assume that good architecture, by its very nature is sustainable and is expected to be as such, (2) Courses that focus exclusively on sustainable technology and design practices need to be created and maintained, and (3) There needs to be a wholistic approach that integrates sustainable theory into all parts of the curriculum, constantly and consistently expecting particular results (Wright 2).

**Part IV: Case Study: Zambia**

In developing nations like Zambia, there begins to be an interesting juxtaposition between rural populations and city-dwellers as the society urbanizes. Rural areas, nearly without exception, are not connected to any sort of power grid and as a whole do not have any electrical capacity, with very limited, isolated exceptions. The people residing in such settings have no choice but to build their dwellings using local rapidly renewable materials in deliberately environmental considerate methods. Operable windows, virtually unheard of in modern western cities are a simple fact of construction in rural Zambia. Often, it is merely an open void to let air and light in (Phiri 21-1). Without means of air conditioning, it is a basic requirement to keep conditions bearable.

Urban settings stand quite in contrast. Zambian cities were fostered by western influence through early colonization and industrial development (Tait 263). The British brought their building methods and typologies to Zambia where they were adopted them without being adapted. Even now, the residual effects can be seen in the national

building codes that are not even designed to work with native materials. Easily quantifiable western materials, like concrete block have repressed the use of locally available mud brick and straw bale. The government's own National Development Plans neglect to discourage inappropriate materials and methods imported without being transformed and made Zambian (Mususa 8). Western has become the ideal through decades of social stratification and is still.

In George, a squatter settlement in the capital city of Lusaka, residents diligently save earnings or take out loans to build their houses of concrete block, a very non-native construction material. By 1989 approximately half of the houses which had begun as mud-brick in 1965 had already "upgraded" to concrete block (Schlyter 26). This is because for them, a concrete house is perceived as "a permanent house" even though without proper foundations they are only slightly less likely to collapse over time (Rakodi 46). Within the city, there is currently a project nearing completion whose design is wholly alien to Zambia: a shopping center based on a Mediterranean design. Because of the rising costs of materials like construction steel, the project has run wildly over budget (Zambia: Downtown Shopping Centre Gobbles $10m). Furthermore, the long term costs of operating such an ignorant building in the hot, semi-tropical climate of Zambia are prohibitive. Western building is suited for temperate climates. Even the Zambian government and businesses operate in electrically lit, air conditioned buildings because even in such a poor country, they have the financial means to do so. It is, in effect, a status symbol. To add insult to injury such a design does not consider social traditions, relations or culture (Ramos 260). Without cultural consideration any appropriateness is lost and the building cannot be utilized to full capacity. If these buildings continue to

operate while wasting resources without maximizing their usage potential, then they loose all credit as sustainable archetypes.

On the other hand, smaller nongovernmental organizations, public institutional organizations, and particularly singular homeowners or families lack the same financial resources as the government and as the urbanization of Zambia progresses, their needs must be addressed. Development of new low technologies and the application of traditional construction and design elements are emerging to solve the problems of the poor. They cannot afford to install appliances that consume electricity, nor can they afford to provide the power to them, assuming they have access to power at all. The solutions, therefore, are somewhat more primitive in their execution but much more elegant in the idea.

The new technologies respond to location and are responsive to climate and available resources. One in particular is a new construction material – a building block called stabilized-soil-cement block that shares many of its properties with cement blocks, but which uses less imported cementitious material and instead substitutes soil found at the site of the building. The machine to produce it is portable and based on an existing technology that was modified to fit the format of the situation (Jere 2). Not only is it environmentally sensitive, but there are immediate cost benefits of using the technology. The reduction in use of imported cement is in the neighborhood of 5 to 10 percent, and the resulting cost savings of construction can be anywhere between 35 and 65 percent for a building (Jere 1). The inspiration for development of the stabilized soil blocks actually came out of a desire to help Zambians to build affordable homes and the aesthetic is said to be much more pleasant than that of the concrete block used so often in perimeter

fences in Lusaka (Jere 2). Of course, the major motivating factor was cost reduction. Poverty is running so rampant in cities that due to affordability issues, informal markets have popped up where rubble stone, sand and sun brick are being traded for use as building materials (Tait 289). These have the benefit of being byproducts of other activities and it prevents them from occupying space in a dump that would only blight the landscape anyway. Use of these more native materials has the added bonus consequence of inspiring more traditional forms for buildings that evolved out of need and the most primitive technology.

Andrew Ose Phiri addressed the inappropriateness of many prominent British typologies and laid out very clearly how to better design toward increasing comfort without relying on expensive mechanical means. His study focused on minor modification of an existing design, again in the effort of conserving money. With only minor modifications for building orientation, construction materials used in the building envelope, use of shading devices and changing the ventilation rate, he was able to identify the single most effective means of building passively for comfort in Zambia: the use of a heavy partition wall. According to him and his tests, that heavy partition wall acted as a thermal mass to moderate daily and seasonal temperature swings (Phiri 21-9). It is a simple gesture with so much significance, and it finds itself ignored regularly by architects, designers and builders in Zambia. It gives the idea of building in Zambia hope as news of money being earmarked for construction spreads.

The World Bank just approved this year a project with $48.5 million set aside for construction of institutional buildings (Maggs). These are the buildings with the greatest sphere of influence as they are public buildings that serve masses of people daily. If

those buildings were designed with sustainable ideas driving the process, people could see the implementation of ideas and materials there and feel how much more comfortable and healthy a building is. It would serve as an example to demonstrate the opportunities to live comfortably, within their means, drawing largely upon what they already have.

**Section V: Implications**

It is a struggle to keep globalization from transmitting and embedding existing environmental problems along with economies and technological advances from the developed to the developing world. Particularly in the nations where independence from "mother" nations is relatively young, like Zambia, problems have emerged from outdated, pollutive equipment first installed nearly a century ago as factories belched black smoke and dumped waste into the open. As the developing world, with their very limited resources, is being forced into dealing with the consequences of these establishments, they have begun to institute strategies for sustainable growth.

Unfortunately, the acute lack of financial means prevents nations like Zambia from rapidly modifying their entire system of production and consumption. Progress is painfully slow but must take place gradually regardless. As the architecture of the industrialized urban centers continues to change into its newest and latest form, passive sustainable techniques and materials are returning, especially in residential forms. Indigenous forms and materials keep construction costs low and the indoor climate more comfortable. What gives hope to the situation is that the cities are learning these lessons before they become overwhelmingly dependent on electrical power to solve all of the livability issues that can arise in buildings.

As the urbanization of Zambia continues squatter settlements will organize and become legitimate components of cities. The people who live there will hopefully already have adjusted their building styles and methods to keep their energy efficiency high. Without the same dangerous dependence on electricity as the west, urban Zambia could very well come to rival some of the world's major cities. Environmentally sensitive and responsive buildings lead to sustainable cities and as the pollution of western cities begins to choke them and they enter stages of decline, the possibility exists that the standard of living in Lusaka or Kitwe may even surpass that of contemporary megatropolises. The high building density of cities forces high output per input of energy and materials in order to create a healthy atmosphere and so it is up to the architects to pick up the gauntlet and edit the design process to draw more heavily from local environmental, social, and economic conditions. The charge to improve the city is ultimately theirs, and it needs to happen if any city is to ever be truly sustainable. Every great city that has fallen has done so because of a fundamental mistake. Environmental ignorance is the plight of contemporary cities and the lessons need to be learned if mankind is progress. The changes made already leave hope in the heart of dreamers and planners, and with all of the ideas waiting to be tried yet, success can be achieved with patience.

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