

# **Sustainable development practices in the South African Construction Industry: A review of Related Literature**

**Malingaka Maoeng, E.I EDOUN, Charles Mbohwa**

Faculty of Engineering and Built Environment

University of Johannesburg

[malingakamaoeng@gmail.com](mailto:malingakamaoeng@gmail.com), [edounsen@hotmail.com](mailto:edounsen@hotmail.com), [Cmbohwa@uj.ac.za](mailto:Cmbohwa@uj.ac.za)

## **Abstract**

Sustainable development is a method, which endeavors to save an overwhelming parity state over the long haul. It requires the human, monetary and ecological worries to work together to guarantee 'unending life for mankind' in the all-inclusive regular framework. This expression talks about maintainability of human life by warily balancing social, financial and environmental assets in a persistently altering globe. This article reviews the practices of sustainable development in the South African Construction Industry. Economical practices are likely to wind up executed if there are discernible welfares for example; cost investment funds or endeavors from its inability to act; like reputational harm and lack of market share. However, today the construction industry is facing the environmental issues. Therefore, the construction industry needs to adjust and produce more sustainable homes to withstand destructive forces such as hurricanes and floods so as to avoid large swathes of upcoming populations losing their homes due to unexpected weather conditions. Construction enterprises have been moving in new technologies in order to stave off environmental catastrophe to push forward the sustainable development.

**Keywords:** Construction industry, Economic, Environmental, Sustainability, Sustainable development

## **Introduction**

Construction is a huge, vibrant, and complex industry that portrays a significant role in the state's economy. The roads, houses, workplaces, repairs and maintenances of our nation's physical infrastructure are made by construction workers and employees. Construction work includes working of new structures, which may contain exercises included with separating land available to be purchased as planning of destinations for new development. Development work likewise incorporates redesigns involving augmentations, modifications and fix of structures.

Sustainable development is, accordingly, the capacity to save and grow all social, natural and monetary frameworks of any arrangement so that every age achieves to satisfy its very own necessities and does not compromise the ability of up and coming ages to accommodate them. Alban and Cardenas (2007) portray SD as 'following ecological insurance and applying social measures, though guaranteeing monetary possibility in modern exercises.' However, Bruntland (1987) believes that SD is innovation that experiences the necessities of the current exclusive of trading off the merchandising ability of up and coming eternities to discourse their individual matters'. With the end goal for SD to prosper, it is vital to receive an all-encompassing methodology in managing all issues that relates to it. As indicated by Flint (2007), the range of SD issues is depicted as fusing danger, morals and administration, authoritative prerequisites, regular capital/the green condition, social capital/society, human capital or individuals, financial capital, human-made capital, backhanded and initiated results, unintended outcomes and total outcomes. SD is a framework that subsists on the convergence of the social, financial and ecological circles. Any culpability in one of them causes brokenness. A proficient arrangement of administration must direct the three circles of SD. SD is accomplished just

where the three circles cross. It very well may be accepted that SD comprises evenhanded social advantage, impediment or decrease of natural effects, and upgrading financial value in all basic leadership, which are the objectives of all promoters for SD when basically breaking down this idea.

## **Sustainability**

Sustainability implies utilizing common assets in such a fair condition, that they don't achieve rot, consumption, and purpose of sustainability also, passing on to the accompanying ages by propelling them. In this one of a kind circumstance, reasonability is apparently a thought that can be associated with each field reaching out from overall progression way to deal with utilization of imperativeness sources, and from age expecting to building plan (Hoúkara, 2007). Sustainability goes for assets to exist for ages to drop by protecting normal and manufactured situations, just as dealing with congruity of people and common assets (Osso et. al., 1996). Additionally, sustainability as a multi-dimensional framework expects to upsurge the quality in individuals' lives by patching up the situations of public with bothers, creating productive connections amid individuals by offering obvious quality to coordinated effort and social preferred standpoint, and doing changes in money related issues energized from these standard possessions (Hoúkara, 2007; Oktay, 2005). The idea essentially plans to give harmony admiration to human, time, and spot; in different quarters, parallel portion of earth assets amid all countries, living things and who and what is to come. Sustainability predicts a consistent advancement by changing just our utilization propensities without diminishing our present personal satisfaction. Being in a condition of maintainable advancement connects with an all in unity, a law created and sensible portion. Justifiably, the feasible advancement display recommends that all out improvement understanding goes for ecological organization, social obligation, and money related game plans by deserting from being a buyer society. From this acknowledgment, it will in general be communicated that sustainability has three essential parts: environmental, economical, and societal. Collaboration among every one of the compelling parameters of sustainability is insurance of condition, monetary movement, and social reasonable. A reasonable and reliable connection of ecological, monetary and social segments of sustainability creates vital advancement. It is acknowledged that social sustainability is a necessity of economic sustainability, as ecological and social sustainability can't be available without economic sustainability. These three segments ought to be contemplated as undividable parts of an entire view of their full digestions with one another (HKU Architecture, 2002).

