

A theoretical appraisal of ecologically sustainable practices amongst Engineering and Built Environment Professionals

Mpho Ndou and Clinton Aigbavboa

Sustainable Human Settlement and Construction Research Centre

Faculty of Engineering and the Built Environment

University of Johannesburg

Johannesburg, South Africa

jrndou@gmail.com, caigbavboa@uj.ac.za

Abstract

For many decades, the desperate need for infrastructure development in developing countries has given birth to premature sustainable practices. This is mainly as a result of inadequate ecologically sustainable designs of projects by engineering and built environment professions. The purpose of the study is to evaluate the integration of ecologically sustainable practices among engineering and built environment professionals in developing countries. The research relied on the use of credible secondary based (literature) sources. The literature revealed that ecological integration can be adopted through the following approaches: voluntary labelling, innovative bidding processes and green branding to mention a few. Moreover, the study explores a possible approach through biomimicry which suggest two forms of adoption, a direct and indirect approach of understanding how the ecosystem model function through environmental processes which have remained sustainable to date. Also, the study contributes to the body of knowledge on how ecological economics could bring about radical sustainable development in developing countries.

Keywords

Ecological practices, Integration, Professionals, Sustainability.

1. Introduction

The relationship between environmental knowledge and its ecological impacts are highlighted and scrutinized by various authors and papers. However, Cohen (2006) explains partly the failure and deficiency of the sustainable models use to date. Similarly he observed that sustainability runs parallel to a countries economic and conventional political objectives, which neglects the ecology and hinders on the economy in the long run.

In the late 90s, the term ecological sustainable practices gained popularity in Australia as it advocated that sustainable development should encompass the aspects of the environment and the economy by means of integration (Gamage and Hyde, 2012). Gamage and Hyde (2012) together with Holmes and Hudson (2000) was concerned about enhancing sustainable infrastructure as a mean to mitigate their detrimental effects on the natural ecology. Crawley and Aho (1999) highlighted that the attention of engineering and built environment professionals (EBE) professionals across the world have been captured by the ecological impact of the construction industry, green buildings, designing for recycling and eco-labelling of buildings. Moreover Ding (2008) advocates that the construction industry's performance is currently a primary concern for most professionals within the construction industry. In addition, Cole (2005) emphasized that ecological assessments have emerged due to major problems in sustainable construction.

According to Finnveden and Moberg (2005) who mentioned that building designers and professionals have long been concerned about the building's performance. Similarly, the advantages of ecological sustainable practices are often not palpable; as they are only evident over a long-term cycle with reduced operating costs and a conclusive

environmental and social impact in developing countries. Thus, the significance of this paper is to evaluate various approaches of integrating ecological sustainable practices amongst engineering and built environment professionals.

2. Sustainability – The Ecological Science

Ecological economics (EE) is a moderately new development in economics that was developed due to the restrictions of ecological matters relating to economic development which ignored the human culture and the indigenous environment (Barker, 2013). Beinhooker (2006:24) observed that it is critical to recognize EE and alternative methodologies to the “traditional” economics. A definition by Barker (2013) explained that traditional economics is centred on a model of utility expansion and the assignment of assets by means of the profitability. Similarly, Ackerman and Heinzerling (2004) found that it is arguable that natural resources can be converted into monetary value and vice versa pertaining to infrastructure development without having an irreversible impact on the environment. This is not the case as the generation of tomorrow will confront the danger of the irreversible impacts due to un-sustained development. Therefore it is imperative that EBE professionals adopt ecologically sustainable practices in order to avoid the potential scarcity of natural resources if economic development proceeds without ecological integration.

There is no standard definition for sustainable development to date despite its popularity. An extensive variety of ideas of sustainability is still open and various new considerations and thoughts have advanced after some time (Goh, 2014). According to Bangdome and Kootin (2013), sustainability is a developing economic phenomenon in light of the information that aims to address the association of economic development, ecological systems and the unfavourable effects that economic activities can have on the environment. Different ideas and phrasings have been introduced and substituted throughout the years to promote this new phenomenon such as green building, sustainable design, ecological economics, and sustainable materials, to mention few. Similarly, Jones (2008) opined that if these phenomena would be enacted effectively, a significant milestone of the current state of the ecology and built environment would be achieved. Bangdome and Kootin (2013) highlighted that it is unquestionable that there is a great requirement for physical infrastructure and fast-tracked development in the built environment in third world countries. Nevertheless, these requirements should be accomplished in a manner that is economical and ecologically dependable. Developing countries can take notes from developed nations in relation to the urgency of a sustainable policy for the built environment, rather than utilizing more resources in 'damage control' subsidies which could have been avoided.

