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Kindly note that a limited amount of colour has been used in the production of this Journal, although this is mainly an E-Journal, for those who wish to print the Journal it can be done so responsibly by saving printer ink. Also all considerations have been made in saving paper so texts follow each other immediately to save space, energy and trees.



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Dear Industry Stakeholder,

Dear Journal of Construction Stakeholders,

The first three months of this year have come and gone, and I trust that you have had a successful first quarter of 2017. We are just four months away from the 11th Built Environment Conference to be held in Durban from 6th – 8th August 2017. As a Reminder, the Conference Theme for 2017 is #MAKECONSTRUCTIONGREATAGAIN. Please visit the website [www.asocsa.org](http://www.asocsa.org) for further elaboration on the Conference Sub-Themes.

Once again the Conference is accredited by the South African Council for the Project and Construction Management Professions (SACPCMP) and The Association of South African Quantity Surveyors (ASAQS) for CPD points. In addition, The Department of Higher Education and Training (DoHET) has accredited the Conference Proceedings with Research Points for academics who are presenting conference papers and I therefore each conference paper attracts Half a Research point from DoHET.

The Journal of Construction (JoC) is in its 10th year of Publication and has been on The DoHET list of accredited Journals for the past eight years and is still an excellent way to get original research out into the public domain. Therefore, if you have completed original research and want to share it with the broad Construction and Engineering fraternity you need look no further than the JoC.

I wish you well going into the second quarter of 2017 and look forward to seeing you at the conference in Durban.



Greetings,  
Ferdie  
F C Fester  
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# JOURNAL OF CONSTRUCTION



## EDITORIAL

The 1st issue of Volume 10 of the Journal of Construction (JoC) comprises four papers which cover various topics in construction contributed by African authors.

Firstly, Raymond Puana, Ken Charles and Chris Cloete discuss the procedures and pitfalls in communal land development in the Limpopo Province, South Africa. Secondly, Ibrahim Saidu and Winston Shakantu investigated the impact of material waste on the quantity of materials used in building projects in Abuja, Nigeria. Thirdly, Oke Ayodeji Emmanuel, Aigbavboa Clinton Ohis and Mokasha Mpho Denzel discuss the implementation of the Skills Development Act in the South African construction industry. Finally, Danie Hoffman examined the issue of renting in converted green buildings an exploratory study on office tenant's views.

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# COMMUNAL LAND DEVELOPMENT IN THE LIMPOPO PROVINCE, SOUTH AFRICA: PROCEDURES AND PITFALLS

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## PURPOSE:

**“.. An overview is provided of the land development process and some of the potential advantages and pitfalls that need to be understood in rural areas.”**

## ABSTRACT

### Purpose

In the last decade there has been an increase in interest in commercial development in previously disadvantaged areas in South Africa, including development in rural areas. However, land development in rural areas has to contend with individualised titles to land on the one hand and tenure reform based on customary practice on the other hand. This dichotomy inhibits successful development in these areas. An overview is provided of the land development process and some of the potential advantages and pitfalls that need to be understood in rural areas.

### Methodology

The research study was descriptive by nature and was both qualitative and quantitative. As such a mixed research strategy was employed. A systematic review of the existing sources of information was supplemented by interviews with and structured questionnaires administered to relevant private and public role players in the Sekhukhune area in Limpopo. Given the nature of the study, the results of the study have been presented in a narrative format.

### Findings

The results show that dual land development processes are followed at a local level. One of these processes is informal and mainly used or followed by the locals (bana ba mmu) with relatively fewer regulatory requirements, while the other is formal, generally required for commercial development and/or 'outsiders' or institutional developers.

### What is original/value of the paper

Guidelines for land development in rural areas are provided to assist developers in those areas. The complexity of the prevailing dual approvals system is explained and pitfalls and challenges are highlighted.

**Keywords:** Land development, rural development procedures, Limpopo, development approvals, Sekhukhune

## INTRODUCTION

In the last decade, there has been a significant increase in commercial land development in emerging economic areas commonly referred to as disadvantaged/rural areas. In South Africa, the trend is very evident and extends from mostly previously neglected peri-urban townships to rural areas. Some of these areas have medium-sized populations (up to 600 000 people) with gradual population growth and a rise in small scale commercialisation and consumer demand for convenient shopping<sup>1</sup>. In the past, most developers and investors were reluctant to enter these emerging economic nodes located in rural areas.

However, due to the changing South African national political and economic climate, rural areas have since witnessed steady growth in the middle class which has made these areas more attractive for investors and property developers. Despite the abundance of opportunities offered by these areas, there are potential pitfalls. Previous development success in these areas does not guarantee any future development project success<sup>1</sup>. Entering and developing these market areas is challenging and requires due diligence, proper preparation as well as a thorough understanding of the local context and norms in order to make a success of the available opportunities.

One of the most daunting challenges hampering development particularly in emerging rural areas and which is one of the widely debated issues, relates to the communal land tenure

system of ownership - a challenge compounded by its administrative structure. A large part of the rural land in South Africa is communally owned - the former 'homelands' or 'black' communal areas cover some 17,2 million hectares, of which around 14,5 million hectares was classified as 'agricultural' in 1991<sup>2</sup>. By 2012 post-apartheid land reform had transferred an additional 7.95 million hectares into black ownership<sup>3</sup>. However, what is not widely known is how land is acquired and developed and what the impact is that the lack of clear procedural requirements and the land tenure system have on land development in these areas.

Literature on land development in South Africa is fairly limited. Much of existing research focused on what are considered to be the elements of land development. Most of literature on land administration and related topics have focused on land tenure in rural areas, particularly in the context of land reform<sup>4,5,6</sup>. However, few researchers have also considered the impact of land tenure on development in general; including agricultural productivity and economic development<sup>7,8,9,10</sup>. Studies have also examined the roles and responsibility of traditional authority within the new democratic dispensation<sup>11,12</sup>.

On the other hand, most of the land development and planning fraternity including town and regional planners, geographers, property developers and land development economists have focused mainly on urban areas as their unit of analysis.

However, recent studies have shown that there is a growing recognition that land development can no longer be regarded as just a linear process which starts with land acquisition and ends with construction. Already between 1980 and the early 1990s, land development was viewed not only as a physical process of constructing buildings and transferring them, but as a socially embedded process that is influenced by the economic interest of the day<sup>3</sup>. Any attempt to understand the process should take into account the underlying institutional (formal or informal) structures, and corresponding social agencies and their relations<sup>14,15</sup>.

The policy framework on the subject seems to be controversial. Solutions seem to be far from being attained as attested by the constitutional court judgement on the Communal Land Rights Act, No. 11 of 2004 (CLARA) and the Development Facilitation Act, No. 67 of 1995 (DFA) which are discussed in detail later. This policy vacuum coupled with a lack of understanding and/or proper procedure is often subject to potential abuse and discrimination that threaten the development growth needed to sustain rural livelihood.

Permitting requirements for the development of any land in South Africa are informed by the type(s) of tenure system adopted including communal landownership. These requirements have an immense impact on the development on the ground and can be an obstacle if not properly understood and/or undervalued. Hence, the central argument in the present study is that the post-Apartheid discourse on land development cannot be separated from the land tenure system. Any attempt to incentivise and regulate land development should, therefore, take into consideration the land tenure system that is prevalent in specific geographical areas.

It is against this background that the study attempts to enhance understanding of the development context in rural areas from the perspective of land development and also to lay the foundation for further evaluation of the unintended consequential impact of communal and/or otherwise insecure land tenure on land development, particularly the case of formal commercial development.

The research study was descriptive by nature and was both qualitative and quantitative. As such a mixed research strategy was employed. A systematic review of the existing sources of information was followed by a field survey conducted in Sekhukhune District Municipality, Limpopo. Interviews in Sepedi were utilised to collect data from members of the community and chiefs and/or traditional leaders, while survey questionnaires were mostly administered to developers and government officials who had higher literacy levels.

## LAND TENURE

The land development process in the South African rural landscape is marked by a complex land tenure system. The system which has not been refined nor redefined since the post-1994 democratic dispensation has led to many in the political spectrum considering rural areas as one of the areas that the government has neglected the most<sup>9</sup>. Hence, it is imperative that an overview of the land tenure system prevalent in South African rural areas be provided.

### Historic evolution

History offers an interesting reflection and yet shocking explanation of the current land ownership pattern and land administration systems in South Africa. Historically, land was often owned by the community. Founding of Union of South Africa in 1910 spearheaded the subdivision of South African land. The Land Act, No.27 which was passed in 1913 determined how land was to be divided between blacks and whites in South Africa. The main objective of the Act was to make provision as to which land could be purchased and leased by blacks and whites, and also to prohibit transactions between blacks and whites insofar as land was concerned. After promulgation only a small percentage of land was allocated to the black community under the jurisdiction of the chiefs, and along tribal lines by the colonial and later the apartheid regime<sup>1,12,16,17</sup>. Black communities and individuals were not entitled to acquire and or own land in South Africa<sup>1,12,16,17</sup>.

Post-1994, with the promulgation of the new Constitution, land tenure reform became an important part of redress of the past imbalances. The Bill of Rights, Section 25 of the Constitution of 1996 state that "...person or community whose tenure is legally insecure as a result of past racially discriminatory laws or practices is entitled, to extent provided by the act of Parliament, either to tenure which is legally secure or to comparable redress"<sup>18</sup>. Following these, the Communal Property Association Act 28 of 1996 and the Interim Protection of Informal Land Rights Act 31 of 1996 were promulgated which provided the prospect of having better land management and security of tenure in rural communities was created<sup>19</sup>. According to Cousins, the Interim Protection of Informal Land Rights Act was promulgated as an interim holding measure until such time that a new law was passed as required by the constitution<sup>17</sup>. The Communal Property Association Act was enacted as a measure to ensure security of tenure for many different communities by establishing legal entity (the communal property association) which would enable them to have the power to acquire, hold and manage land as they so wished collectively<sup>20</sup>.

In 2004, amid growing concern about the security of tenure in most of rural areas, the Communal Land Rights Act (CLARA) was introduced. The act was subject to much contestation and was eventually declared invalid in 2010<sup>21,22</sup>.

### Rural land tenure today

Due to the historic evolutionary process of tenure aimed at providing alternatives for black South African rural communities,

at present there are two similar but distinguished forms of tenure. These include what can be termed as tribal-led tenure and trust tenure. The tribal-led tenure basically refers to all forms of communal tenure which were mainly found in the homelands and self-governing territories. According to De Klerk, the so-called communal tenure as it is known today is a result of the translation of the colonial understanding of communitarian landholding by African indigenous people that was used in order to impose indirect control by the state<sup>23</sup>. Historically, this tribal-led tenure was mainly based on the traditional institution conferred by the Proclamation R88 of 1967.

On the other hand, trust tenure relates to the land that was held in trust by the South African Development Trust under the Development Trust and Land Act, No.18 of 1936 for the specific communities. Because the trust tenure has always been associated with the Apartheid betterment planning policy, it was generally a more restrictive form of tenure and placed the control and administration of land outside the community<sup>23</sup>. Although these two forms of tenure are understood to provide different mechanisms for control by the traditional authority, the community and the state, the difference in application is not clear.

History/Theoretical Stance  
For Models of the Developmental Process  
1954-2012  
\*Based on articles by Healey 1990

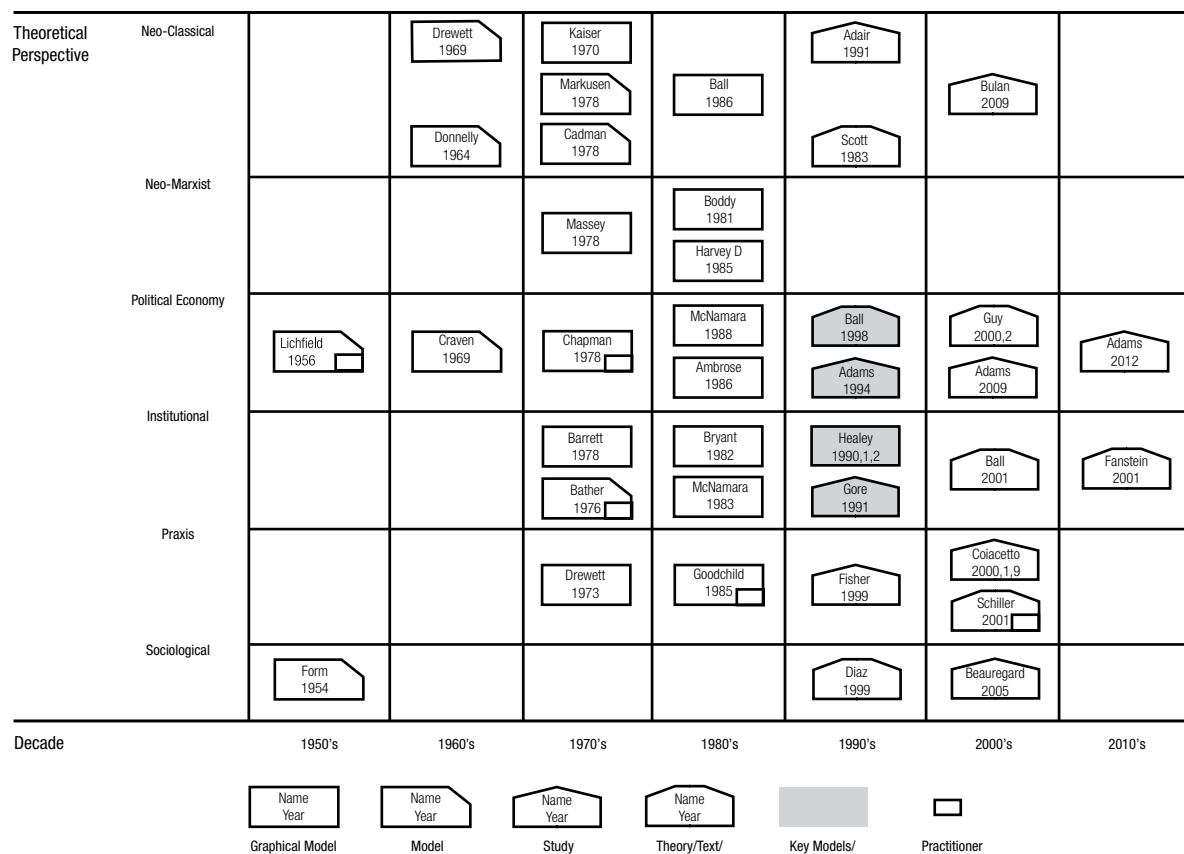


Figure 1: Historical overview of land development models<sup>34</sup>.