## **Environmental Sustainability**

Environmental sustainability implies handing the globe to up and coming ages in a superior condition than it was gotten, shielding environmental equalization and common frameworks from harm (Sev, 2009). It is important to consider environmental parity and lessening the use of unrenovable resources. Practicality of a benefit is liable to the limit of the resource for reestablish itself. For example, the major resource in the water cycle is the climb of water by methods for dispersal and after that tumbling rational after development as rainfall. The past situations for intelligence of this cycle are kept water and cleared air. Along these lines, sullyng of water in association with waste water, rustic pesticides, air tainting and carbon outpourings unfairly impact the sensible cycle of water. In one way, biological sensibility suggests giving of typical advantages for exceptional ages without destruction. For this technique of thinking, it must be thought about not to outperform rates of reviving of these advantages, including rates of these benefits for opportunity of pollutants while choosing usage level of trademark resources (Patel and Chugan, 2013). Environmental viability incorporates being delicate to the subjects of: confirmation of aliveness and not too bad assortment on the earth, conservation of life-candidly supportive networks, manageable use of sustainable assets, decrease in utilizing unrenovable assets, limiting mischief to nature and living things, and security of social and ancient conditions (Hoúkara, 2007).

## **Economic Sustainability**

In the present current monetary progression model, it is predicted that monetary movement will climb in the market by advancement in acquiring ability of people and in like manner, upsurge in Gross National Product (GNP). This headway show depends upon unlimited age and usage as understood from its definition. The recently referenced model insists on utilizing current assets as if they are vast when considered from organic appreciation. Regardless, possessions that can encounter the crucial needs of publics are compelled, and these benefits are getting diminished, well-ordered without restoration in view of an over the top measure of usage. On the other hand, there are characteristic

issues due to wastes which are an outcome of this use free for all (Torunolu, 2003). In fiscal methods, as age use balance must be set in context on natural susceptibilities and social sensible issues, money related sensibility is a champion among the most fundamental subjects of supportable progression. A sensible money related progression requires: development of new markets and advancing openings, decrease in cost by methods for giving profitability by reducing imperativeness and asset contribution to generation, and arrangement included esteem (HKU Architecture, 2002).

Summing up, financial sustainability is course of action of a persevering vulnerable and confidential theory stream with beneficial use and the officials of advantages; assessment of money related capability with social criteria as an alternative of progressive advantage (Hoúkara, 2007). Social sustainability as the most imperative focal point of sustainable improvement revolves around some essential privilege and prospect related to existence. The greatest discernible fundamental human right is opportunity and reasonableness and equality between eras. Resources can be given on to the bleeding edge to help their existences and give their riches. They will be provided gratitude to social sustainability; given fundamental prerequisites, for example, work, lodging, wellbeing conditions, training and social exercises for every person as long haul (deliberately), expanded personal satisfaction, reintegrating handicapped gatherings once again into society, and in the meantime, ensured directly to life for future generation (HKU Architecture, 2002).