3. Ecological practices – Methods of Sustainable Integration

The Organization for Economic Co-operation and Development (OECD) (2008) studied the following approaches of encouraging the integration of ecological practices amongst EBE professionals who play a key role in infrastructure development and sustainability in developing countries:

3.1 Communication Campaigns

Parker (2005) stated that communication campaigns are aimed at conveying a particular message regarding various issues hindering sustainable practices amongst professionals. The OECD (2008) observed that recent communication campaigns have advanced in their approach to concepts dealing with single issues and the utilization of multi-media channels. Similarly, Parker (2005) highlighted that multi-media communication channels could be used to target a wider public audience. However, campaigns that are specifically directed to a certain audience are more efficient. Community levels vary around the globe about the size and culture of the audience, but majority of the platforms share common communication channels. These communication channels include those of interpersonal relations (one-on-one interaction or a collective live dialogues, conferences, telephone communication, emails and chat rooms) and through mass-mediated relations such as (magazines, newspapers, television, radio and the internet being the largest source of information). The above communication channels could allow EBE professionals to share more ecological ideas and processes that could contribute towards sustainable practices amongst professionals.

3.2 Voluntary Labelling

According to the OECD (2008), voluntary labelling is amongst the most used measure for encouraging more sustainable consumer choices when they are in the market for particular goods or services. The most practical labels

that are highly recommended are those which meet environmental and sustainable criteria which are certified by a third party agents such as governmental and non-governmental associations. These labels provide a platform for various products to be compared with those in the same category relating to its environmental impacts which include but not limited to its pollution content and biodegradable levels throughout its usage lifecycle. Another labelling principal that can be adopted is that of a certification process that pertains to a particular environmental and social characteristic of a product, like low emission cement, less corrosive steel alloys, fibre roofing amongst other ecological certified products.

Poncibo (2007) discovered that the rapid increase of voluntary labels in an economy has inflicted consumer confusion relating to certified labels from third parties. The OECD (2008) studied that sustainable labelling tactics are rising with a higher consumer interest in environmental and social problems. In addition to this, Choi (2009) mentioned that third-party rating systems provide simple, recognizable methods to consumers in identifying ecological companies. A few developers are beginning to utilize the various rating systems to market their companies. Despite the fact that rating systems cannot promise performance, they can differentiate between competent sustainable companies and those who are not.

3.3 Integrating Policy Instruments

According to Czech (2009), EE is an innovative policy panacea to the issues of unsustainable development and uneconomic growth (e.g. development greater than the standard scale) experienced in developing countries. Ecological policies were created to combat real and perceived shortcomings of a countries' economy. Though sustainability within the South African construction industry is encountering various challenges, the primary source is influenced by differences in political backgrounds arising from challenges linked to critical analysis of economic development as a policy objective.

Hansen & Power (2010) studied that policy implementation of a singular type instrument has limited impacts. Moreover making use of a homogenous integration of multiple policy instruments to address various categories of EBE professionals has a greater effect on the implementation of ecological sustainability. The OECD (2008) noted that the effectiveness of a combined policy instrument will be based on the various factors hindering on ecological integration such as, the legal, social and cultural environment structure of a country. Furthermore, Choi (2009) observed that integrated policy design approach can assist EBE professionals in reducing the cost of infrastructure development throughout all stages of the of the building's lifecycle in a sustainable manner.

3.4 Green Branding

Green branding through media platforms (advertising) can be a useful tool for encouraging ecological practices by underlining the sustainable scale of various goods and services which in turn will persuade developers to adopt them, notwithstanding its price tag. The OECD (2008) observed that regulations can be established in effort of regulating the authentication processes of green branded commodities, fair trade legislation, and consumer protection agencies which produce policies aimed at monitoring those commodities. Therefore the implementations of these regulations will shield advertising claims made in connection to the environmental and ethical aspects of various green products and services. Moreover, the International Chamber of Commerce (ICC) in 2005 published a global code of environmental advertising that averts specious statements about ecological aspects of manufacturing till the disposal phase of particular goods and services. In 2011, the ICC consolidated the code to include requirements of practical communication which must be legal and ethical together with various provisions relating to advertising and marketing communications, whether digital or analogue.

3.5 Subsidies and Incentives

The primary focus on sustainable development by various stakeholder, which include local private-sector clients and international investors is based on their financial capabilities. Similarly, The OECD (2008) discovered that subsidies and incentives promote the harvesting, manufacturing and usage of sustainable goods and services in developing countries. The U.S. Green Building Council (2011) highlighted that these subsidies were monetary grants, donations of green products and economic incentives in the form reduced taxes on any ecologically sustainable practices. Although the amount of these sustainable incentives are insufficient when compared to social subsidies aimed at production sectors, they still encourage consumers and producers make decisions relating to the sustainability of

infrastructure development in developing countries. These decisions are influenced by EBE professionals, thus the adoption of ecologically sustainable practices is important when guiding these decisions. In addition, Diyana and Abidin (2013) revealed that rewarding stakeholders of infrastructure development who promote sustainable practices will in return yield an increased adoption of sustainable development and even bring about innovation and higher levels of demand for greener technologies amongst EBE professionals.