Currently, the debate on land is centred on the appropriate mechanisms and systems of securing and strengthening land ownership rights and land management or administration<sup>7,12,24,25,26</sup>. Some have consistently argued for more formal ways of acquiring and holding land in the form of the titling system<sup>27</sup>. The latter has been received with a mixture of reactions and criticism from scholars, particularly property law practitioners<sup>11</sup>. Some of the criticism included is the fact the land titling system has failed to offer economic benefits to all its constituents as expected<sup>28,29</sup>. On the other hand, they are some who have suggested that traditional/customary land rights need to be formalised where necessary and transformed as part of the process of creating an effective modern land tenure system<sup>25,30</sup>. In this regard, Cousins and Okoth-Ogendo have suggested a framework on how to adapt these customary land rights into a mainstream land tenure system<sup>9,31</sup>.

## LAND DEVELOPMENT THEORIES AND MODELS

In theory, land development and the process thereof seem to be tied to the capitalist urban environment rather than adopting a

holistic view. Healey and Barret in their contemporary land-mark study on land development, echoing Harvey's sentiment in his circuit of capital theory, suggested that "the mode of production drive the processes through which the built environment is produced"<sup>15</sup>. Furthermore, according to Healey and Barret, land development is a process in which the built environment is produced and is key component of urban development<sup>15</sup>.

Healey and Barret's theory was criticised mainly for the inaccurate account of the spatial variations and time factor in land development; particularly, Healey's last theoretical conception which is considered composite of all the theoretical undertakings<sup>13</sup>. Despite having an urban bias, Healey and Barret and others like Ismail, Harvey, Guy and Henneberry and Drane have provided a meaningful theoretical conception on land development<sup>15,13,32,33,34</sup>.

On the other hand, there are a varying number of land development models which are considered to be a reflection of the complexity and scope of land development, both as a phenomenon and process. According to Drane, the land or

property development model provides a bridge for the theoretical concept into which a practice can be generalized<sup>34</sup>. The model of land development is thus considered to be representative of a particular theoretical conception and vice versa.

Although is beyond the scope of this paper to dwell in depth on the models, it is important to note this as they provide a framework within which land development can be studied and understood. Furthermore, what is of particular interest to note, is the considerable decline in the neo-classical and Marxist theoretical conception<sup>34</sup>. According to Drane this seemed to have paved new wave of theoretical perspectives from political, economic and institutional analysis drawn from the Giddens foundation and some of the influential work by Healey, McNamara and Barrett<sup>34</sup>. Drane in his study of the contemporary limitation of the property [land] development model traced and provided a historical account of models in land development <sup>34</sup>. In the study, 26 models were identified; as reflected in Figure 1.

## STUDY AREA

The research was conducted in areas situated within Sekhukhune District Municipality, in the province of Limpopo (Figure 2), specifically in the so-called nodal development point of the Jane Furse, Atok-Nchabeleng, Tubatse and Monsteruslus areas where there are ongoing as well as completed development projects.

The rationale for the selection of the areas were: 1) growing commercial land development activities particularly along the major arterial routes; and 2) the areas still very much under traditional authority such as the traditional authority/council supposedly play a crucial role in land development matters alongside the municipality and other state organs. The purpose of this field observation was to obtain first-hand information on the procedure followed and the challenges encountered relating to development in the communal owned rural land in the above-mentioned areas in Sekhukhune District Municipality.

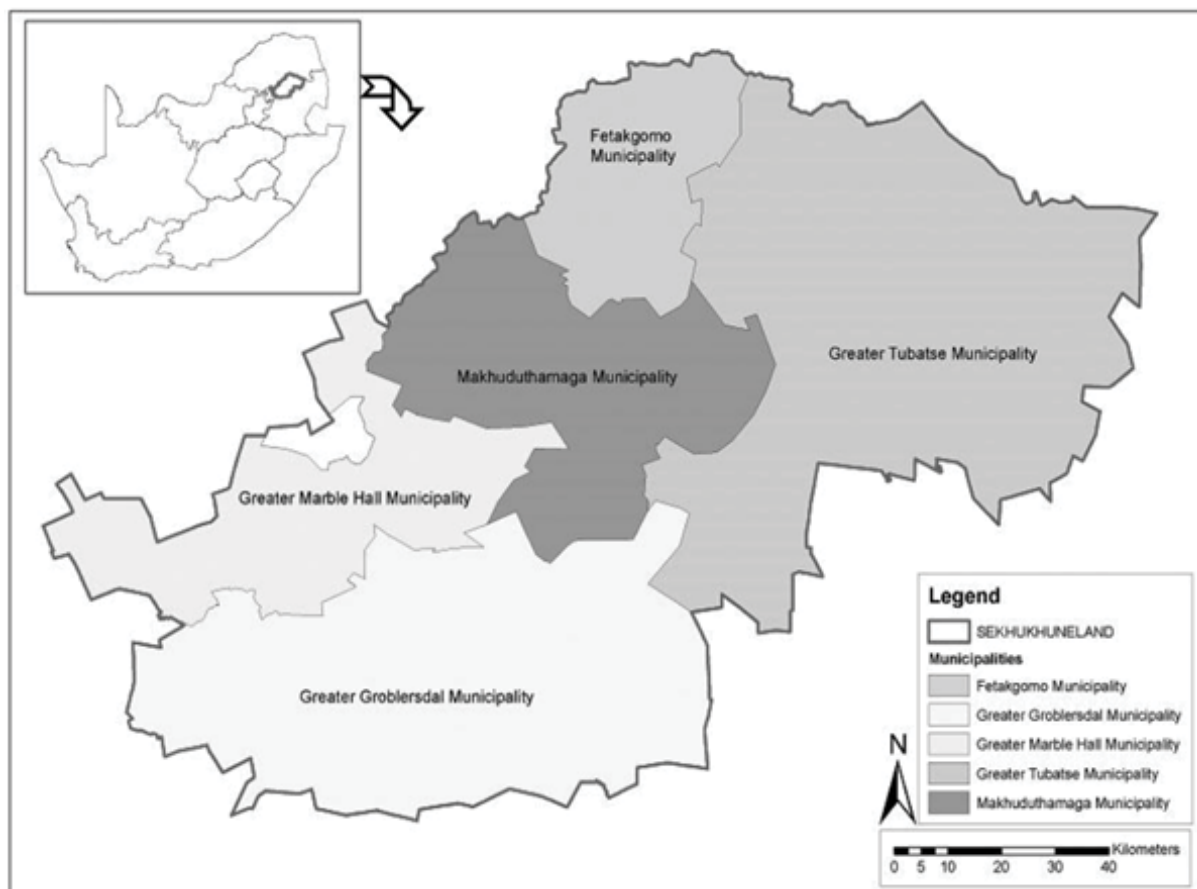


Figure 2: Location of Sekhukhune district, Limpopo Province<sup>10</sup>.

## METHODOLOGY

The research study was descriptive by nature and was both qualitative and quantitative. As such a mixed research strategy was employed. The study was conducted by means of a systematic review of the existing sources of information, followed by a field survey conducted in Sekhukhune District Municipality. Obtaining the existing (secondary) data sources is often less costly than collecting primary data. However, given the relative few studies on the research problem, in particular in South Africa, much primary data was collected. Survey questionnaires and interviews were administered to various relevant participants.

Interviews were utilised to collect data from members of the community, and chiefs and/or traditional leaders. The survey

questionnaires were mostly administered to developers and government officials whose literacy level is supposedly higher than general community members such as chiefs and/or traditional leaders. The first researcher employed the schedule and translated the questions into Sepedi which is the language most commonly spoken in the area.

The data analysis of the research involved three stages<sup>35</sup>. The first stage involved the identification of the main themes that emerged during the field survey and interviews conducted. Secondly, the identification of the main themes grouped in the questionnaires was followed by coding of the data. This made it relatively easy to present and analyse the data. In addition, this enabled quotes in verbatim format and the presentation of some of the follow-up interview findings as part of the study. Thirdly, the responses were integrated into different themes in the research report.

Due to capacity constraints, only five out of six local municipalities in the district were selected for the study, as well as, in addition, the district itself. Representatives from each municipality were selected. At least two officials dealing from land and development planning department were selected from each municipality. Four traditional councils were consulted and interviewed. Due to time constraints and cost, ten business owners and operators were randomly selected from urban centres in Jane Furse (4 individuals), Monsterlus (3 individuals) and Tubatse (3 individuals). In addition, five community members were randomly interviewed to ensure more impartial and representative results.

The data collection process revealed the need to develop a composite sampling process and a design of an appropriate survey tool that is participatory as well as offers an opportunity for the respondents to engage with the researcher. The field survey revealed that the education levels and lack of policy awareness of land development was not adequately considered in the design of the study as conflicting responses were obtained. This was fortunately counteracted by follow-up interviews conducted to clarify some of the responses. The lack of understanding of ownership patterns and types of land development that rural areas are subject to seems to have led to extraneous questioning of some respondents. There appeared to be a general lack of interest in the study. Some of the business operators and traditional council officials were reluctant to participate in the study because they seemed to be afraid of disclosing certain information, particularly relating to how land is obtained or obtainable.

Methodologically, it was found that the use of closed questions in some respects tended to limit individuals to the options provided despite the fact that an opportunity to write additional responses was provided in the questionnaires. Even though, as part of the design process of the study this was anticipated and a follow-up interview was put in place as a mitigating measure, the difficulty was revealed later in the study as the questionnaires were not marked to correspond with the contact details of the respondents. Furthermore, it was anticipated that the follow-up interviews would be conducted with government officials mainly as the questionnaires would have been emailed to them and the interviews offered an opportunity to clarify certain issues.

The overall findings of the study are presented in a narrative format. The narrative technique is best used for qualitative research to describe situations, events or phenomenon that are interrelated or interact with one another<sup>35</sup>. According to Sandelowski, a narrative is an interactive and interpretive tool which offers one the opportunity to bridge the discontinuities between stories as told (recorded) and the realities on the ground<sup>36</sup>. One of the advantages of the narrative research format is that it enables deep insight, interpretation and conclusions about interrelated events or phenomenon<sup>33</sup>. The narrative technique in data presentation is known to best represent and explain events that are connected and often sequential<sup>35</sup>.

The findings are presented in a narrative format mainly because of the explorative nature of the study and the proportional sample selected. This offered the researchers an opportunity to ascertain the implications of the data obtained in answering the research problem.

## RESULTS AND DISCUSSION

### Procedure

The study examined the land development process starting from the land acquisition/allocation to the permitting of land use rights. In contrast to the underlying research assertion,

the study revealed no separate processes for either of the two main components of the land development process studied. This is attested by the fact that even though one may not apply formally to the local municipality, one may still be allowed to use allocated land with no limitations except for that which is expressly recognised by law.

In essence, the whole land development process is considered to be single integrated process. To fully comprehend the process, it is suggested that a framework be established which captures all the components and dynamics at the local level with respect to both internal and external factors which also includes institutional structures and changes. Figure 3 schematically illustrates this single integrated land development process. The study revealed that the Permission to Occupy (PTO) is the single most important tool currently used for land administration and management in rural areas. It is, therefore, important to note that the PTO serves two most important functions: it is the basis for both land parcel allocation and for land use rights allocation.

Although there is slight difference in the actual procedure followed for the different types of developments, the schematic illustration provides a relatively better overview. The whole process begins with the applicant (being the prospective user or developer of land) who initiates the process and engages the traditional authority. The applicant with or without the local traditional/tribal officers may identify a site prior to the initiation of the engagement. Once this is completed, the applicant engages in negotiation with the traditional council regarding the possible acquisition of the identified land parcel. On conclusion of the negotiation, the traditional/tribal officers may sign a recommendation letter to the applicant. The letter serves as basis for further application for the land parcel allocation and land use rights in the form of permission to occupy.

Depending on the type and scale of land development, the traditional authority prior to conclusion of a leasehold for the identified land parcel will in conjunction with the Department of Rural Development and Land Reform (DRDLR) seek community approval. The DRDLR makes it mandatory for the community to be involved as they have a direct interest and are an affected party in the land development. The community participation process then culminates in a community resolution which is signed by all community members and certified by the department.

In the third phase of the process, the applicant is required to submit the application to the local municipality. The application is mainly for what one of the respondents termed "fictitious" land use rights. Just as the Town Planning and Townships Ordinance No. 15 of 1986, applicable to former Transvaal urban areas, is the main provincial legislation governing land development planning matters, the Land Regulations, 1969 (Proclamation No. R188 of 1969) serves as the principal regulation for land development procedure in the communal rural areas. Although the actual administration of the regulation and the approval thereof is at the provincial level, the application is submitted at the local municipality. This is to allow the municipality to assess the feasibility of the development in line with its local spatial and land use planning policies and visions.

The municipality after conducting own assessment issues a planning permit in the form of a council resolution which forms part of the recommendation to the provincial approving authority (currently the Department of Cooperative, Human Settlement Governance and Traditional Affairs, CoHSTA).

The CoHSTA as the provincial approving authority is responsible for the issuing of the approval, and thus the PTO. It was, however, discovered that in some instances the PTO is also used

as a means to ensure that the building meets certain standards as required by law, that is, National Building Standards. As revealed by the study, in this instance an approval ("approval in principles" as it is commonly referred to) is issued only without

the PTO to allow the applicant to design and construct. The PTO is then issued once the building is completed and certified by the relevant building occupancy and compliance authority at the local or the district municipality.

Table 1: Table of land development process in communal rural areas.

