

Empirical Study on the Differences in Stakeholder Perceptions on Locations of Filling Stations in Kitwe, Zambia

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Abstract

Locations of filling stations in every economy, whether a small town, city or mega city, are perceived by the citizenry that, they are placed at strategic and convenient places to enable users access their service at the time of need. What the public is ignorant about are the factors, i.e., planning standards and principles that are used to determine the best locations. This study focused on establishing the perceptions of residents living within the proximity of filling stations, the motorists who purchase the products, the entrepreneurs who own the filling stations and business owners who locate their businesses near the filling stations. The assumption was that, the four stakeholders will have different perceptions based on their interest. The proposition of this study was that, filling stations must be located taking into consideration, the environmental sustainability concerns enshrined in the town and country planning standards and principles to reduce the risks to environment and the eco-system. Similarly, environmental impact assessment criteria must be fulfilled before an approval is given to commence the project. The main assumption underlying the proposition was that, with the stakeholders having little knowledge on the location criteria, they will have different perceptions on the location of filling stations. The research was a qualitative one that utilized descriptive cross-sectional survey. The likert scale qualitative structured questionnaire was used to generate quantitative data to test the hypotheses. The t-test statistic was used to test the hypotheses. The main finding was that, the perceptions amongst the stakeholders were different.

Keywords: Filling Stations, Different Stakeholder Perceptions, Locations, Kitwe, Zambia

1. Introduction

Locating filling stations in urban areas must be guided by planning standards and principles whilst taken into serious consideration factors that will facilitate and promote sustainable environmental quality management and ecological balance. What most entrepreneurs or filling station owners do not know is that, the service station is tantamount to serious environmental and ecological pollution which affects both the underground water system. Numerous studies have been done in the developed economies to ascertain the extent of pollution of the soil and water bodies of petrol filling stations especially after their closures (Hilpert, et al., 2015; Industrial Economics Incorporated, 2015; Terres et al., 2010; Borowiec, et al., 2008; Dowd, 1984). Similarly, a significant number of researches have been conducted in the modelling of competitive price differentials and locations of petrol filling stations (Wang et al., 2016; Haucap, et al., 2015; Semih & Seyhan, 2011; Clemenz & Gugler, 2006; Chan et al., 2004; Light, 2004). In recent times, attention seems to be focused on site selection criteria for filling station locations as a result of the risks associated with its operations (Wang et al., 2016; Njoku & Alagbe, 2015; Aslani & Alesheikh, 2011; Semih & Seyhan, 2011). This study made the effort to establish the differential perceptions of the public specifically focusing on residents who live within the 100 metre radius of the filling station, motorists who are serviced by the stations, owners of the stations and business owners who locate their businesses in close proximity to the filling stations. The approach for this study was based on the perceived risks and dangers associated with filling stations. The questions that seem to guide the research were: *“Do the four identified stakeholders know the dangers and risks associated with locating their businesses and residential properties near the filling stations?” Is it possible that the perceptions of the four stakeholders will be similar or there is likelihood that there will be some differences?*

1.1. Definition of Filling Station

Filling station is synonymously characterized by other names in different countries of the world. For instance, in Australia the facility is called service station; in Canada, it is referred to as garage, fueling station or gas bar; in some English speaking Commonwealth countries, it is also referred to as petrol station or petrol pump; in India, it is known as petrol bunk; in Japan, it is referred to as gasoline; in Nigeria, it is also referred to as filling station, petrol station, gas station or petroleum outlet (Ayodele, 2011); in United Kingdom and South Africa, it is called garage and in USA it is known as gas station. Hanekom (2001), Genovese (2004) and Spencer (2004) are all of the view that, no matter the filling station, it could be any petroleum facility, service station, public garage, highway filling station, petrol port, traffic station, distribution station or fuel depot that sells fuel and lubricants for motor (Nieminen, 2005). It is a very important service facility because of mankind's mobility within his or her spatial environs where he or she engages in transactions, i.e., commerce, agriculture, manufacturing, and social networking.

2. The Problem

Mshelia, Abdullahi and Dawha (2015, p.1) indicated that considering the high risks and dangers associated with petroleum products as highly inflammable, its exploration, transportation, offloading, storing and sale points facilities should not be taken for granted. In view of the authors' observation in their study, location of filling stations in urban areas especially within developing countries have been subjected to compromise on planning and environmental standards (Taylor, Sichinsambwe & Chansa, 2016). It has been discovered that filling stations are located close to residential areas and in some cases, close to commercial and industrial activities (Mshelia, Abdullahi & Dawha 2015, p.1). It is perceived by concerned stakeholders that the location of filling stations is done at the discretion of choices made by potential entrepreneurs who engage in the distribution of petroleum products such as petrol, diesel, kerosene and engine oil etc. An observation that seems to draw the attention of most residents including motorists of the City of Kitwe is the indiscriminate location of filling stations. It is believed that the role of the Town Planning Department of the Kitwe City Council, The Energy Regulation Board, the Zambia Bureau of Standards and the Zambia Environmental Management Agency (ZEMA) are to coordinate their efforts to ensure that filling stations are located in accordance with the law and planning standards hence, regulating the indiscriminate proliferation. It is important to state that, location of filling stations in Zambia shall be approved by the Energy Regulation Board in accordance with the provisions of the Energy Regulation Act, Cap 436 of the Laws of Zambia (Zambia Bureau of Standards, 2015). The City of Kitwe has 28 filling stations with 18 of them being managed by Puma, Total, Kobil, Petroda and Mount Meru. Their spatial distribution pattern in the City of Kitwe seems not to be guided by any law or regulation and standards. For instance, some of the filling stations are located in residential areas whilst others are located very close to areas of industrial activities without strict adherence to planning standards. This is a commonplace feature in most urban areas of Zambia in as far as filling stations are concerned.