## **The construction industry and sustainable development**

One of the fundamental allegations leveled against the development business is the extreme utilization of worldwide assets (Curwell, 1997; Uher, 1999; Ding, 2008) and this puts mounting weight on the business to discover methods for diminishing over-dependence on common assets (crude materials). So as to limit the impeding consequences for the indigenous habitat, there are worries about how to enhance development rehearses (Cole, 1999; Holmes and Hudson, 2000 in Bogner, 2007). These worries have prompted the idea of sustainability in development (Ding, 2008). To accomplish compelling and proficient short-and long haul utilization of regular assets, economic development executives includes the productive allotment of possessions, slightest vivacity application, little exemplified energy power in building supplies, reprocess and diverse systems (Demarco, 2008; Ding, 2008). As indicated by (Shen and Tan, 2002), endeavors towards rehearsing natural administration in the development business have been developing quickly, grasping all players in the business seeking after the mission of sustainable advancement. Every one of these endeavors despite bearing that it has been hard to enhance the manner in which society utilizes assets, enhance productivity and decrease the ecological effects related with the stream of undesirable materials and vitality (Strange, 2002). The development business is known to be a noteworthy maker of waste, albeit squander age is a general issue in practically all major mechanical areas. Subsequently, the administration of waste is a substantial piece of ecological administration and sustainability, as it can prompt asset protection just as taking care of the majority of the natural issues.

## **Sustainability in construction sector**

All through civilisation, individuals need a great deal of structures for supporting their lives. All through the development, task, upkeep, and decimation, these organizations initiate a ton of ecological problems. Structures devouring enormous measures of energy and common resource impinge on environmental alteration by persuading nature of air and water in built-up communities (Vyas et. al., 2014). As indicated by a report of 2010 data, 45% of globe vitality and half of water are used by structures. While taking a gander at natural sways, 23% of air pollution, half of ozone depleting substance creation, 40% of water sullyng, and 40% of solid waste in urban regions are biological issues realized by structures (Dixon, 2010). These normal issues realized by the advancement business can be extensively diminished through amendment in presentations. Regardless of the way that the greatest express or measureable effect of industry is on its earth, money related effects moreover cause genuine obstacles (CIB and UNEP-IETC, 2002). Activities in the advancement business, solid, liquid wastes and gas outpourings toward the completion of improvement and demolition practices contrarily influence the earth in light of the way that there is a concentrated usage of normal resources. These adverse influences can be laid out as use of unrenovable possessions, reduction in natural grouped assortment, damage of woods regions, deficit of agricultural locales, air, water and soil tainting, pounding of regular green zones, and an overall heat change. The money related effects of the advancement business, improvement industry with its structure, definitive structure, and implementation, can augment monetary practicality, as declared by CIB (2002). Nevertheless, in light of the way that nationwide affiliations can't fight with

overall affiliations in view of globalization, dependent upon broad import material use; budgetary decisions can't be kept up within the country and GNP reduces. Development industry can't bolster ecological sustainability in light of delivering excessively squander and the powerlessness to utilize assets proficiently; it is likewise not effective in a financial appreciation. The work serious nature of the development enterprises can build personal satisfaction of low-pay individuals generously with openings for work. It can add to the headway of social sustainability by organization for envisioning scarcity in people in over-all eye (CIB and UNEP-IETC, 2002). Enduring plans have not been found to issues begun by manifestations being developed; sustainability and sustainable improvement are not seen as normal in light of the current situation. In this movement, "functional plan" and "sustainable advancement" thoughts, which serve an efficient method to manage the subject by choosing benchmarks, systems, procedures and end up discernible for finding answers for biological issues achieved by structures.