Main Activity	Role Players	Output	Discussion
Initiation	Applicant	Application Letter	The applicant may identify a particular site which is considered feasible or ideal for the proposed development even prior to the actual application for the land parcel.
Site/Land Negotiation	Traditional Council Developer and Department of rural Development and land Reform	Land Allocation Letter and /or Lease Agreement	Department of Rural Development and Land Reform mediate the negotiation.  The department also considers representation of the affected community and makes some recommendations on the decision-making process.
Planning Permit	Applicant (Developer) Local Municipality	Site Analysis Report, Motivation Memorandum	After the agreement with the local traditional council, the applicant is required to submit the planning permit application.  Recommendation letter from ward councillor and the traditional council is sought as part of the application.  On receipt of the application, the municipality conducts a site analysis to determine suitability of the site and advises accordingly.
Planning Permit Application and Approval	Local Municipality Provincial Authority (i.e. Department of Cooperative Governance and Traditional Affairs)	Permission to Occupy	After the site analysis, the municipality drafts and submits motivational memorandum to the provincial approving authority.  The provincial authority assesses and approves or disapproves the application. Once approved, PTO is issued.

## Requirements

They are two pieces of legislation that serve to guide land development in the rural areas; namely Proclamation R188, Land Regulation of 1969 and the Interim Protection of Informal Land Rights Act, No. 31 of 1996. Although the requirements for these two pieces of legislation are not clearly outlined, the provincial planning approving authority (CoGHSTA) and "the national rural land custodians authority" (DRDLR) in mitigating some of the challenges have provided guidelines and a list of requirements that need to be met in order to comply with the provisions of the said legislation.

For instance, community support or a resolution in terms of the Interim Protection of Informal Land Rights Act is required. The DRDLR, in particular, strictly facilitate the process to ensure that all interested and directly affected members of the community are informed of and partake in the decision regarding the

proposed land development. The application to the municipality also makes it mandatory that the site allocation letter from the traditional council is part of the "fictitious" land use rights application.

## Role Players

Land development in rural communal areas is complex partly because of the numerous stakeholders that are involved. Every stakeholder has specific interest in the land. The Traditional Authority wants to make sure that they control who occupy and use their land, whereas the DRDLR wants to ensure that procedures that are followed in terms of the allocation of the land are fair and just, and offer every interested and directly affected members of the community a platform to partake in the development. The local government as the custodian of municipal planning and land use management wants to ensure the most efficient use of the land after taking into account

their specific spatial planning policy and visions for the entire municipal jurisdiction.

### Potential advantages and pitfalls

The study revealed numerous challenges relating to land development in communal rural areas. Many of these challenges are politically and structurally embedded in the system. This subsection highlights some of the pitfalls or challenges and potential advantages in rural areas that need to be taken into account when considering property development in these areas.

#### Pitfalls

The first challenge relates to policy and legislative framework. The fact that there are currently two legislative frameworks which are not clearly articulated presents challenges in the application process despite efforts made by the respective authority to outline them. Many studies found that the one of the challenges in dismantling the apartheid structure in the rural areas particularly former homelands is complex and unstructured legislation governing the areas which have not yet been repealed<sup>3,5</sup>.

A finding of particular interest in this study is the use of legislation such as the Interim Protection of Informal Land Rights Act (IPLRA), No. 31 of 1996, 20 years in the post-1994 democratic dispensation. The Act was not only viewed as an interim measure, but it is supposed to be renewed annually by means of a notice which last seemed to have happened in 2010. This raises many questions regarding the validity of the Act and the application thereof. In addition, the promulgation of the Act (IPLRA) never provided further clarity on the already dealt matter of land tenure or informal land use rights or repealed in whole or in part the provision of Upgrading of Land Tenure Rights Act, No.112 of 1991. In the study it was revealed that no particular reference to Upgrading of Land Tenure Rights Act, No. 112 of 1991 was made albeit its regulatory connections to tribal or communal land and informal land use rights. On this note, there is a general sense of doubt among different stakeholders as to which legislation, policy and/or regulation is applicable in the rural areas.

On the other hand, the promulgation of Spatial Planning and Land Use Management Act, No. 16 of 2013 seems to have added to the complexity of the whole myriad of legislation at a local level in rural areas. The Act does not provide any relief process on how to deal with the traditional council areas where land is un-surveyed and no form of land use management system is in place. Although the Act makes it mandatory for the municipality to adopt a wall-to-wall, single land use scheme including areas within the traditional council, it does not make any pronouncement on how to deal with the land development matters within these areas. In the interviews with some local municipal officials, many raised concerns regarding the land development process which included the fact that the Act does not repeal existing sections applicable to land development in rural areas including the Interim Protection of Informal Land Rights. Despite this, Section 2 subsection 2 of the Act provides that no any other legislation may provide an alternative or parallel process for land development that is inconsistent with the Act.

The second challenge relates to structural arrangements at a local level; autocracy versus democracy. The relationship between the local municipality and traditional authority is not well-defined. The study revealed that recommendation letters are sought from local councillors as elected community representatives at ward level and yet again, letters are also required from traditional and sometimes even from headman as part of the land use (PTO) application process to the municipality.

On another level, the relationship between political representations and the administrative function of the municipality compound the challenges. The study revealed that in some instances both political representatives and the traditional council recommend approvals for certain developments without prior consultation with their municipal administrative counterparts. The traditional authority allocates land based on needs irrespective of its suitability while the municipal elected councillors due to the nature of their political position which demands support from the community often recommend any application for land development. The municipal administrative function, on the other hand, needs to determine the feasibility of the land and subsequently, approve or disapprove land development application. The latter possesses several challenges insofar as land allocation and land use rights are concerned.

The third challenge involves the supply and demand of land in rural areas. Land is not sold nor bought in the market mainly because the land is not surveyed and therefore, there is no individual title to land. The study revealed that the traditional authority and the DRDLR are responsible for land allocation and administration even though the actual rights are still a much contested matter; this is discussed subsequently. Depending on the scale, owner and type of the business, most of the land for commercial purpose is allocated on a leasehold basis.

The fourth challenge is linked to the third one and is related to security of tenure. Adams et al. found that the lack of clarity regarding tenure arrangements was among many factors hampering investment and development in former homelands<sup>5</sup>. These assertions seem to be fading with trends showing growth in rural investment. However, what is evident particularly from the developers in line with the findings of Adams et al. is that there is growing uncertainty relating to the extent of the rights to land as to who is authorised to make decisions about land and development<sup>5</sup>. From the study, it is clear that people on the ground are also not well informed as to the nature and extent of their rights and the regulations in place to protect their rights to land.

The fifth challenge is related to the system of land use allocation and management. There is virtually no efficient and reliable system of land use allocation and management in the rural areas. Perhaps the main contributing factor behind this is the collapse of past administration and keeping of records. Adams et al. found that the system of administration and keeping of records in the former homelands have broken down; some land records have been lost<sup>5</sup>. Again most of land remains un-surveyed; this means that there are no cadastral maps and thus, this leads to abuse and disputes. Moreover, the so called "land use rights" conferred mainly through the PTOs are fictitious because they are based virtually on almost non-existence property. As a result, individuals can easily extend boundaries and close streets without notifying the authorities with any recourse.

Lastly, the lack of bulk services has been highlighted as one of the biggest challenges by most institutional developers. This is true as most of the rural settlements have never been established with sufficient if any bulk services since the previous political dispensation. The status quo has remained in the current post-1994 democratic dispensation. Even though the government in post-1994 has placed a great deal of emphasis on the developing rural areas, the bulk service infrastructure backlog still remains, thus, hampering the envisaged land development.

### Potential advantages

Firstly, one of the main advantages of developing land in communal rural areas is the short timeframe required as opposed to the traditional land development permit application

in urban areas with proper scheme regulation specifically for local and small business operations. Generally speaking, the timeframe for obtaining land and its associated development rights is short. However, this is subject to numerous other factors including the challenges previously discussed and some of the other institutional requirements like community resolutions and environmental impact assessments which have the potential to prolong the actual timeframe. Perhaps one of the most important foundations for successful development in communal rural areas is to ensure complete local buying into the project so that they rally behind the development. In interviews with some developers, it was indicated that the motivation and benefit of land development should be clearly articulated particularly to the communities and the traditional leaders. This is particularly important in rural areas as there are high expectations and many of the areas are still behind in terms of development.

Secondly, change of specific use to another seems to be of no concern to the authority. In fact, it appears as though the only change that needs authorisation is when a big development is about to take place such as changes from a residential area to a shopping complex or other big commercial or industrial purposes. Land for residential areas can easily be converted to a small business like a "Spazashop/Tuckshop", a convenient store that does not need prior authorisation. Land for a small business can also be easily translated to big commercial development like office space.

Thirdly, the holding cost is one of the main reasons why some development, specifically in urban areas, ends up being abandoned. Although not the unit of analysis of the current study, all indications suggest that there is no holding cost that prospective developers incur while they await approval of the development permit. Land in rural areas is not subject to property taxes and rates.

## CONCLUSION

The purpose of the study was to establish the common procedural requirement for land development in the communal property rights parts of rural areas. The study was premised on the view that there are permitting requirements that need to be met for any development to take place in South Africa which are as a consequence of type of land tenure which in turn have impact of land development project or programmes. The study conducted a survey among the community members, traditional leaders, government officials who deals with land administration, planning and development matters, and developers including owner occupied business operators.

In general the study established that there is a dual system of the process of land development that is dependent on the scale and type of development and the type of applicants (whether institutional developers, or individual or local developers). For instance, small local developers are only subjected to relatively minimal requirements as opposed to large and institutional developers or 'outsiders'.

The study also revealed that land administration including allocation is a function of the traditional authority/ council supported by the national government. The national government provides technical guidance with regard to the whole land allocation/acquisition process and also facilitates community resolutions and management of funds as well as other related matters for the benefits of the affected communities. On the other hand, the provincial authority supported by the local municipality is the approving authority responsible for the allocation of land use rights. The community is the key participant in the whole land development process.

Furthermore, the findings showed that there are two key legislative frameworks currently being used to guide the land development process in communal rural areas. These include legislation from the previous dispensation, Proclamation R188 of 1969 and the post-1994 dispensation, namely, the Interim Protection of Informal Land Rights Act of 1996. To a lesser extent, the transitional law of Upgrading of Land Tenure Rights Act of 1991 also plays a role. Proclamation R188 is mainly applied as a guiding measure for land use rights under the administration of the provincial government and local municipality as the land use permit approving and supporting the authorities respectively. On the other hand, the Protection of Informal Land Rights of 1996 is mainly used for land allocation and for further protecting individual or community members' rights to land.

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# IMPACT OF MATERIAL WASTE ON THE QUANTITY OF MATERIALS USED: A CASE OF ONGOING BUILDING PROJECTS IN ABUJA, NIGERIA

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## PURPOSE:

The research examines the impact of material waste on the quantity of materials used for ongoing-building projects.

## ABSTRACT

### Purpose

The research examines the impact of material waste on the quantity of materials used for ongoing-building projects.

### Design/Methodology/Approach

The research method is quantitative. The investigation included ongoing building-construction projects within Abuja, from which a sample of 31 projects (public and private) was purposively selected (project value of R100 million Rand and above). The data were sourced from the measurement of the volume of material waste and data from the archival records: drawings, bills-of-quantities, project-progress reports, and specifications on the quantity of material used and the percentage of work completed for each project.

### Findings

The percentage proportion of material waste to quantity of material used ranged from 1.96% to 8.01%, with an average proportion of 3.92%. Only five projects (16%) had their percentage proportion above 5%. Construction professionals should be well informed of these proportions, and the process be regularly evaluated at stages of construction, so that the allowable limit for material waste in the bill of quantities is not exceeded.

### Original/value of the paper

The allowable percentage for materials to take care of waste in the bill of quantities is mostly exceeded and this is a challenge to construction professionals. This research will be of value to professionals to plan and apply the appropriate waste management techniques, in order to minimise extent of this challenge.

**Keywords:** Materials Used, Nigeria, Ongoing-building Projects, and Waste Volume

## INTRODUCTION

The rapid urbanisation in developing nations has resulted in a substantial increase in construction activities, which in turn, has led to the generation of a large quantity of construction-material waste<sup>1</sup>. Material wastage has become a serious problem, which requires urgent attention in the Nigerian construction industry. This constraint harmfully affects the delivery of many projects<sup>2</sup>. Therefore, extra construction materials are usually purchased due to the material wastage during the construction process<sup>3</sup>. Moreover, the quantity of material waste generated on some construction sites is to some extent over the 5 percent allowance made to take care of material wastage in the course of preparing an estimate for a project<sup>2</sup>. Accordingly, 10 percent of the materials delivered to sites in the United Kingdom (UK) construction industry end up as waste that may not be accounted for<sup>4</sup>. In Nigeria for every 100 houses built, there is sufficient waste material to build another 10 houses<sup>5</sup>. Studies from Nigeria revealed that the actual construction waste figure is consistently more than the estimated figure<sup>6,7</sup>. In the last decade, little attention has been paid to the management of waste generated in the Nigerian construction industry. This could be as a result of the low level of awareness of the construction workers, a low level of available means of waste disposal, or the slow adoption of environmentally sustainable practices<sup>8</sup>.

Research evidence has shown that previous studies from different parts of Nigeria centered mostly on waste and waste-management practices in the construction industry; as well as the necessary tools, models, and techniques for their management. Nonetheless, these studies have failed to

objectively (quantitatively) address and give a clear indication on the impact of material waste on the quantity of materials used for ongoing building projects in Nigeria. Thus, a further investigation on the actual volume of material waste was recommended; because the insufficient attention given to material-waste generation during the past decades has resulted to a dearth of statistical data on the quantity of material-waste generation in developing countries<sup>9</sup>. This assertion is supported by research<sup>7</sup>, showing that the situation is not any different in the Nigerian construction industry.

Consequently, this recommendation led to the development of the problem posed in this study that: statistical data relating the quantities of material waste and those of material used for ongoing projects have not been well documented; and statistics on the waste generated are minimal in the Nigerian Construction industry<sup>10</sup>. On this basis, this article reports the findings of an objective investigation on the impact of material waste volume on the volume of material used for ongoing building projects in Abuja, Nigeria.