3.6 Innovative Bidding Processes

Rustom (2014) explained that when examining projects, equity and markets usually utilize criteria that are tuned more towards traditional developments rather than 'green' or sustainable developments. On this note, it may be difficult to bid or tender for non-traditional projects, which are projects that feature ecologically sustainable design elements from secondary markets. Thus market conditions usually create sustainable infrastructure projects to be more demanding from a risk and profit perspective. The industry and state principles used to evaluate projects, particularly those relating to factors such as overrun cost assumptions, can reveal whether or not the project is financially feasible to embark on from the feasibility stage. The analysis of various factors needs to be looked at to ensure that they are not involuntarily impeding on sustainable development by stretching the payback period.

Similarly, agreements can be designed to encourage the behaviour of ecologically sustainable practices, as well as creating opportunities for EBE professionals to learn more on sustainable features of infrastructure development projects. Choi (2009) studied that incorporating innovation in bidding processes to require sustainable designs or features that will encourage ecological practices from the inception phase till the hand over phase of a particular project.

3.7 Biomimicry

Biomimicry is a term that stems from the Greek prefix *bios* which is interpreted as 'living' and the suffix *mimesis* which is denoted as 'imitation', for it is the imitation of the life (eco) system (Benyus, 2002). Gamage and Hyde (2012), Vincent (2009) and Wilson (2008) studies that there are various scientific terms that stems from the theory of biomimicry. They include biomimetics, biognosis and bionics which all share a similar conceptual idea as that of biomimicry as they all learn or adopt concepts from nature. Ultimately, the concepts adopted from biomimicry will aid in the mitigation of un-sustainable human practices through sustainable structures, methods and ecological applications through innovative technologies inspired by nature. EBE professionals can adopt the principle of biomimicry as an approach to being more ecologically inclined in their day-to-day practices towards promoting sustainable infrastructure development.

Adoption can take place in a direct or indirect approach. Helms et al (2009) and Wilson (2008) stated that the direct approach directly imitated the biological systems and patterns of the ecosystem's behaviour when resolving issues similar to that of nature. Gamage and Hyde (2012) and Panchuk (2006) mentioned that the indirect approach encompasses the use abstract theories and patterns designs as principles adopted from the ecosystem model. In an article by Mortice (2016) who studied the various approaches of biomimicry, revealed that the coral reefs are developed through an ecosystem of microorganisms that produces calcium forming bonds that gives the reefs its structural strength. This biological process has been mimicked by bioMASON, a company in North Carolina that produces biological cement which emits lower levels of carbon emissions during manufacturing. In another application, Mortice (2016) mentioned that the direct use of bacteria has allowed bioMASON to reconfigure the pH levels of aggregate materials used in the manufacturing of bricks. This bacteria creates calcium carbonate which acts as an adhesive compound that binds the aggregates together, which gives the brick its strength while limiting carbon emissions.

3.8 Corporate Reporting

The OECD (2008) observed that various company's usual report on the sustainability of consumers relating to their environmental and social values beyond sustainable characteristics of particular products, which is addressed by the labelling aspects. The environmental and social standards that products are produced under are made available to the public through corporate reporting. The use of corporate reporting has been practiced by firms offering financial services of (investment, insurance, and pension). The OECD (2008) further noted that corporate governance, employee

health and safety, environmental performance, community contribution and the supply and demand chain management are amongst other subjects discussed in the report.

In addition, The OECD (2008) concluded that the breach that exists between corporate reporting and other concepts of sustainable awareness is significantly large. This is evident as only a few organizations provides feedback on how ecological and sustainable elements were considered during a products life-cycle and environmental impacts assessment. Although a hand full of companies make use of corporate reporting, this may not represent a sustainability being practiced on a larger scale. For this reason, it is therefore imperative for EBE professionals to adopt the principle of corporate reporting as part of their ecologically sustainable practices in order to bring about sustainable transformation in developing countries.

4. Research Methodology

The research study is conducted on the basis of credible literatures and theoretical frameworks relating to ecologically sustainable practices amongst engineering and built environment professionals. The exploratory nature of the study allowed for the appraisal of possible approaches to be adopted by EBE professionals in effort of achieving sustainable infrastructure development in developing countries. Moreover, there are only a few studies exploring the various ecological applications towards sustainability amongst EBE professionals and thus adds to the body of knowledge. The current quantitative research methodology was adopted in this study.