Sustainable development can be comprehended as the use of the standards of reasonable improvement to development. Affirmation of practical development showed in 1994 amid the primary global meeting on sustainable development that took place in Tampa, Florida, United States of America (Kibert, 1994), where manageable development was characterized as "... making and working a solid fabricated condition dependent on asset effectiveness and biological plan" (Hill and Bowen, 1997). Different pundits proposed that sustainable development ought to be seen as the obligation of the development business with regard to sustainability (Bourdeau, 1999; Hill and Bowen, 1997). Nonetheless, Kibert additionally recommended that practical development ought to be translated as a subcategory of ecological improvement (Kibert, 2008). This agrees with the statement that sustainable development is the methods across which the development business adds to accomplishing ecological improvement (CIB, 1999). Sustainable development practices ought to address the three mainstays of maintainable improvement, since supportable development is identified with economic advancement. As indicated by a broadly cited definition, economical improvement is advancement "that addresses the issues of the present without trading off the capacity of future ages to address their very own issues" (Brundtland et al., 1987). Attaining practical advancement insist on adjusting monetary, social, and ecological mainstays of sustainability (Edum-Fotwe and Price, 2009; Parkin, Sommer and Uren, 2003). It is examined by Edum-Fotwe and Price (2009) that thought of one column just, two columns just, and all the three columns, identifies with first request, second request, and third request conditions of sustainability, separately. In this manner, viable development can be understood to show in first, second, and third request conditions of sustainability. Sources advise that the drivers for maintainable development can be organized into ecological, financial, and social drivers. All things considered, systems that expect to enhance ecological development should empower something like one of such drivers of practical development. Be that as it may, for a given undertaking, streamlining all the conceivable accessible drivers of sustainable development is regularly outlandish; bargains are, in this way, unavoidable (Hill and Bowen, 1997). Accordingly, a methodology that encourages the biggest sum of the drivers for economic development would significantly add to improving supportable development rehearses. In the building area, a majority of systems; for example: EU's European Performance of Buildings Directive (CA EPBD, 2014) up to this point center around vitality proficiency, which identifies with driver number two. As indicated by Ibn Mohammed et.al 2013, the expanding center around vitality effectiveness in the operational periods of structures has made encapsulated vitality, and therefore exemplified carbon (EC) discharges, unmistakable in the lifecycle of structures. Along these lines, for all encompassing improvement of sustainable development, techniques that attention on vitality effectiveness wants to contemplate EC discharges too. EC are discharges that are generally ascribed to exercises like factual production, conveyance, and in-situ development, amid the making of structures (Cole, 1998; Hacker, De Saullés, Minson, and Holmes, 2008; Hammond and Jones, 2008). Present day look into set forward that EC ought to be incorporated in the natural evaluation of structures, in order to increase sustainable development (Hakkinen, Kuittinen, Ruuska, and Jung, 2015; Kibwami and Tutesigensi, 2016; Knight and Addis, 2011; Teh, Wiedmann, Schinabeck, Rowley, and Moore, 2015; Yuan and Ng, 2015). Most current attempts, for example, in the UK, nearby arranging specialists began requesting foundation engineers to show how they use "materials that are manageable and have low encapsulated carbon" (Brighton and Hove, 2013, p.162). Moreover, there are expanding numbers of rules that incorporate evaluation of EC in ecological appraisal of structures (BSI, 2011; Franklin and Andrews, 2013; RICS, 2012). In this way, it is likely to theorize that coordinating the appraisal of EC discharges in prevailing development applies can upgrade maintainable construction.

## **The process of construction works**

The supervisory crew of sustainable development work task should thoroughly reflect on the whole procedure from a premature plan in relation to the last item, and the advantages and negative effects in regards to the triple primary

concerns of sustainability that are not out of the ordinary amid the lifetime of the last item. There are moderately a couple of instances of good practice with respect to sustainability in standard development. It appears that customers and undertaking chiefs are confronting obstacles to execution. Williams and Dair (2005) found no less than 12 hindrances to usage; the most widely recognized were an absence of being star dynamic in sustainable measures, clashes in genuine and saw expenses, and insufficient execution aptitude. A typical confusion is that sustainability in development works is all the more exorbitant as far as speculation costs contrasted with 'ordinary' standard structures. A review directed by the World Business Council for Sustainable Development (WBCSD, 2008) explored that the adjustment in speculation cost amid a 'typical' building and an affirmed reasonable building is approximately 17%. Different informants assessed this figure to be up to an extra of +15% (Lützkendorf, 2005). However, Balcomb and Curtner (2000) demonstrate that underlying expenses don't really rise if vitality utilization is dense by about a half. This can be realized by methods for leading vitality.