The success in waste management, depends on three factors, namely: awareness, decision making, and action<sup>11</sup>. Therefore, this study will create awareness and provides guidance on the efficient use of materials by contractors and sub-contractors; as well as construction practitioners focusing on: the effective estimating of material waste, and the production of accurate records of waste to the built environment professionals in the Nigerian construction industry. The recommendations of this paper, if properly implemented, would achieve the best value for money to the client. The awareness would encourage the contractor in exploring the possible ways of minimising the rate of waste generation on site, which would in turn, reduce the amount of construction waste that would be sent to landfills<sup>10</sup>.

## LITERATURE REVIEW

### The Concept of Waste in the Construction Industry

Construction waste is a global challenge facing both construction practitioners and researchers. It can have a significant impact on time, cost, quality and sustainability, as well as the success of projects<sup>12</sup>. It is the difference between purchase and actual use<sup>13</sup>. Furthermore, waste is any surplus or unwanted material persistently causing environmental difficulties and global warming<sup>12</sup>. Consequently, waste has been described as any constituent generated, as a result of construction work, and abandoned whether or not it has been processed, or stocked up before being abandoned<sup>14,15</sup>. In another view, waste is anti-sustainability that paves the way towards sustainability<sup>16</sup>.

Construction waste is viewed by many scholars as any human activity that consumes resources, but creates no value, such as mistakes that require rectification, waiting time/waste of time, cost, unwanted production/overproduction, management of work programmes, and poor constructions<sup>1,16,17,12</sup>.

Construction waste was categorised into the physical waste and the non-physical waste<sup>18</sup>. The physical waste is the waste from construction, renovation activities, including civil and building construction, demolition activities, and roadwork. It is, however, referred by some directly as solid waste: the inert waste which comprises mainly sand, bricks, blocks, steel, concrete debris, tiles, bamboo, plastics, glass, wood, paper, and other organic materials. Some of these wastages are usually recovered through re-use and recycling, or even removed from the site to landfills<sup>18</sup>.

Conversely, the non-physical waste normally occurs during the construction process. By contrast with material waste, the

non-physical waste relates to time and cost overruns for a construction project<sup>18</sup>. The non-physical waste includes undesired activities, which can cause the physical waste, such as rework, unnecessary material movements, and so forth<sup>19</sup>.

### Procedures for Quantification of Construction Material Waste

The quantification of the amount of construction-material waste is important for the building practitioners to properly plan and control their disposal thereof<sup>20</sup>. Researchers quantify construction site waste in many ways<sup>21</sup> as discussed below.

In the Netherlands, construction waste has been measured in three ways: as a percentage of the total amount of waste, the purchased amount of material, and the total waste costs. It was also found that the amount of waste for each building material lies between one (1) percent and ten (10) percent of the amount purchased<sup>6,22</sup>.

In Malaysia, the quantification of material waste is based on the volume of stockpiled waste, which is determined either on the basis of a rectangular prism, or in a pyramidal shape<sup>23</sup>. For the pyramidal shape, the volume =  $\frac{1}{3} (B \times L \times H)$ ; and for the rectangular prism form, the calculated volume is  $= L \times B \times H$ . Where 'L' is the length, 'B' is the base, and 'H' is the height<sup>23</sup>.

Furthermore, different practices can be used to measure waste: either by weight (kg or ton), or by volume (cubic metres/m<sup>3</sup>)<sup>24</sup>. However, the Waste Generation Rates (WGRs) are calculated by dividing the waste by either the amount purchased, the amount required by the design, or per square metre / m<sup>2</sup> of Gross Floor Area (GFA). Therefore, the four typical measurements for WGRs are: (1) the percentage of purchased materials; (2) the percentage of material required by the design; (3) kg/m<sup>2</sup> of GFA; and (4) m<sup>3</sup>/ m<sup>2</sup> of GFA<sup>24</sup>.

The Waste Generation Rates (WGRs) are useful variables that lie at the core of many efforts for understanding waste management in the construction sector. WGRs can provide quantitative information for benchmarking different construction waste-management practices<sup>24</sup>. This is achieved by measuring the quantity of construction waste generated by weight (tons) for every square metre of normalised floor space at the construction sites<sup>25</sup>.

$$WGR = \frac{\text{Total construction waste(tons)}}{\text{Total floor space ( m}^2 \text{ of normalised floor space)}}$$

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It is believed that material-waste quantification commences with the following steps: (1) listing the major types of construction material; (2) the purchased amount of major materials; and (3) the actual material waste rate of each type of material listed in 1, by dividing the amount of waste by either the amount of purchased material<sup>26</sup>, or by the amount of material required by the design. And, lastly, (4) estimation of the percentage of the remaining waste. Therefore, major materials account for nearly 90 percent of the total construction waste. The remaining waste occupies approximately 10% of the total waste<sup>21</sup>.

## RESEARCH METHODOLOGY

The research employed the quantitative approach that is rooted in the positivist research paradigm. It is quantitative because the data were generated from the numeric measurement of the volume of on-site material waste and the volume of materials used for the project.

The study covers "on-going" building construction projects (public and private) within Abuja, the Federal Capital Territory of Nigeria, from which a sample of 31 projects was selected. The sample comprised both public and private projects, with a

value of 1.6 billion Naira/100 million Rand and above, using the purposive sampling techniques. The rationale behind this selection is that, building construction projects of this value and above are likely to generate large quantities of material waste, when compared with projects of less value. Also, it is possible to have more experts (experienced professionals) than in smaller-sized/lower-valued projects. Abuja as a geographical case study area was selected, because it is one of the metropolitan cities in Nigeria that has the highest population of professionals within the built environment and has many on-going construction projects.

This study focused mainly on the primary data, which included: the field investigation and data from the archival records (drawings, project progress reports, and specifications) on material waste in the Nigerian construction industry. These data were generated from “on-going”, and not fully completed projects. The data on the quantity of material waste and the quantity of material used for projects are each expressed in volume (cubic metre).

#### Archival Records

The Total Volume of Materials Designed for each Building Project (TVMDBP) was generated from the measured quantities of each material from the priced/unpriced Bills of Materials (BOQ) prepared for that project. The measurement unit of each material, as contained in the BOQ (linear, square and cubic metre, number, kilogram, tonne, and so on) were converted to a common standard unit (volume/cubic metre). The converted volumes were summed up to achieve the TVMDBP. Furthermore, the Percentage of the Work Completed for ‘each’ Ongoing Project (PWCOP), ( % of WC ) was collected from the project progress record compiled by the projects’ Quantity Surveyors, and was multiplied by the generated TVMDBP to achieve the Volume of Used Materials for each Project (VUMP).

Where access to the BOQ was denied, the TVMDBP was generated by taking direct measurements of the quantities from drawings, and by making the necessary adjustment (for openings, plastering, finishes, and so forth), in accordance with the rules of the Standard Method of Measurement (SMM) for building works, in order to determine the net TVMDBP.

#### Field Investigations

The data on the volume of on-site material waste was generated by physical on-site measurements with the aid of measuring instruments, such as tape and measurement rule. Also, where the generated on-site material waste has already been disposed and removed from site, a request was made to allow the researcher to assess the total volume (material waste) disposed/removed from the project’s onsite records. The collected data (volume of material waste) for each project was used to determine the ‘impact of material waste on the volume of material used for projects’.

#### Analyses of the Data

Both ‘descriptive’ and ‘inferential’ analyses of the data were employed in this research. The percentage distribution (descriptive) was used to analyse the impact of material waste on the quantity of material used as presented in the last column of Table 2. The linear regression (Inferential) analysis available from the Statistical Package for Social Sciences (SPSS) was performed to determine the relationship between the following variables:

1. ‘Volume of materials used ‘x’ and the ‘volume of materials waste (y)’;
2. ‘Building size (LxWxH) ‘x’ and the volume of material waste (y)’; and
3. ‘Percentage of work completed ‘x’ and volume of material waste (y)’

The letters ‘x’ and ‘y’ denote the independent and dependent variables respectively. Therefore, the linear regression equation was given as:

$$y = a + bx \quad \text{and} \quad x = a - \frac{y}{b}$$

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

Where y is the dependent variable (Volume of waste); x is the independent variable (volume of material used); b is the coefficient of x and a is a constant. Also, the approximate conversion rates used as at the period of data collection were:

Nigerian Naira to US dollar ₦200=1\$;

Nigerian Naira to South African Rand ₦16=R1.

Moreover, the average percentage of project completion for the entire building-construction projects visited was 52.4%, as the constructions were on-going as at the period of data collection. This kind of research is easier with ongoing projects because, material waste is mostly removed from project sites, as soon as the projects are completed, and as such, the actual measurement of material waste would be difficult.

## RESULTS AND DISCUSSION

#### Relationship between the Volume of Material Waste and the Volume of Materials Used for Projects

The result of the linear-regression analysis between the volume of material waste generated on-site (dependent variable “y”) and the ‘volume of materials used for projects’ (independent variable “x”) is shown in Table 1.

It was observed from the analysis that the probability value (0.0027) was less than the 0.05 (5%) significance level. The R-square value (56.53%) shows a strong relationship between the variables. Therefore, it is inferred that the relationship was statistically significant. The result implies that, any increase in the volume of materials used would result in an increase in the quantity of material waste to be generated for that project.

#### Relationship between Building Size and Volume of Material Waste

Furthermore, it was also observed from the second analyses (relationship between the building size and the volume of material waste) on Table 1 that the probability value (0.001534) was less than the 0.05 (5%) significance level. The R-square value (55.28%) shows a strong relationship between the two set of variables. It is inferred that the relationship was statistically significant. The result implies that; increase in building would result to an increase in the volume of waste. Therefore, bigger sized buildings generate more material waste than the reduced sized building projects.

#### Relationship between the Percentage of Work Completed and the Volume of Material Waste

Consequently, the third analysis on Table 1 (relationship between the percentage of work completed and the volume of waste) reveals a probability value of 0.021231, which was less than the 0.05 (5%) significance level. This shows a weak relationship between the two set of variables. It is inferred that the relationship was statistically significant. The result implies that, increase in the ‘percentage of work completed’ would result in an increase in the quantity of ‘material waste’ for that project. Though, the R-square value (14.60%) was weak. This could probably mean that increase in the percentage of work completed could possibly result in decrease in the quantity of material waste, only if onsite-waste management is very functional, and all necessary waste management techniques are strictly adhered to in the long run.

**Table 1 : Results of the linear regression analysis**

Sn	Variables		Type of Analysis	Observation		Inference	
	X	Y		R square	Probability value	Strength of Relationship	Remarks
1	Volume of material used	Volume of material waste	Linear regression	56.53%	0.002276	Strong	Statistically significant
2	Building size	Volume of material waste	Linear regression	55.28%	0.001534	Strong	Statistically significant
3	Percentage of work completed	Volume of material waste	Linear regression	14.60%	0.021231	Weak	Statistically significant

Since it has been statistically established that a strong relationship exists between the volume of generated material waste and the quantity of material used; Table 2 further explains the percentage proportion of material waste to the quantity of materials used for projects in a descriptive form.

#### **Average Percentage Proportion of Generated Material Waste to the Volume of Material Used for Project**

Table 2 shows the results of field investigation on the volume of material waste and the data collected from the archival records, as well as the onsite progress records for the visited construction projects. An average percentage completion of 52.4% was attained for the visited projects. About 15 out of the 31 projects were 50% completed and only 7 were 90-100% completed. These findings are reliable; because the average percentage of project completion is above 50%. This kind of research is easier with ongoing projects; as completed projects would constrain the on-site measurement of material waste.

It was apparent from Table 2 that the percentage proportion of material waste to the quantity of material used for the projects ranged from a minimum of 1.96% to a maximum of 8.01% with an average proportion of 3.92%. This shows the level of variation in the management of materials, as well as waste on construction site amongst the construction professionals. This percentage proportion could be as a result of quality in planning, procurement of the right materials, the method of construction, as well as the related waste management principles applied for the projects. This average percentage of "3.92%" is still within the 5% limit that is normally allowed for materials, to take care of waste in the process of compiling a bill of quantities in Nigeria. Though, Table 2 indicates that, only five (5) projects (16%) had their percentage proportion above the allowable limit of 5%. This result could serve as a warning sign to the following projects with more than 5% proportion. These include: "6.35% proportion with 43% completion"; "8.01% proportion with 63% completion"; "6.13% proportion with 68% completion"; "5.12% proportion with 65% completion"; and "6.10% proportion with 56% completion", respectively. Out of the five stated projects, only one project had its percentage of completion below 50% that is 6.35%. Therefore, unless the management of materials as well as material waste is tight in the long run, these indications may likely affect the costs of these projects.

These results confirm the findings which state that the quantity of material waste generated on some construction sites in Nigeria is to some extent over the 5% allowance made to take care of material wastage in the course of preparing an estimate for a project<sup>2</sup>. The result also validates the findings which concludes that the actual construction waste figure is consistently more than the estimated figure in the Nigerian construction industry<sup>6,7</sup>. However, the result refutes the finding which concludes that 10% of materials delivered to some construction sites end up as waste that may not be accounted for<sup>4,5</sup>. Though, these projects are still ongoing; but these proportions could rise to, or even above the 10% limit stated by<sup>4,5</sup>.

Furthermore, the remaining projects that have their proportion

of material waste to the quantity of material used below 5% are said to be working within their allowable limit of waste in the bill of quantities.

#### **CONCLUSION AND RECOMMENDATIONS**

Material wastage has become a serious problem, which requires urgent attention in the Nigerian construction industry. This constraint harmfully affects the delivery of many projects. Material wastage on construction sites can have impact on the quantity of materials delivered/used for ongoing-building projects; but objective research to provide evidence of such impact are suboptimal. Thus, the actual proportion is not yet ascertained. This research provides an analytical insight into the impact of material waste on the quantity of material used for ongoing-building projects in Abuja, Nigeria.