5. Findings and Discussion

In a study conducted by Ndou (2016), it was revealed that communicating new ideas, incentivising ideas for change relating to greener construction and voluntary rating to help clients recognize green contractors were the most listed methods that can be taken adopted to encourage the adoption of EE in developing countries. These findings were similar to finding by the OECD (2008), which revealed that communicating new ideas, advertising through media and voluntary rating were the leading approaches of integrating ecological practices amongst EBE professionals. On the other hand, OECD (2010); Rubik (2009) and Jackson (2005) revealed that the integration of policy instruments were amongst the least approaches that encouraged the integration ecologically sustainable practices amongst professionals. Also, studies conducted by Dyana and Abidin (2013) and Häkkinen and Belloni (2011) were analogous in that subsidies and incentives were highly recommended as an approach that encouraged the integration of ecological practices within various sectors, mainly the public and the private sector. Choi (2009) and Rustom (2014) who ranked the changing of the bidding process to require ecological features as the least likely approach that could encourage the adoption of ecological sustainable practices in developing countries. In addition, Gamage and Hyde (2012) and Wilson (2008) observed that biomimicry assimilates various advantages and disadvantages that arises from the two approaches, mainly problem and the solution-driven as the designer relies on the application of biology to define and solve human problems using similar structured organisms or ecosystems.

Also, Ndou (2016) studied that EBE professionals faced various challenges in adopting sustainable practices in the construction industry, which played a significant role in infrastructure development of developing countries. It was noted that sustainably inclined EBE professionals did not practice in the private sector as suggested by Muhwezi et al., (2013). Moreover, Ndou (2016) revealed in a study that sampled 132 EBE profession that although 53 per cent of the companies of the professionals were operating both in the private and public sector, 50.8 per cent of the professionals had not been involved in a 'green'/sustainable project to date. On the other hand, achieving a sustainable construction industry would be almost impossible if traditional building standards and regulations are used to oversee green projects.

6. Lessons learnt from literature review

The theoretical review explored various approaches towards adopting ecologically sustainable practices that will aid EBE professionals in achieving sustainable infrastructure development, particularly in developing countries. It is evident that nugatory efforts have been seen that encourages EBE professionals to promote sustainable infrastructure development. Through the theoretical appraisal, it was noticed that there are fewer resources deployed via budgets and subsidies by the government in hosting more conferences and seminars, amongst other communication campaigns, that promote the ecological drive amongst professionals more actively. Similarly, little or no effort is observed in

terms of incentivising key professionals and stakeholders of infrastructure development in order to yield an increased adoption of ecological practices and innovative ideas advocating for greener building technologies. Various developing countries in Africa have commenced moving in a sustainable manner, but the stagnated implementation for more ecologically sustainable policies and systems by the government and stakeholders of infrastructure development is discouraging its application by EBE professionals. These countries included Botswana, Kenya, Nigeria and South Africa just to mention a few.

7. Conclusion

This paper has evaluated theoretical studies on the approaches that encourage the integration of ecological sustainable practices amongst EBE professionals. Literature revealed that communications campaigns, voluntary labelling, green branding, subsidies and incentives, biomimicry and corporate reporting were amongst the effective approaches of integrating ecological practices. From the lesson learnt, it is therefore recommended that EBE professionals should adopt the highlighted ecological practices of promoting a more sustainable infrastructure development. Moreover, further research can be conducted on the barriers preventing the adoption of ecological practices amongst the stakeholders of infrastructure development in effort to shed light on the stagnate implementation of ecologically sustainable policies and systems in developing countries.

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Biographies

Mpho Ndou is currently a fulltime PhD student of the School of Engineering Management, which is part of the Faculty of Engineering and Built Environment in the University of Johannesburg, South Africa. Mr. Ndou holds a Master's degree in Construction Management from University of Johannesburg. His research interest are situated in the fields of sustainable infrastructure development, with focus on: Ecological Economics, Indoor Environmental Quality and sustainable development in developing countries. Moreover he is also a candidate member of the Royal Institution of Chartered Surveyors and the Association of South African Quantity Surveyors.

Clinton Aigbavboa is currently an Associate Professor at the University of Johannesburg, South Africa. Prof. Aigbavboa holds a Doctor of Philosophy degree in Engineering Management from the University of Johannesburg. His research interest are situated in the fields of sustainable human development, with the focus on: sustainable

housing regeneration (urban renewal and informal housing), Life Cycle Assessment in the Construction Industry, remanufacturing, leadership in low-income housing, biomimicry, post occupancy evaluation and green job creation.