Building framework Components Products/Materials Performance traits (triple main concern) Physical/Functional Environmental Economic Social/social 55 reproduction tests at a beginning period of the arranging procedure, in this way limiting the expenses of warming; airing and cooling (HVAC) gear. These expenses are as high as about 40% of the all-out development costs, and could be offset with the enhancement estimates that make HVAC scaling back conceivable. Kats et al (2003), and Matheissen and Morris (2007) set up that a 'green' building is practical, no supplementary expense contrasted with ordinary structures is essential, and the all-out advantages over the existence cycle are in excess of multiple times the normal unique venture necessary to plan and develop a green building. It appears that the partners in a development venture, for example customers and task group, are not sufficiently acquainted about the essential connection among development works and sustainability. To advance work concerning sustainability during the time spent for development venture, some monetary instruments can be utilized, particularly by money related specialists, networks and government. These are uncovered by Drouet (2003) and are talked about further in this fragment.

## **The South African construction industry**

In the line with the all-inclusive pattern, the South African government, acting both as a controller and customer, is energetically advancing a solid and agent development industry that utilizes assets effectively, diminishes squander and transmutes the workplace of its kin for better business and efficiency (CIDB, 2004; and Van Wyk, 2004). Despite the weight on the business to change, inquire about reports show that development stays refined to its old methods for working together. Hazard assignment is relentlessly unbalanced in the store network, in contrast to that found in the ventures. While most ventures have embraced huge changes in the course of recent decades, the South African Construction industry presents clear and glaring special cases to such patterns (Shakantu et al., 2007).

The CIDB places that the South African Industry is outstanding for its wasteful aspects, just as the hesitance of its members to execute significant upgrades. The CIDB report asserts that discontinuity reduces the productivity of the business and prompts much adjust and wastage downstream. The audit of the fact of the matter is that development extends in South Africa depend on an assortment of firms with ineffectively coordinated proficient and temporary worker associations. Every individual firm plays out an assorted variety of inefficient exercises inside its own control, which help to make wasteful aspects, resulting in considerable deferrals and expenses.

## **Sustainable development policy**

The manufactured condition makes an essential commitment to natural debasement. In RSA, tasks of the building division represent 23% of ozone depleting substance discharges, while discharges from the assembling of the real building materials add up to around 18mtCO<sub>2</sub> (around 4% of the absolute CO<sub>2</sub> outflow) every year (Gunnell, 2009:3). In any case, the negative ecological effects of building have prompted the ascent of economical building ideas, which are intended to be vitality and water proficient, utilize innocuous materials and give solid beneficial conditions. Regardless the point that endeavors to address the experiences of environmental alteration through speeding up a feasible and reasonable progress to a low-carbon economy are fundamental to guarantee an ecologically maintainable financial improvement and developing way for South Africa. The legislature has found a way to organize and build up a coherent strategy system to control GHG discharges by 34% by 2020 and 42% by 2025, beneath the nothing new (BAU) direction, subject to the arrangement of satisfactory budgetary, innovative and limit developing provision by industrialized nations (Department: National Treasury (DNT) 2013:7).

The administration carbon discharge programs are focused at improving South Africa's environmental amendment moderation and adjustment endeavors in the vitality, water, transport and waste parts, and just as the development division. Various monetary help measures for tending to environmental change are foreseen to supplement the arrangement of need projects and bolster South Africa's GHG relief system. These procedures contain alternatives to change current consumption projects and assessment motivator measures. It sets the picture for dealing with the effects of environmental change viably through receiving suitable strategy intercessions to control the progress to an atmosphere versatile, low-carbon economy. The endeavors are gone for alleviating the impacts of environmental change; adjusting procedures, frameworks and methodologies; building innovation and limit; activating monetary assets; and building up a proper framework for observing and assessment (DNT, 2013:9-10).