The empirical findings from the study have established that a relationship exists between material waste and the quantity of material used for projects; material waste and building size; and material waste and percentage of work completed. The results imply that an increase in the 'quantity of materials used for a project', increase in 'building size', and increase in the 'percentage of work completed' would lead to an increase in the quantity of material waste.

It is also concluded from the descriptive analysis that the significant percentage proportion of material waste to the quantity of material used ranges from a minimum of 1.96% with a 17% project-completion rate, to a maximum of 8.01% with a 63% project-completion rate, and a general average proportion of 3.92% of material waste to the quantity of material used for projects. The average percentage of 3.92% is still within the 5% limit, which is normally allowed for materials, in order to take care of waste in the process of compiling bills of quantities in Nigeria.

Moreover, these results could be a warning sign to the projects that have their percentage proportion of material waste above 5% (6.35% with 43% completion, 8.01% with 63% completion, 6.13% with 68% completion, 5.12% with 65% completion, and 6.10% with 56% completion respectively). It was obvious that only one of these projects had its percentage completion below 50% that is 6.35%. Therefore, unless the management of materials, as well as material waste is tight and more functional in the long run, these indications might likely affect the project cost.

Based on these findings, it can be concluded that effective management of material waste and constant evaluation of the amount of wasted materials at stages of ongoing construction work would translate into a reduction in the level of material waste; as well as keep the project within the 5% limit of waste allowed during the production of the bill of quantity.

The study recommends that construction professionals should be well informed of these proportions, as well as the processes involved in determining the proportion, which should be regularly evaluated at stages of construction, so that the 5% allowable limit for material waste in the bill of quantities is not exceeded.

**Table 2:** Average proportion of material waste to the quantity of material used

Project number	Building Volume (L x W x H), (M³)	Estimated volume of materials for Projects (M³)	Percentage (%) of work Completed	Volume of material used (M³)	Volume of Material waste (M³)	impact of material waste on the volume of material used (%)
1	26,262.94	8, 925	17%	1,517.25	65.24	4.30%
2	186,860.00	35, 503. 40	47%	16, 686.60	634.09	3.80%
3	17,486.60	5,126. 84	59%	3, 024. 84	124.02	4.10%
4	56,532.00	10, 741. 08	35%	3,759. 38	155.49	4.14%
5	29,964.00	7, 191. 36	43%	3, 092. 29	196.23	6.35%
6	102,320.00	19, 082.68	63%	12, 022.09	963.40	8.01%
7	635,737.20	75, 033.66	30%	22, 510. 10	891.85	3.96%
8	93,440.00	14, 651.39	30%	4, 395.42	128.04	2.91%
9	18,170.00	5, 566.77	68%	3, 785.40	232.14	6.13%
10	105,658.00	14, 010. 25	23%	3, 222. 36	136.34	4.23%
11	130,311.60	17, 201.13	65%	11, 180.74	572.45	5.12%
12	82,080.00	13, 953. 60	25%	3, 488. 40	108.14	3.10%
13	181,622.41	14, 633. 00	15%	2, 194. 95	57.72	2.63%
14	5,181,480.0	673, 592.40	5%	33, 679.62	707.27	2.10%
15	102,550.00	17, 320.70	17%	2,944.519	57.71	1.96%
16	26,223.37	4, 982. 44	23%	1, 145. 96	36.01	3.14%
17	127,615.32	20, 791.48	31%	6, 445. 36	223.01	3.46%
18	104,286.00	17, 207. 19	25%	4, 301.80	141.96	3.30%
19	130,000.00	19, 019. 15	90%	17, 117.24	701.81	4.10%
20	622,021.36	67, 385.61	11%	7, 412. 42	158.85	2.14%
21	148,500	19, 305. 56	48%	9, 266. 67	398.47	4.30%
22	42,700.00	9, 522. 10	100%	9, 522. 10	400.88	Completed=4.21
23	43,747.20	7, 231.41	56%	4, 049. 59	247.03	6.10%
24	84,240.00	10, 951.20	68%	7, 446. 82	156.38	2.10%
25	29,568.00	5, 322.35	100%	5, 322.35	NR	No Record
26	84,000.00	15, 414.00	60%	9, 248.40	322.74	3.49%
27	136,000.00	16, 728. 00	88%	14, 720.64	529.94	3.60%
28	89,060.00	15, 585. 50	99%	15, 585.50	568.87	3.65%
29	118,263.00	19,158.61	95%	18, 200.68	893.65	4.91%
30	126,615	16, 459. 95	98%	16, 130.75	645.23	4.00%
31	3,252,311	211,914.50	90%	190, 723.05	4005.18	2.10%
			Average =52.4%			Average=3.92%

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# IMPROVING SKILLED WORKERS: A PANACEA FOR IMPLEMENTATION OF SKILL DEVELOPMENT ACT IN SOUTH AFRICAN CONSTRUCTION INDUSTRY

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**PURPOSE:**  
**Skill Development Act (SDA)**  
**provides an organizational**  
**framework to devise and**  
**implement national sector**  
**and workplace strategies in**  
**order to develop and improve**  
**the skills of the South African**  
**workforce. This study examined**  
**various factors that can assist**  
**in improving the number**  
**of skilled workers in the**  
**construction industry for better**  
**implementation of the Act.**

## ABSTRACT

### Purpose

Skill Development Act (SDA) provides an organizational framework to devise and implement national sector and workplace strategies in order to develop and improve the skills of the South African workforce. This study examined various factors that can assist in improving the number of skilled workers in the construction industry for better implementation of the Act.

### Design

Using survey design, questionnaires were administered on stakeholders that are directly involved with the implementation and practice of skill development in the construction industry. Mean Item Score (MIS) was computed from the collected data and used for analysis and ranking of identified variables.

### Findings

All the identified factors were found to be important for improving the number of skilled workmen with a least MIS of 3.18 on a 5-point Likert scale. There is a need for the reintroduction of the apprenticeship system for construction workers as well as truthful and sincere use of skills development levies by concerned stakeholders.

### Value

This study explored various variables that could be of assistance in increasing and improving the number of skilled workmen in the South African Construction industry in the quest to achieving the goals of SDA in the industry. It will be useful for Sector Education and Training Authority (SETA), Construction Education and Training Authorities (CETAs) and other stakeholders in the construction industry in realising the goals of SDA, thereby improving performance of construction projects.

**Keywords:** Construction skilled labour, Education and training, Skill development, Skills Development Act (SDA), Skill shortage.

## INTRODUCTION

In South Africa, the issue of skills shortages cuts across a range of market sectors, with the engineering and construction sector suffering particular constraints on growth and effectiveness<sup>1</sup>. Hence, in 1994 the elected democratic government inherited an economy that was typified by faltering growth, rising inflation and unemployment. As a result, the administration was mandated with developing a comprehensive education and skills training system that would promptly respond to meeting the needs of the country and its citizens to enhance the country's global competitiveness<sup>2</sup>. Despite the achievements in these areas, a number of endemic problems still remain. It is widely acknowledged that South Africa faces two important challenges apart from the prevalence of HIV/AIDS and a high incidence of crime<sup>3</sup>. The two challenges are related to very low level of education and skills among the previously disadvantaged Bantu majority and persistently high levels of unemployment despite reasonable economic growth<sup>4,5</sup>. In South Africa, an inadequately educated workforce has been identified as the most problematic factor for doing business.

One of the greatest challenges currently facing the construction industry is its inability to attract and retain skilled professionals<sup>6</sup>. Further, in South Africa the issue of skilled labour shortages has been well acknowledged by national government as well as the engineering and construction industry<sup>7</sup>. Additionally, it was observed that the skills deficits appears to be a path where the demand will continue to outstrip the supply as a result of substantial growth in infrastructure investment<sup>8</sup>. In light of this, restoring the skills pipeline requires that the demand for skilled labour equal the supply<sup>9,10</sup>. As a result of various transformation

programmes, South Africa has achieved a lot but as government itself has acknowledged, the pace of change is scarcely enough to keep up with accelerating social and economic challenges.

Review and evaluation of existing literature materials shows that very few studies have focused on the Skills Development Act (SDA) as a potential solution to redressing the legacy of the past. Most of the existing studies on skills development are majorly focused on addressing the needs of employer, and much effort has also been directed at ensuring the comprehension and compliance of complicated legislative framework underpinning the concept of skills development<sup>2</sup>. Hence, the motivation for conducting this research study arises from the need to assess the ambit the efficiency of the SDA in improving the number of skilled workers in the South African construction industry. The aim is to increase stakeholder's awareness of the need to access relevant education and training opportunities of highest quality, including enterprise-based learning (EBL) opportunities and experience in order to allow citizens' effective participation in the economy and in society in general. The study will be useful for various arms of government, construction employers, contracting firms and construction professionals as well as other concerned stakeholders in understanding the need for effective skills development in the quest for improved productivity of workforce and better performance of construction projects.

#### **SDA And Skill Development of Construction Workers**

Skills development and training focuses on creating circumstances that enable employees to acquire the required job skills, knowledge, as well as attitudes for better performance. The concept of training and development is therefore related to the development of persons as a whole, rather than the improvement of an individual in general. Employee development focuses mainly on creating learning opportunities, in turn enabling learning in all organizations<sup>11</sup>. Skills development is therefore a planned process of developing task-level expertise through having an experienced and qualified facilitator to train a novice employee at, or near the actual work setting<sup>5</sup>. In a similar view, it was stated that skills development is an important element in ensuring that employees perform their tasks to the level that the job requires<sup>12</sup>. As such, skills development echoes individual training or instruction in the workplace.

In the assessment of the SDA, it was emphasized that training programmes had substantial potential to improve workforce based skills, productivity, social service delivery and the return on investment in education and training<sup>13</sup>. The report also encouraged employee participation in the flagship learnerships as well as other learning programmes. The drive for skills development in South Africa is a crucial priority and this is evidenced by the establishment of the Joint Initiative Priority for Skills Acquisition (JIPSA) in 2006. Notably, this initiative aims to affirm the urgency of South Africa's skills demand, and also seeks to find quick and effective solutions to this problem.

#### **State of Skilled Workforce in the Construction Industry**

In South Africa, the issue of skilled labour shortages has been well acknowledged by both government and industry<sup>7</sup>. The skills deficit appears to be on a path where the demand will continue to outstrip the supply as a result of substantial growth in infrastructure investment. Furthermore, government initiated projects also suggest a significant number municipal, provincial and national projects that require more skills spread over a number of projects rather than a concentration of definite skills in fewer larger projects.

Additionally, private sector including corporate bodies are also expected to rollout a limited number of larger scale projects in addition to the several, already existing dams, airports, stadiums,

housing developments and other national roads projects, such as the construction of the R23 and the Gauteng Freeway Improvement Project (GFIP). However, the skills requirement for each of these projects is expected to be in the order of 10's for professionals (i.e. educated persons) and 100's for artisans, with Eskom for instance, having required about 2,000 artisans at peak levels of demand for each of the new power generation projects<sup>7,8</sup>. This fall short of the current number of skilled workforce necessitating the need for more workmen and further training of the existing ones.

#### **Skill Development in South Africa**

The basic elements of skills development under the Apartheid (regime) are well established and they include: low skills production; voluntarism on behalf of employers, and a highly unequal public education system<sup>14,15,16</sup>. As with other African countries, work-related curricula have been associated with low achieving learners, and the control of social deviancy<sup>17</sup>. Over time, a system emerged which was highly racialized, fragmented and separated from the rest of the educational system<sup>18</sup>.

In response to economic difficulties, the (late) Apartheid government attempted to transform the skills regime by moving the system away from its Apartheid low skills origin towards a framework based on free market regulation, a revived apprenticeship system, and a new institutional environment<sup>19</sup>. Moreover, Industry Training Boards (ITBs) were established in all industries, and given absolute control over the administration and certification of training. Furthermore, another study described how the shape and form of the apprenticeship system followed changes in work organization, with the move to mechanization thus prompting the need to include mathematics and science in college curricula, and later, with a move to standardization in mass production and the introduction of competence-based modular training<sup>18</sup>. The change through which time-based training systems were modified into competence-based systems was described as a key innovation<sup>19</sup>. Hence, in 1994, when the first democratically elected government came into existence, education and training were split between two ministries, being the Ministry of Education (responsible for schools, adult education, colleges and universities) and the Ministry of Labour which was in charge of skills development.

#### **Skill Training of Construction Workers**

Overcoming the skills deficit has been a major concern for South Africa since the dawn of democracy in 1994<sup>20</sup>. In response to this, the learnership system, which was established by the Skills Development Act 97 of 1998 proposed a dual vocational-training model (which included theoretical learning at a recognized training institution with practical on-the-job training in the workplace) resulting in a recognized national occupational qualification. The system therefore creates employment, while simultaneously developing the skills base of a learner according to labour-market needs. To ensure growth and development in quality and quantity of the system, the Sector Education and Training Authorities (SETAs) were given the responsibility of overseeing and promoting skills development in general and learnership training in particular in their own economic sectors<sup>21</sup>. Moreover, the SETA responsible for the construction industry is the Construction Education and Training Authority (CETA). The CETA was established in April 2000 by way of the SDA. Its primary objective is to strategically influence the course of training and skills development by ensuring that all training reflects the needs and requirements of the construction sector<sup>9</sup>.

Since its inception, however, and even though it features in the top ten learning interventions of the most recent South African training industry report<sup>20</sup>, the system has nonetheless failed to meet expectations, particularly in terms of employer participation.

This is particularly true for the construction sector, which is labour intensive, and uses relatively elementary skills, and is regarded as one of the key drivers of reducing unemployment and poverty. In addition, the sector also provides infrastructure to support economic growth in all other economic sectors<sup>22,23,24,25</sup>.

## RESEARCH METHODOLOGY

The study was conducted with reference to existing theoretical literature relating to legislative policy documents governing the education, training, and skills development of the South African construction labour force. Documentary reviews in construction education and training was also consulted to compliment the information from literature.

Using quantitative research approach, 59 structured questionnaires were administered on respondents. These included 24 to contractors, 7 to consultants, 9 to private clients and 19 to relevant government stakeholders through convenient sampling method. The respondents for government stakeholders are various construction related training groups which are: Construction Education and Training Authority (CETA); CETA registered training providers; Council for Higher Education; Construction Industry Development Board; Department of Higher Education and Training; Department of Labour; Practicing construction professionals; Quality Council for Trades and Occupations; South African Qualifications Authority; and South African Council for Project and Construction Management Professions. The questionnaires were delivered personally after making the necessary appointments with the individual respondents. Using self-reporting structured questionnaire, it is necessary to engage respondents that could read in English and have adequate knowledge about the Skills Development practices within the construction industry. The instrument could not be translated into local dialects because of the 11 different dialects spoken in the study area, which could have created difficulty in the accuracy of translation.

For ethical considerations, a cover letter was provided informing the respondents of the general aim of the study, purpose and confidentiality of data supplied as well as average duration it will take to complete a questionnaire. Also, research objectives were articulated verbally and in writing so they could be clearly understood by respondents. Thereafter, participants were invited to take part in the research, but only on the condition of voluntary participation. Equally important, participants were assured of their anonymity and this was guaranteed through the confidentiality of the study. They were also informed that they were free to disengage from participating at any stage of the research without fear of prejudice.

A 5-point Likert scale was used to solicit information on drivers and barriers to the implementation of the SDA and level of achievement of SDA goals. The adopted scales are:

- 1 = Strongly disagree (SD)/ Extremely unlikely (EU);
- 2 = Disagree (D)/ Unlikely (U);
- 3 = Neutral (N);
- 4 = Agree (A)/ Likely (L); and
- 5 = Strongly agree (SA)/ Extremely likely (EL).

The five point scale was transformed to Mean Item Score (MIS) for each factor and the indices were employed to determine the rank of each variable. For reliability test, Cronbach's Alpha was employed for internal consistence check with a value of 0.83. An alpha coefficient of 0.80 represents a reasonable degree of internal consistence and the value above 0.70 is acceptable<sup>26,27</sup>. This implies that the calculated Cronbach's alpha value is within the tolerable levels; hence all the identified factors in the study were measuring the same construct.

## FINDINGS AND DISCUSSION

Out of the 59 questionnaires distributed, 48 were retrieved while 3 were found unsuitable for further analysis. This implies that 45 questionnaires were analysed representing 76% response rate.

### Demographic Information of Respondents

The results of analysed data in table 1 revealed that respondents are evenly spread in that, 53.33% were male and 46.67% were female with average of about 11 years working experience. Findings relating to respondents' age group revealed that majority are between 26 and 55 years. The study spread across all ethnic groups in that about 53% of respondents are Black, 27% are White, 11% are either of Indian or Asian descent and 9% are Coloured. On their current employer, about 47%, 26%, 16%, 7% and 4% are employees of contracting firms, government training agencies, private sector clients, public universities (others) and consulting firms. On the number of skills development/training programmes respondents were involved in the last ten years, 26.67% were involved in 1-2, 15.56% were involved in 3-4, 44.44% were involved in more than 4, and 13.33% of the respondents were not involved in any training programmes.

Table 1: Characteristics of respondents

Characteristics	Frequency	Percent
<b>Gender</b>		
Female	21	46.67
Male	24	53.33
<b>Ethnic group</b>		
Black	24	53.33
Coloured	4	8.89
Indian or Asian	5	11.11
White	12	26.67
<b>Current employer</b>		
Contractor	21	46.67
Consultant	2	4.43
Private client	7	15.56
Government	12	26.67
Others	3	6.67
<b>No. of Skill development programmes involved</b>		
More than 4 programmes	20	44.44
3 - 4 programmes	7	15.56
1 - 2 programmes	12	26.67
None	6	13.33

## FINDINGS AND DISCUSSION

Based on their experience, the respondents were asked assess the factors that would assist in improving the skilled workers in the South African construction industry. Reintroduction of the apprenticeship system is the most important factor with a mean value of 4.16 and standard deviation (SD) of 9.381 as indicated in table 2. This is followed by truthful and sincere use of skilled development levies by concerned stakeholders; improvement of the attractiveness of trade skills; enabling of an integrated (skills training) approach to bridging the skills gap as well as increase

in the training of skills development facilitators, reintroduction of technical, improvement of the accuracy of NSL, improvement of the quality of Sector Skills Plans (SSPs), increment of learner remuneration as well as increase of the existing national skills levy.

**Table 2:** Factors influencing improvement of skilled workers

Factors	MIS	$\sigma X$	R
Reintroduction of the apprenticeship system	4.16	9.381	1
Truthful and sincere use of skills development levies	4.11	9.179	2
Improve attractiveness of trade skills	4.11	9.912	2
Enable an integrated (skills training) approach to bridging the skills gap	4.04	10.210	3
Increase SETA support	4.02	9.354	4
Reintroduction of national trade tests	3.98	7.616	5
Improve quality of the National Skills List (NSL)	3.91	6.964	6
Improve and increase training of skills development facilitators	3.82	8.276	7
Reintroduction of technical "N" programmes	3.80	7.810	8
Improve accuracy of NSL	3.76	8.124	9
Improve quality of Sector Skills Plans (SSPs)	3.76	8.631	9
Increase learner remuneration	3.47	6.595	10
Increase National Skills Levy	3.18	3.937	11
MIS = Mean Item Score; $\sigma X$ = Standard deviation; R = Rank			

These findings were similar to the an earlier study where reinstating training schools for artisans, improving collaboration with the private sector in resolving the skills shortages and introducing market related salaries for artisans were identified as the major factors to promoting greater relevance and responsiveness in the education and training system as well as in strengthening the employability of artisans<sup>12</sup>. Similarly, in improving the number of skilled operatives, there is a need to streamline the functions of SETA so that their primary focus will lie within translating the demand that has been established as part of the sector skills to providers and workplaces<sup>8</sup>. However, accuracy of the NSL and improving the SETA SSPs were identified as the prominent factors to increasing the number of competent construction workers<sup>28</sup>.

## CONCLUSION AND RECOMMENDATION

This study has been able to examine the critical factors that would assist in improving the number of skilled workers in the South African construction industry in the quest to enhance the effectiveness of the SDA. The essence is to increase the awareness of stakeholders in the construction industry of the need for education, development and training of workmen in the quest for better delivery of construction projects to cost, time, quality and satisfaction of clients. A synthesis of the reviewed literature together with the findings from the questionnaire survey was adopted to achieve the objective of the study. Findings revealed that the reintroduction of the apprenticeship system, the truthful and sincere use of skills development levies by concerned stakeholders, improving the attractiveness of trade skills, enabling an integrated (skills training) approach to bridging the skills gap and increasing SETA support are the major factors

that should be necessary for the improvement in the quantity and quality of skilled construction operatives.

Skilled labour shortages in South Africa, especially in the construction industry are the consequence of the interplay of several complex socio-political and economic factors. In view of the findings of this study, there is a need for CETA to implement more thorough screening processes in the selection and certification of its training providers, so as to optimise the quality of training outcomes. There is a need for the increase in the National Skills Levy, not only as a way of stimulating employer participation, but also to increase the wealth of the National Skills Fund. However, the authority concerned, that is, CETA, should regularly visit registered training sites to ensure training providers' appropriate use of skills development levies.

In the course of the study, various areas that require attention from educators, researchers as well as stakeholders concerned with skills and training related issues in the construction industry were identified. It will be of immense benefit if a construction skills improvement model can be developed for South African construction industry, especially for the small and medium enterprises. A similar study to the current one should also be undertaken with a different set of respondents, especially in other regions of the country for better application of the recommendations emanating from the studies. Further studies should also be undertaken to determine the extent to which the two economic sectors, that is, public and private, have adopted and implemented the SDA in relating to addressing the skill shortages in the construction industry.

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# RENTING IN CONVERTED GREEN BUILDINGS: EXPLORATORY STUDY ON OFFICE TENANTS VIEWS

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## PURPOSE:

**Greening the existing stock of non-green office buildings in South Africa is a significant challenge faced by the local green industry. This study evaluated the opinions of tenants of non-green office buildings in Gauteng, South Africa on renting green office space in existing office buildings.**

## ABSTRACT

### Purpose

Greening the existing stock of non-green office buildings in South Africa is a significant challenge faced by the local green industry. This study evaluated the opinions of tenants of non-green office buildings in Gauteng, South Africa on renting green office space in existing office buildings.

### Methodology

This report builds on a previous study by Hoffman & Pedregal<sup>1</sup> on the opinions and believes of Gauteng office tenants on converting existing office buildings into Green Star SA certified buildings. Data was acquired with a Likert-scale based questionnaire completed by 32 randomly selected commercial office tenants from A-rated office buildings in Sandton, Rosebank and Centurion.

### Findings

The study indicated that 81% of office tenants support knowledge about environmental sustainability but only 50% have green building strategies and only 22% are considering renting space in a converted Green Star SA certified office building soon. Small firms and recently established firms were much less supportive of green building practices.

### Limitations

A larger, more representative follow-up study is necessary to provide industry stakeholders with more authoritative findings. More specific information is required on what will persuade tenants to actively pursue green office space.

### Value

This study described the views of commercial office tenants regarding renting green office space offered in existing office buildings. Evidence was provided that supplying focussed information and education to office tenants may be an efficient way to stimulate demand for green office space

**Keywords:** Converted office space, Existing buildings, Green Building, Office tenants, South Africa.

## INTRODUCTION

During the previous decade the general levels of awareness in South Africa regarding the limitations of our natural world has increased significantly. Concepts such as ozone depletion, climate change, carbon footprint and sustainability often appear in the public domain and are discussed in the media. The built environment is one of the largest contributors to this predicament. A total of 40% of global energy use and 32% of the world's resources are linked to buildings and up to 30% of global greenhouse gas emissions originate from the built environment<sup>2,3,4</sup>. Local studies confirmed similar statistics for the South Africa construction industry<sup>5,6</sup>.

The built environment therefore has the potential to make a significant contribution towards a more sustainable, greener world. This will require new buildings to be built according to green principles, but also for the existing stock of buildings be converted to environmentally sustainable principles. To understand and stimulate the demand for green office space in existing buildings will be an important future challenge for the green industry.

### Importance of the Study

Property owners, developers and the green industry will have to be aware of the dynamics of supply and demand of green office space. The opinions of tenants regarding green office space and

of their subsequent behaviour will be a very important part of this process. This study described the views of a selection of commercial office tenants regarding renting green office space offered in existing office buildings. This information will assist property owners, developers and the green industry to effectively communicate with office tenants about green building and to stimulate demand for green office space offered by existing non-green buildings.

## REVIEW OF RELATED LITERATURE

### The International Scenario

The challenge presented to the international built environment at the end of the 20th century to address global environmental sustainability effectively, was substantial and required international coordination and organization. The World Green Building Council (WGBC) was established in 1998 with nine founding members - Australia, Brazil, Canada, India, Japan, South Korea, Mexico, Spain and the USA<sup>7</sup>.

Many WGBC members developed and launched green building rating tools to certify buildings that qualify as green buildings, suited to their local conditions. Well-known green building rating systems are the Building Research Establishment Environmental Assessment Method (BREEAM) tool launched in the United Kingdom in 1990, Leadership in Energy and Environmental Design (LEED) launched in the United States in 2000 (WGBC, 2014) and the Green Star system launched in Australia in 2003<sup>7</sup>.

### Green Building Council of South Africa (GBCSA)

The GBCSA was established in 2007 in South Africa and since then has certified more than 200 green buildings<sup>8</sup>. South Africa is still the only established member of the WGBC on the African continent with Ghana, Kenya, Mauritius, Namibia, Zambia and Nigeria as prospective members, Tanzania as an emerging member and Botswana and Zimbabwe identified as potential future members<sup>9</sup>. The GBCSA has the vision to be a leader in transforming the South African property industry to allow South Africans to work and live in healthy, efficient and productive environments<sup>10</sup>.

The South African Green Star SA rating system was launched by the GBCSA in 2008 and is based on the Australian Green Star tool, but customised for the South African landscape and context<sup>10</sup>. The large majority of initial South African green building initiatives focussed on new buildings. However new buildings only account for about 2 percentage of the total commercial building stock<sup>11</sup>. In support of the process of upgrading existing non-green buildings to green certified buildings, the GBCSA also launched the Existing Building Performance Tool (Pilot version) in 2013 which is a performance based tool. The certification is only valid for a three year period. This ensures that buildings continue to operate in a sustainable manner<sup>10</sup>.

This tool focuses on measurable performance indicators such as energy and water, management policies and plans required to achieve environmental performance, and lease agreements with building tenants. The tool caters for a broad range of existing buildings including office buildings and allows for the fair and independent benchmarking, rating and certification of environmental design initiatives for existing building stock<sup>11</sup>.

The progress of converting the existing stock of South African office buildings into certified green buildings has accelerated more recently. Of a total of 189 Green Star SA certified buildings a total of 60 existing buildings have to date been certified by the GBCSA as Green Star SA buildings, mostly through the use of the Existing Buildings Performance tool. Approximately 3 million m<sup>2</sup> of green construction area has been provided to the property

industry<sup>8</sup>. It is a very positive start to the challenge of greening the large stock of existing non-green office buildings but much work must still be done.

A recent study by Hoffman & Pedregal<sup>1</sup> evaluated office tenants of major commercial office nodes in South Africa on green building and the conversion of conventional buildings to provide green office space. A total of 59,4% of respondents agreed that green credentials are important to their firms. The majority of respondents were therefore sufficiently convinced by the merits of green building to want to be known to actively support green building. However only 34,4% of tenants already include green initiatives in their operational strategies. Action seems to lag behind beliefs.

### International developments on refitting of existing office buildings

The importance of the green retrofitting of existing buildings is widely recognised internationally. Retrofitting refers to the altering and upgrading an existing building into a green building instead of building a new green building<sup>12</sup>. A survey by Fitch & Laquidara-Carr found that more than 50% of industry stakeholders support retrofitting. Countries with volatile energy prices such as South Africa also stand to benefit more from savings on operating cost<sup>13</sup>. Fitch & Laquidara-Carr support green building through retrofitting of existing buildings in countries with older building stock, such as in the United Kingdom and Germany<sup>13</sup>. A South African study<sup>14</sup> also found that retrofitting can result in significant energy savings.