South Africa is gaining ground in safeguarding that its monetary advancement is supportable, and specific consideration is paid to the manner by which financial, social and ecological resources are utilized. Some ecological issues have been perceived and different government divisions have created arrangement methods to discourse these worries, dominantly in the territories of environmental conversion, air quality, squander the executives, and exterior and groundwater contamination. It is perceived that great quality development is basic to guarantee that the nation's advancement is practical and its natural assets continue to be flawless to undergo the utilization essentials of mutually existing and who and what is to come. These powers are replicated in the National Framework for Sustainable Development in South Africa (DEA, 2008), just as the National Strategy for Sustainable Development and Action Plan (DEA, 2011b). This proceeding with methodology will send the important arrangement and cost signs to speculators and buyers of the need to guarantee that future ventures are more atmosphere strong. This will limit the requirement for retrofitting, just as minimize the danger of leaving on excess, vast scale, significant capital undertakings and ventures. It is foreseen that the carbon charge be presented as a major aspect of a bundle of mediations to guarantee that the essential target of ozone harming substance (GHG) moderation is accomplished, and to decrease potential antagonistic effects on low-salary family units and industry aggressiveness (DNT, 2013:7).

### **Economic benefits of sustainable construction**

A reasonable house is a longstanding speculation that ought to give advantage to its proprietors as far as solace, quality and life expectancy (Jenkins et al., 2007). As per du Plessis (2002:17), a financially productive development industry enlarges ecological manageability by guaranteeing least-cost techniques for development that supports ideal assignment of assets, and disheartens squander. Financial manageability inside development obliges that social and natural expenses are received and reflected in the last item costs (du Plessis 2002:17). Be that as it may, the cost reserve funds on vitality utilization and different administrations charges after some time are accepted to counterbalance some portion of the expanded capital cost (Chang, Rivera and Wanielista, 2011:1182).

Briefly, there is developing consciousness of the social value contention for making practical lodging arrangements all the more extensively accessible (Sullivan and Ward, 2012:314). Doing as such gives access to the medical advantages of feasible redesigns, (for example, indoor-air quality), just as the financial advantages of vitality and water sparing advances. Sullivan and Ward (2012:314) further express that nonappearance of vitality proficient lodging in low salary networks implies that more unfortunate family units were exposed to bringing about upper utilities costs in respect to their salaries and ability to pay.

Going before analysts have checked that reasonable development gives a chance to utilize assets all the more effectively while building a building that upgrades human wellbeing, improves a domain and spares cost (Kubba, 2012:493). An examination led in the UK by McGraw-Hill Construction in 2006 announced in Kubba (2012:494) reveals that inhabitation rate for supportable structures was 3.5% higher, lease level was 3% higher and working expense of feasible building was anticipated to be 8% to 9% lower than the conventional building.

### **Sustainability performance measurement in the SACI**

SDC is comprehended by numerous names, for example, 'green plan and development', 'biological structure and development' and 'natural benevolent structure and development'. Every one of these terms conveys associated implications (McLennan, 2004; Bennetts, Radford, and Williamson, 2003). SDC, green structure and development will be utilized conversely on the grounds that both are extensively utilized in the development business and convey pretty much indistinguishable significance from utilized in engineering.

SDC is coordinated by the idea of maintainability. It has the surmising of a superior suitable for the world, the nearby atmosphere, the location and the particular spot we assemble live and toil in. It is tied in with structuring networks

that upsurge regular and human limits (Williams, 2007). Jason McLennan (2004: 4) divided maintainable plan as a "structure reasoning that tries to expand the nature of the fabricated condition while limiting or taking out the negative effects to the indigenous habitat." This definition spots of intrigue the key segment of SDC, which is the objective of amplifying excellence and limiting undesirable effect. He watched SDC as the "philosophical premise of the developing development of people and associations that actually try to re-characterize how structures are planned, manufactured and worked to be progressively capable to the earth and receptive to individuals" (McLennan, 2004: 4). Similarly, Van der Ryn and Cowan (1996: x) accentuated the benefit of limiting ecological effect. This can be found in their portrayal of natural structure as "any type of plan that limits ecological dangerous effects by incorporating itself with living procedures". The principle part of this depiction, adjacent to the plan objective of limiting the negative effect to the earth, is the combination with living procedures. This portrayal underscores that one of the approaches to attain coordination with living procedures is the necessity to comprehend the setting we are structuring for, regarding condition, socio– social viewpoints, and the economy of a specific spot.

Moreover, Bennetts, Radford, and Williamson (2003: ix) consider reasonable engineering as an "overhauled conceptualization of design in light of a horde of contemporary worries about the impacts of human action" that effectively shields the earth from contamination and debasement started by social exercises. For Bennetts, Radford, and Williamson (2003) 'great' plans are recognized from structures that don't attend to the adverse effect of human exercises on the earth. The central segment of this portrayal is that it recognizes the reason for natural corruption as social exercises. Social exercises are partial by the structures we make and as per WCED (1987) mankind has the bent to create (or not to create) advancement maintainable. This relies upon individual exercises with their plans and development exercises.

The investigation acknowledges and swells to McLennan's meaning of feasible plan as a structure logic and development methods that seek after to augment the nature of the assembled condition on killing the negative effect to the common habitat, financial system and societal welfare. The quality of this description is that it features a crucial part of the economic structure logic, in particular this is a way to deal with plan and not a structure style (McLennan, 2004, Van der Ryn and Cowan, 1996). A structure design can with age inevitably be eliminated or redesigned by a different design. Conversely the logic plan can't leave style and can be suitable in a building.

## **Conclusion**

The main focus of this article was to review on the practices of sustainable development in the South African construction industry. It therefore sought to broaden our perspectives that, South African construction industry is encountered with a number of threats, which expressively have an effect on its performance in sustainable housing construction. The unmet demand, due to incapitation of the construction industry in provision of housing, is evident in the irregular emergence of shacks in cooperation with town and countryside communities in evolving nations. In order to obviate continual emergence of shack building, the South African government has legislated a sequence of housing rules over the years, many of which were announced to have influenced delivery of affordable housing significantly, though the houses built lack the tenet of sustainable development. The aim of sustainable development is to supply a bodily, communal and mental atmosphere in which the behavior of the people is amicably amended to improve the present and provide for the future. The considerations in this article have shown that awareness of sustainable construction is low in countless countries, situations that some authors ascribed to dearth of training and education on sustainable building design, dearth of pure conceptualization of sustainability, dearth of vibrant case for sustainability aids, and dearth of long-term perception on sustainability.

## **References**

Alban and Cardenas (2007), "Sustainable Development of Biofuels in Latin America and the Caribbean"

Balcomb, J. Douglas & Curtner, Adrienne. (2000). Multi-Criteria Decision-Making Process for Buildings. Proceedings of the Intersociety Energy Conversion Engineering Conference. 1. 528 - 535 vol.1. 10.1109/IECEC.2000.870762.

Bourdeau, L., Halliday, S., Huovila, P. and Richter, C. (1997) Sustainable development and the future of construction. Proceedings Second International Conference on Buildings and the Environment, CSTB and CIB, Vol. 2, Paris, June, pp. 497-504.

Brighton and Hove. (2013). Brighton and Hove City council's local development framework. Retrieved 28 February 2015, from <http://goo.gl/KI888c>

Brundtland Commission (1987), "World Commission on Environment and Development (WCED)", <https://www.are.admin.ch/.../sustainable-development/...sustainable-development-1987>

CA EPBD. (2014). Concerted action: Energy Performance of Buildings Directive. Retrieved 01 November 2014, from <http://www.epbd-ca.eu/>

CIB. (1999). Agenda 21 on Sustainable construction. CIB Report publication 237.

CIB & UNEP-IETC. (2002). Agenda 21 for Sustainable Construction in Developing Countries: A discussion document. Pretoria: Published by the CSIR Building and Construction Technology.

Cole, R.J. 1999, Energy and greenhouse gas emissions associated with the construction of alternative structural systems. *Building and Environment*, 34, pp. 335-48.

Curwell (1997, Uher 1999, Ding, 2008), "Sustainability Assessment of Urban Development Plans.

Demarco and Ding (2008), "Building professionals' intention to use smart and sustainable building ...<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6070263/>

Department: National Treasury (DNT) 2013:7).