An integrated design team and development process is essential if retrofitted projects want to reduce energy consumption by 30% or more<sup>15</sup>. Stakeholder opinions on retrofitting are important and are widely acknowledged. In a 2013 United States study<sup>16</sup> confirmed that different levels of industry stakeholders all agreed on the necessity to refit existing buildings and that the main sustainability focus areas are to save energy, reduce costs and adhere to government policy.

However to convert the opinions into reality is a significant challenge. A 2012 New Zealand study by Bond and Perrett<sup>17</sup> confirmed low client demand is a primary barrier to green building growth. Out of a list of ten possible barriers to green building, lack of client demand was identified as the most important barrier. Other significant barriers were high cost of green building, lack of government incentives and unwillingness to commit to extra costs. The study by Hoffman and Pedregal<sup>1</sup> confirmed that the lack of demand is also applicable in South Africa.

The sustainability industry has also experienced some opposition. Leadership in Energy and Environmental Design (LEED) in the United States is increasingly criticised for only rewarding incremental solutions towards sustainability and the retrofitting of existing buildings. A study<sup>18</sup> in a Colorado study proposed a more in-depth green design approach informed by local geographic conditions and natural climate systems.

### Non-alignment of stakeholder interest

Many stakeholders in the construction and property industry consider adaptability of existing building stock a desirable design characteristic. The alignment of the interest of different stakeholder groups will support adaptability<sup>19</sup>. Developers will prefer adaptable buildings as they will attract higher prices from investors, who in turn will be able to more easily lease such buildings to tenants and end-users.

The non-alignment of stakeholders' interests can also be linked with green retrofitting of buildings. The misalignment of incentives of developers, investors and tenants known as the

'vicious circle of blame' often prevents investment in green retrofitting of buildings<sup>20</sup>. The 'vicious circle of blame' concept introduced by David Cadman in 2000, suggested that the lack of commitment to adopt healthier and/or more resource-efficient real estate practices originated in the sequentially blaming of each other by investors, tenants, contractors and developers. Property owners will typically only decide to energy retrofit existing buildings once the demand for such strategy will ensure an acceptable rate of return on investment<sup>21</sup>.

Developers' financial dilemma has always been one of risk and return. Research however has pointed out that energy retrofitting of existing building stock may reduce investors' risk. Tenant demand combined with increasing awareness of climate change will readily attract and retain tenants for sustainable buildings and thus reduce the development risk<sup>22</sup>.

### South African developments

Real Estate Investment Trusts (REIT's) were introduced in 2013 in South Africa. Morgan Stanley Capital International's (MSCI) Environmental Social Governance (ESG) research concluded that the top drivers of green building include a regulatory environment, instability in fossil energy prices and stakeholder awareness. In combination these three concepts creates a 'green wave' in property investment. Andrew König of Redefine, which is the 2nd largest local REIT company, noted in 2014 that green building in South Africa has largely focussed on new construction. Most investors refurbish their existing buildings incrementally toward more sustainable buildings (without Green Star SA certification) as most tenants can't afford to pay the green premium on new buildings<sup>23</sup>.

### THE APPROACH OF THIS STUDY

This study supports the argument that the rate of the green retrofitting of South African office building stock can be accelerated by increasing the tenant demand for green office space. If more office tenants renting space in non-green buildings express a demand for green office space, developers will respond to this need. The study argument therefore accepts and supports some of the underlying principles of the 'circle of blame' concept referred to above.

For tenants to have a greater demand for green office space, they must be sufficiently informed about the benefits offered by green buildings practises and of the need of their own participation in the process. If renting office space in a green building makes business sense to office tenants, the study assumes that demand from tenants for green office space will increase.

Once the growing demand for green office space becomes known in the market, developers and building owners will in response act to supply the market with more green office space. If this new demand from tenants for green office space is significant, new green buildings will only be able to satisfy a limited portion of this new demand. The remainder of the demand will have to be supplied by the conversion of existing office stock to green buildings.

Organisations such as the GBCSA and the South African Property Owners Association (SAPOA) are capable of informing and educating tenants in this regard. However to effectively communicate with and inform tenants on green building, the current status quo of tenants views must be known. This study describes the opinions of office tenants regarding this subject and will provide green building stakeholders with some perspective on the challenge of this conversion process and how to approach it with more certainty and better focus.

### METHODOLOGY

This report builds on the findings of a previous study by Hoffman & Pedregal' on the opinions and beliefs of Gauteng based office tenants on converting existing office buildings into Green Star SA certified buildings. The study interviewed 32 respondents from disciplines of :

Accounting (9,4%),  
Law (6,3%),  
Engineering (6,3%),  
IT (9,4%),  
Marketing (6,3%),  
Consultancy (12,5%),  
Medicine (21,9%)  
and others (28,1%).

The respondents of the study can therefore be considered to be a reasonably varied group of firms representing many different industries of the South African economy. The study also indicated that the large majority of office tenants are small or relatively small firms with more than 87% of firms having less than 40 employees and with no firm with more than 80 employees.

A 5 point Likert scale (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) was used to describe office tenants' views on green building aspects and about converting existing office buildings into Green Star SA certified buildings.

In aid of basic statistical analysis, the data was awarded numerical values:

Strongly Disagree = 1,  
Disagree = 2,  
Neutral = 3,  
Agree =4 and  
Strongly Agree =5.

Average scores were calculated for the different statements and questions of the questionnaire. An average score of less than 1,80 was considered a significantly negative opinion.

An average score of 1,81 – 2,60 was considered as negative, an average score of 2,61 – 3,40 was considered as neutral, an average score of 3,41 – 4,20 was considered positive and an average score of more than 4,20 was considered as significantly positive.

### DATA ANALYSIS

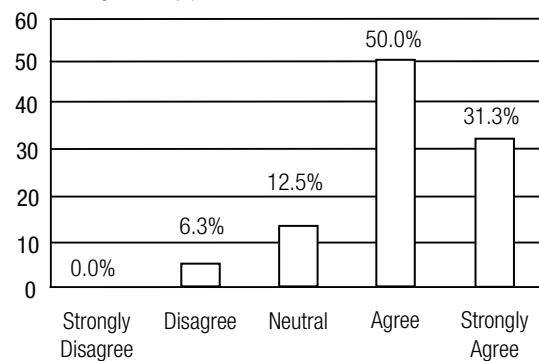
The study describes two basic aspects of the opinions of office tenants regarding the conversion of existing office buildings into green buildings that will be very important for creating future demand for green building space:

- 1 Do office tenants know enough about Green building to understand that their contribution and participation in this process by renting space in a Green building will support environmental sustainability?
- 2 If they do, have their conviction resulted in action or business strategy to decide to rent space in a Green building in the near future?

#### Renting space in a Converted Green Star SA office building

This study first considered if office tenants were informed enough about Green building to understand that their contribution and participation in this process by renting space in a Green building will support environmental sustainability.

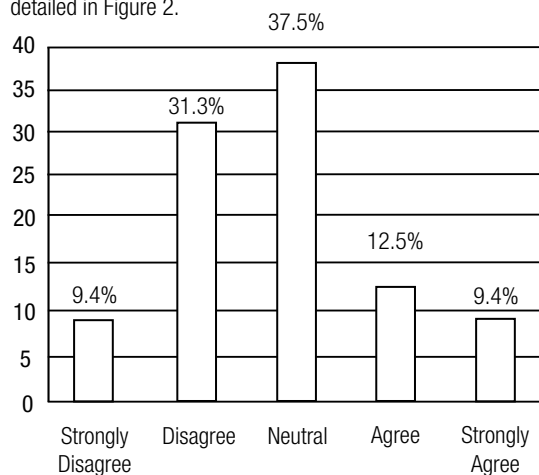
A total of 81,3% of the respondents agreed with the statement that renting space in a Green Star SA certified office building will support environmental sustainability. Only 6,3% disagreed with a further 12,5% being neutral 3 (see Figure 1). The average score was 4,06 out of 5,00 which classify the opinion on this issue as significantly positive.



**Figure 1:** Renting in a converted Green Star building supports environmental sustainability

When asked to respond to the statement:

*"As tenants you are considering moving into a converted Green Star SA certified office building once your current lease expires"* only 21,9% of the respondents agreed. 37,5% was neutral while 40,7% replied negatively. The average score was 2,81 out of 5,00 which classify the opinion as neutral, but close to the negative edge of the stated range (2,61-3,40). The data is detailed in Figure 2.



**Figure 2:** Considering to rent in a converted Green Star building

This finding confirmed that when evaluated on their actions in support of green building the respondents' displayed a 44,5% less positive response ( $4,06 / 2,81 - 1 = 44,5\%$ ) than when tested on their insight into green building (21,9% positive vs. 81,3%). A substantial part of the respondents was still negative or undecided about the decision to rent space in a converted Green Star building in the near future.

**Table 1:** Renting in a converted Green Star SA office building (Q9 & Q10)

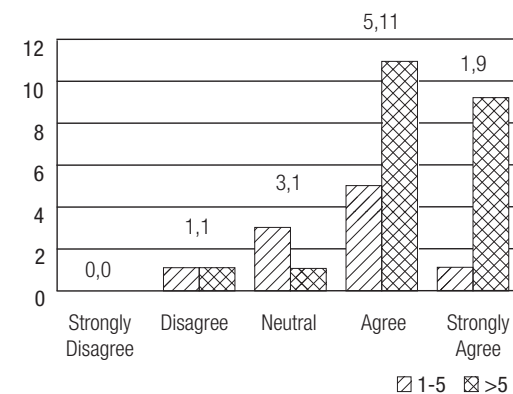
	Mean	Standard Deviation	Variance	Skewness
Intend to rent space in a converted green building	2,81	1,06	1.13	0,33
Green buildings support environmental sustainability	4,06	0,83	0.68	-0,82

The two findings merit further analysis to enable this study to describe the opinions of respondents in more detail.

#### Renting in a Green Star building support environmental sustainability

According to Figure 1 only 18,8% of respondents was neutral or did not agree that renting in a green building will support environmental sustainability. The professional discipline of each responding firm indicated that medical firms and marketing firms were much more negative regarding this aspect with a total of 50% of firms being neutral or not agreeing.

The age of responding firms however revealed significant additional insight into this aspect. A total of 40% of firms not older than 5 years was neutral or did not agree that renting in a green building will support environmental sustainability. This response is 213% as high as the average group response of 18,8% ( $40\% \div 18,8\% = 212,8\%$ ). A total of 91% of firms older than 5 years agreed with the statement which is 484% higher than the average group response ( $91\% \div 18,8\% = 484,0\%$ ). Figure 3 details the relationship between firm age and opinion that renting in a converted green building will contribute to environmental sustainability.



**Figure 3:** Firm age compared against opinion on renting in a converted Green Star building to support environmental sustainability

In order to further describe the above matter the respondents' considered views on whether renting in a green building will support environmental sustainability were compared against their responses on how important their firms regard having green credentials. Figure 4 presents a detail of the responses from respondents on these two aspects.

The linear relationship between the independent variable Y and the dependent variable X was explored by simple linear regression analysis to calculate the best fit straight-line (see Figure 4 line AB) to describe the data<sup>24</sup>:

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \quad (4.1)$$

where

$\beta_0$  = Y intercept for the population

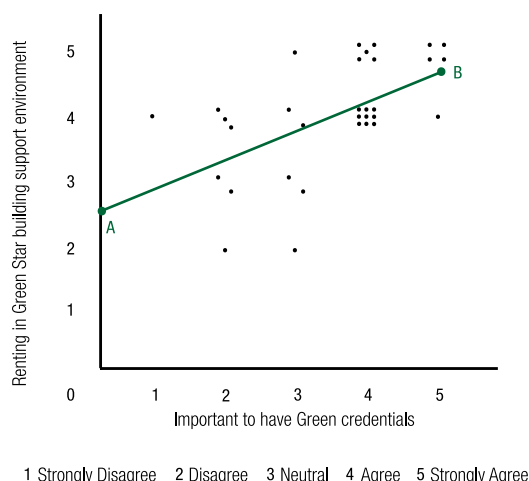
$\beta_1$  = slope for the population

$\epsilon_i$  = random error in Y for observation  $x_i$

The correlation between the independent variable Y and the dependent variable X was described with the Pearson product moment correlation<sup>25</sup> which suited the ordinal nature of the data<sup>26</sup>.

The Y intersection of the regression line was calculated at 2,51 with the slope being 0,44. The random error in Y for observation  $x_i$  of 0,70 indicated that only 30% of the measure of variability around the regression line could be explained by the regression

line. The Pearson correlation ( $r$ ) of 0,57 indicated a fair amount of positive correlation between the independent and dependent variables of the data. However the coefficient of determination ( $r^2$ ) indicated that only 32,5% of the variation of the dependent variable Y can be explained by the independent variable X.

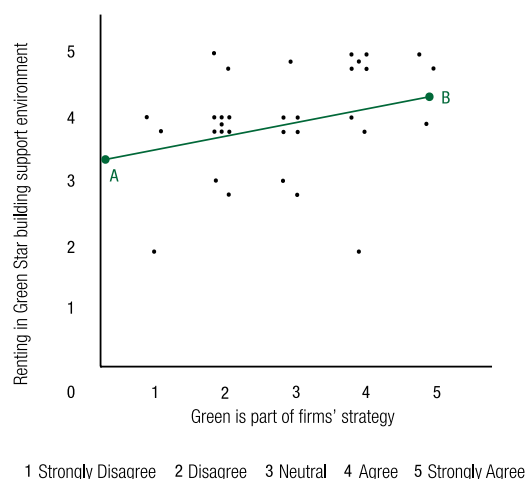


**Figure 4:** Correlation between renting in a Green Star building to support sustainability and the importance of having green credentials.