Ding, G K C (2008) Sustainable construction—The role of environmental assessment tools. *Journal of Environmental Management*, 86(3), 451-464.

DIXON, Willmott, (2010). *The Impacts of Construction and the Built Environment*, Briefing Notes, Willmott-dixon Group.

Drouet D., *Recherche Développement International* 2003, Instruments économiques et construction durable. ARENE

Du Plessis, N. and Grobler, A.F., 2014. Achieving sustainability through strategically driven CSR in the South African retail sector. *Public Relations Review*, 40(2), pp.267-277.

Edum-Fotwe and Andrew (2008), "A social ontology for appraising sustainability of construction projects and developments", *International Journal of Project Management* 313–322

Edum-Fotwe, F T, & Price, A D F. (2009). A social ontology for appraising sustainability of construction projects and developments. *International Journal of Project Management*, 27(4), 313-322. doi: 10.1016/j.ijproman.2008.04.003

Flint (2007), "Seeking Resiliency in the Development of Sustainable Communities"

Franklin, & Andrews. (2013). *CESMM4 Carbon & Price Book 2013*. Retrieved 23 March 2015, 2015, from <http://goo.gl/LCH280>

Häkkinen, Tarja & Kuittinen, Matti & Ruuska, Antti & Jung, Nusrat. (2015). Reducing embodied carbon during the design process of buildings. *Journal of Building Engineering*. 4. 1-13.

Hill, R.C. and Bowen, P.A. (1997) Sustainable construction: principles and a framework. *Construction Management and Economics*, Vol. 15, pp. 223-39

HKU Architecture. (2002). Sustainable Architecture and Building Design, Report, Hongkong. Impact of Population Growth

Houkara (2007), “Coherent risk measures in real estate investment | Journal of Property Management.

Kats et al. (2003), “Green Building Costs and Financial Benefits”

Kibert, C. J. (1994) Final session of First International Conference of CIB TG16 on Sustainable Construction, Tampa, Florida, November

Kibert, C J. (2008). Sustainable construction: green building design and delivery (2nd ed.). Hoboken, N.J.: Wiley.

Lützkendorf Thomas & David Lorenz (2005), “Sustainable property investment: valuing sustainable buildings through property performance assessment”

Matthiessen, L. and Morris, P. (2007) Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption. Davis Langdon, New York.

Oktay Vehbi (2005) & Şebnem Önal Hoşkara (2007), “A Model for Measuring the Sustainability Level of Historic Urban Quarters

Osso, A., Walsh, T., & Gottfried, D. (1996). Sustainable Building Technical Manual. Public Technology Inc. New York

Patel, C., & Chugan, P. K. (2013). Measuring awareness and preferences of real estate developers for green buildings over conventional buildings, Consumer Behaviour and Emerging Practices in Marketing, 332 – 341.

Sev, A. (2009). Sürdürülebilir Mimarlık (1. Baskı). İstanbul: YEM Yayın, İstanbul.

Shen L.Y, Vivian W.Y. Tam (2002), “Implementation of environmental management in the Hong Kong construction industry”, International Journal of Project Management 20(7), 535-543.

Sullivan, J., 2009. Greenwashing gets his goat—environmental activist coined famous term. Recordonline. com-Times Herald-Record-Recordonline. com.

Torunolu, E. (2003). Sürdürülebilir kalkınma paradigması üzerine ön notlar. Tübitak Vizyon 2023: Panel için notlar: İstanbul

Vyas, S., Ahmed, S., & Parashar, A. (2014). BEE (Bureau of energy efficiency) and Green Buildings, International Journal of Research, 1, 23 -32.

WBCSD. (2012). World Business Council for Sustainable Development(WBCSD): Manifesto for Energy Efficiency in Buildings. Retrieved 28 November 2013, from <http://goo.gl/0vOXm7>

Williams, K. and Dair, C. (2005) Achieving sustainable development on brownfield sites: Key research findings and their implications for practice. In: The International Conference on Managing Urban Land, Belfast, Northern Ireland, 13th-15th April, 2005. Available from: <http://eprints.uwe.ac.uk/10023>