A total of 50% of respondents had perfectly correlated responses on the above two aspects. Of the remaining 50% of respondents, 87,5% (14 out of 16) displayed a more positive response to knowledge about green building than to taking a decision on green building (average score of 3,75 vs. 2,50 out of 5,00).

All respondents who agreed on the importance of having green credentials also agree that green renting supports environmental sustainability. A total of 73% of respondents who agreed that green renting supports environmental sustainability, also agreed that green credentials are important. The 19% of respondents who agreed that green renting supports environmental sustainability but did not agree that green credentials are important are all small firms with less than 20 employees.

To conclude this part of the study a similar correlation approach was applied to evaluate the respondents' views on renting in a green building to support environmental sustainability against their responses to have green initiatives as part of your firms' operational strategies (see Figure 5).



**Figure 5:** Correlation between renting in a Green Star building to support sustainability and having green initiatives as part of company strategy

Figure 5 reveals a much weaker relationship between the two sets of data compared to the relationship detailed in Figure 4. It must however be remembered that Figure 5 evaluates the relationship between an opinion on green building concepts versus an action in support of green building.

The Y intersection of the regression line was calculated at 3,30 with a slope of 0,26. The random error in Y for observation  $x_i$  of 0,79 indicated that only 21% of the measure of variability around the regression line could be explained by the regression line. The Pearson correlation ( $r$ ) of 0,37 indicated a weak positive correlation between the independent and dependent variables of the data. The coefficient of determination ( $r^2$ ) therefore confirmed that only 13,7% of the variation of the dependent variable Y can be explained by the independent variable X.

Only 18,8% of respondents revealed a perfectly corresponding relationship in their responses to both statements. Of the remaining 81,2% of respondents, 92,3% (24 out of 26) displayed a more positive response on knowledge about green building compared to take a decision on green building (average score of 4,17 vs. 2,50 out of 5,00). Only 38,5% of respondents who agreed that renting in a green building support environmental sustainability have already incorporated green initiatives in their firms' strategies. A total of 50% of all respondents agree with the concept that renting in a green building support environmental sustainability but they do not yet include green initiatives as part of their firms' strategies. Only 6,3% of firms were more positive on having green strategies than they were about the concept of supporting sustainability through renting in a green building.

#### Tenants considering to move into a converted Green Star SA certified office building

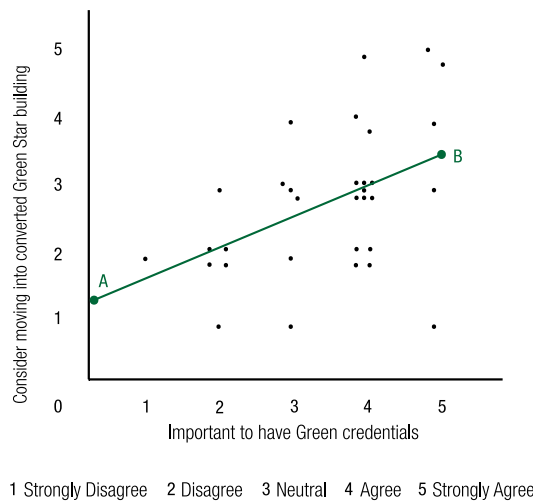
According to Figure 2 as many as 40,7% of respondents disagreed that they are considering to move into a converted green building. Only 21,9% of the respondents replied with a positive answer while 37,5% was neutral. No accounting, engineering, law or marketing firm replied positively to the statement. Firms with no more than 20 employees had an average score of 2,75 while firms with more than 20 employees had an average score of 3,25, which lend some support to the previous indication that smaller firms are less positive about supporting green buildings. Firm age did not add any significant further insight to the analysis.

Respondents decision on renting in green buildings in the near future were then compared against their responses on how important their firms regard having green credentials (see Figure 6). Similar to the data from Figure 5, this analysis also evaluates the correlation between an opinion on green building concepts versus an action in support of green building. Figure 6 revealed a relatively weak positive correlation between the independent and dependent variables. It must again be remembered that Figure 6 describes the relationship between a decision on green building versus an action in support of green building.

The Y intersection of the regression line was calculated at 1,16 with a slope of 0,47. The random error in Y for observation  $x_i$  of 0,98 indicated that only 2% of the measure of variability around the regression line could be explained by the regression line. The Pearson correlation ( $r$ ) of 0,47 indicated a weak positive correlation between the independent and dependent variables of the data. The coefficient of determination ( $r^2$ ) therefore confirmed that only 22,1% of the variation of the dependent variable Y can be explained by the independent variable X.

A total of 34% of respondents showed an exact correlation in their opinions regarding the two mentioned aspects. Of the remaining 68% of respondents, 81,0% (17 out of 21) were more

positive about green credentials than renting in a green building (average score of 3,94 vs. 2,41 out of 5,00). Only 31,6% of respondents who agreed that green credentials is important are considering to rent in a converted green building in future. A total of 59,4% of all respondents agree with the importance of green credentials for their firms but they do not yet consider renting in a green office building.



**Figure 6:** Relationship between moving into a Green Star building and having green credentials

The data also provided some support of the previous findings on the more negative opinions held by smaller firms. Of the respondents who were negative about having green credentials 86% were also negative about renting in green buildings. All of them were small firms with less than 20 employees.

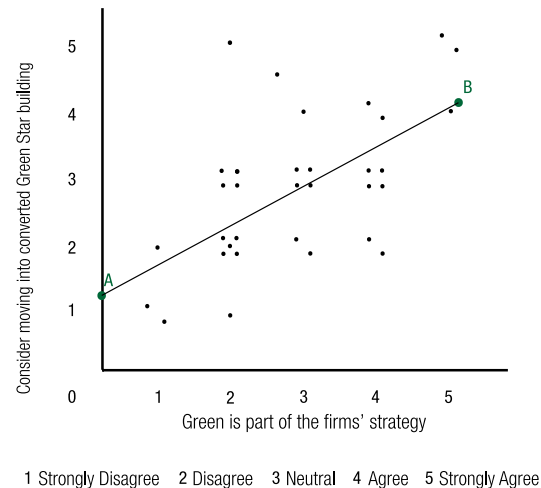
A total of 68,4% of respondents who were positive on having green credentials are still not positively considering to rent space in a green building soon. This finding strongly agreed with previous findings and supports the argument that even though managers of firms are supporting green building concepts, they may need more information before converting their opinions into action.

In conclusion the above relationship approach was applied to evaluate the respondents' views on renting in a converted green building in the near future against their responses to including green initiatives in firms' operational strategies'. Figure 7 presents a detail of the responses on these two statements.

Figure 7 revealed a relatively weak positive correlation between the independent and dependent variables. The Y intersection of the regression line was calculated at 1,15 with a slope of 0,57. The random error in Y for observation  $x_i$  of 0,87 indicated that only 13% of the measure of variability around the regression line could be explained by the regression line. The Pearson correlation ( $r$ ) of 0,62 indicated some positive correlation between the independent and dependent variables of the data. The coefficient of determination ( $r^2$ ) therefore confirmed that only 38,4% of the variation of the dependent variable Y can be explained by the independent variable X.

A total of 47% of respondents showed an exact correlation in their responses while 44% more had responses that were closely correlated. Only 9% of respondents had non-aligned opinions on these to statements. The above findings support the proposition made earlier that to compare respondents' opinions on two green building concepts will most likely reveal high degree of correlation. The same logic therefore predicts that to compare two different actions of respondents in support of green buildings is likely to reveal significant correlation, even

though the scores for the opinions on actions in support of green buildings may be lower (more negative) than the scores on opinions about green building.



**Figure 7:** Relationship between moving into a Green Star building and having green initiatives part of company strategy

## FINDINGS

This study re-visited the data from the study by Hoffman & Pedregal<sup>1</sup>, and further explored the data to search for possible relationships or linkages between the results of specific questions. The study also highlighted important findings related to strategic decision making aspects of the respondents participating in the study.

A total of 81,3% of respondents agreed that renting space in a green building will support environmental sustainability achieving a significantly positive score of 4,06 out of 5,00 (Figure 1). However only 21,9% of respondents' firms were considering to rent space in a green building (Figure 2). The consequential demand for green office space can be expected to be relatively weak. This finding is of specific importance to the GBCSA and their recent initiatives to expand green building to the stock of existing non-green buildings in South Africa<sup>10</sup>. Any potentially significant challenges to the advancement of green building needs to be noted, described and addressed.

The above finding identified such an important problem area that probably are hampering and obstructing the advancement of green building in South Africa. To be able to address the problem area it is important to explain and describe the nature of the problem and the probable causes of it in as much detail as possible. For this reason the results of the above findings were analysed in more detail.

The study found that firms not older than 5 years were 213% more inclined to disagree that renting in a green building supports environmental sustainability than older firms (Figure 8). A possible explanation for this finding may be that younger firms are still trying to establish themselves in the market and they may therefore often be under significant financial pressure. Young firms may also be hampered by capacity constraints and may therefore not have the 'luxury' to also focus on secondary issues such as environmental sustainability nor be able to afford the additional expenses of renting in a more expensive green building even though the payback period may only be say 5-8 years.

The study also found that 84% of respondents' views on renting in green buildings to support sustainability agree to a significantly extent with their views on the importance of green credentials for their firms. This finding is in agreement with

the findings of international studies<sup>13, 16</sup> that the retrofitting of existing non-green buildings is considered to be an important part of the green building initiative.

The study however also indicated that 26,9% of respondents who agreed that renting in green buildings will support environmental sustainability, did not agree that green credentials are important to their firms (Figure 4). These firms that did not support green credentials are all small firms with not more than 20 employees. The finding that a substantial portion of tenants is informed about green building, but is still not embracing green building principals is very important to property industry stakeholders concerned about stimulate support for green building amongst tenants.

The high degree of agreement of views confirmed by the above analysis may be explained by the fact that the two aspects considered refer only to what respondents think about green building and not what they are actually doing about it. In general for managers of firms to have opinions on something does not in itself cost firms money, does not require capacity and does not have consequences. However to actually act on such opinions such as accepting a strategy or making a renting decision will have consequences.

People in general and more specifically managers and decision makers of firms need information or education to recognize and accept a new concept or change their opinion on something. However for managers to take action on new opinions will probably require a higher order of understanding and conviction, because action will have consequences and therefore contain risks. This argument therefore expects that when evaluating an opinion on green building against an action on green building, the correlation may well be much lower.

The findings detailed in Figure 5 confirmed the above argument as only 38,5% of respondents who agree that renting in green buildings support sustainability have already incorporated green initiatives in their firms' strategies. Figure 5 also confirmed that 50% of respondents who agreed that renting in green buildings will support environmental sustainability, did not have green initiatives as part of their firms' strategies. This finding supported the previous finding that managers of firms renting space in office buildings are sufficiently informed on green building concepts to have definite and mainly supportive opinions thereon. However conclusive action by a substantial majority of firms in support of green building is still lacking. This finding also supports the finding of the New Zealand study<sup>17</sup> and the earlier proposal of Cadman<sup>21</sup> that weak demand for green office space is a significant green building challenge.

Analysis of the data in Figure 2 on firms that are considering to rent space in converted green buildings, revealed that firms with no more than 20 employees scored on average 2,75 out of 5,00 while firms with more than 20 employees scored 3,25. Table 4 indicates that 18,8% of firms are negative about both aspects and all of them are small firms. These findings support previous findings that smaller firms have generally more negative views on green building.

Figure 7 indicates that of all firms not considering to rent in converted green buildings soon, 69,2% were also negative about including green principles in their firms' strategies. A total of 78% of these firms were small firms. As a regulatory environment to support green building does not yet exist in South Africa, very little financial incentives exist to assist young firms with new green building strategies. MSCI research<sup>23</sup> also regards a supporting regulatory environment as essential for green building progress.

## CONCLUSION

A significantly more positive opinion was expressed by office tenants regarding renting space in a green building in support environmental sustainability compared to their view on actually deciding to rent space in a converted green building in future. Their knowledge about green building has not yet resulted into a significant increase in demand for converted green office space.

The study identified that a substantial portion of office tenants has been educated and convinced about the benefits of green building but they have not yet become active supporters of sustainability by applying green building principles in the running of their firms. Smaller and younger office tenant firms indicated a much higher likelihood to display such behaviour.

This finding indicates that office tenants may need more information to convince them of the benefits of green building. The finding may also suggest that tenants need more time to get used to the relatively new concept of green building before deciding to use the benefits offered by green building as part of their future business strategy.

Industry stakeholders such as the GBCSA, SAPOA, professional associations and councils as well as academic institutions may benefit from taking note of the above findings. The rate of converting the current stock of South African office buildings to Green Star SA rated buildings must be accelerated. This study provided evidence that more specifically focussed information and education of office tenants may be a very efficient way to address this challenge.

## RECOMMENDATIONS

The following recommendations are suggested for future research to further explore the findings made by this study:

- A larger, more representative study should be done to provide industry stakeholders with more authoritative findings;
- The findings that smaller and younger firms are more negative about supporting green buildings should be studied in more detail;
- Further research should be done to establish what information is required by managers of firms to persuade them to put their positive opinions on green building into physical actions and strategies;
- Research should be done to describe the effect of the new GBCSA Existing Building Performance Tool on the rate of conversion of existing buildings into Green Star SA certified buildings; and
- Research should be done on optimal ways for professional associations, academic institutions and the GBCSA to inform and educate stakeholders on sustainability and the business case for green building.

## ACKNOWLEDGEMENT

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How are the objectives achieved? Include the main method(s) used for the research. What is the approach to the topic and what is the theoretical or subject scope of the paper?

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What was found in the course of the work? This will refer to analysis, discussion, or results.

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A short acknowledgement section of one paragraph is permissible at the end of the text.

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Table 1 : Component of expenditure

Component	Expenditure (%)
Cleaning Works	40.9
Mechanical Services	37.7
Building Works	13.6
Civil Works	7.8
<b>Total</b>	<b>100</b>

Source<sup>1</sup>

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[2] Stone, P.A. (1980) *Building Design Evaluation: Costs-in-use*. E & FN Spon, London.

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