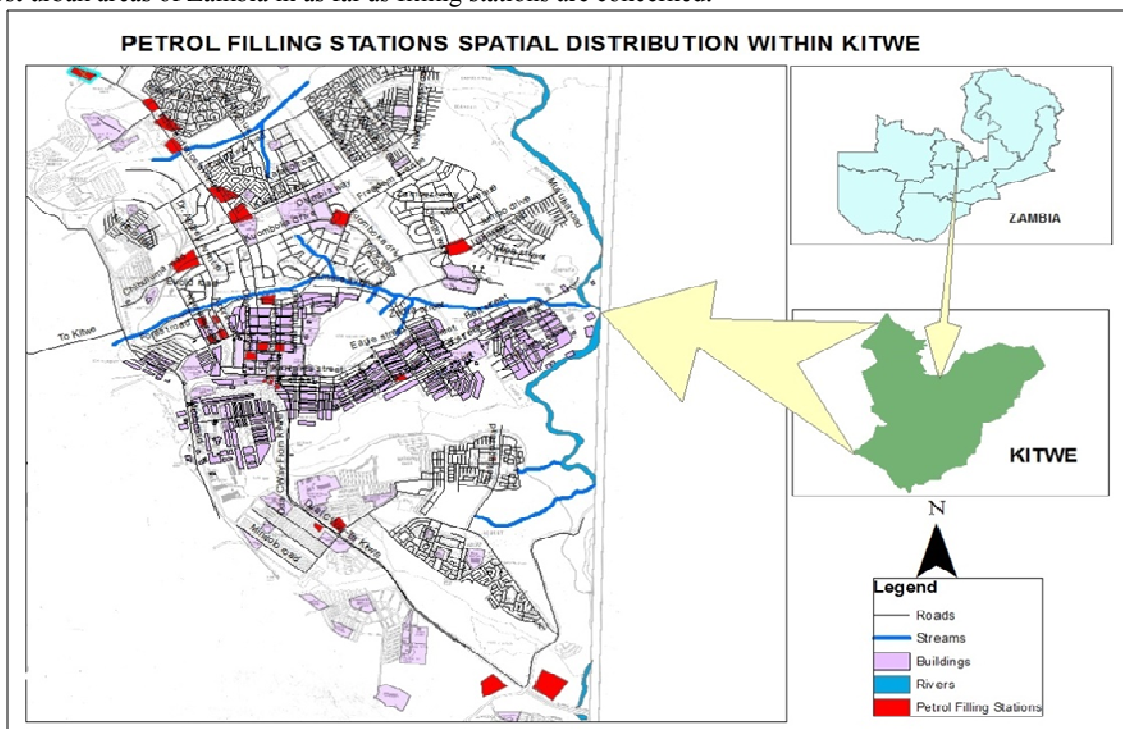


Figure 1: The Spatial Location of Filling Stations in the City of Kitwe

3. Study Area

Kitwe is a mining city which covers an area of 777 square kilometers and has an estimated population of 468,682. The City of Kitwe lies between Latitude 12° and 13° south and Longitude 28° and 29° east. The city sits on a fairly flat land with an altitude of 1,295m above sea level. The city boasts of the centrality of its location in the Copperbelt Province of Zambia, and is bordered by Kalulushi, Mufulira, Luanshya, and Lufwanyama Districts and the city of Ndola (www.kcc.gov.zm). It is called the "hub of the Copperbelt" due to its centrality. The City has a well-developed service industry and is a centre of education and culture. Due to its high rate of urbanization, as a result of the mining activities and educational institutions, the city's population is expanding rapidly whilst there is also pressure on its land for residential as well as service facilities development. Some of the service facilities include schools, health centres, shopping malls and filling stations. Interestingly, due to the increase in car ownership rate in the city of Kitwe in the last decade, there been increase in the number of petrol

filling stations. Unofficial estimates place Kitwe's residential population at 700,000, while a transient population from the surrounding towns and agricultural hinterland push the daytime population past 1.2 million. It is envisaged that the population of Kitwe will double within the next decade, due to natural growth and the city's growing importance as a centre of trade and mining activities (UN-HABITAT, 2009, p.9).

4. Literature Review

Literature on location choices of petrol filling stations has not been extensively documented. However, what has been documented significantly is the modelling of locations vis-a-vis price competition (Wang et al., 2016; Semih & Seyhan, 2011; Terres, et al., 2010; Hamid et al., 2009; Chan et al., 2004). One significant case study is the research published by Chan et al (2004, p.1) who proposed a structural model to explain both the geographic locations of gasoline retailers in Singapore. The premise underlying the development of the model was that, the Singapore government, *perceived as a social welfare planner*, determines where to locate gasoline stations in the city. Another case of interesting significance is that of location of petrol filling stations in a continuous urban growth experienced by Spain in recent years that has resulted in many petrol stations being built within urban areas surrounded by buildings (Terres et al., 2010, p.2754). Terres et al. reported that, the situation has led to controversy between the citizens whose houses are close to the petrol stations and the authorities responsible for land management. In another fascinating revelation by Wang et al. (2016) on their research on *Multi-criteria approach for the optimal location of gasoline stations being transformed as self-service in Taiwan* emphasized that, location selection for the fuel stations is characterized by constraints on investment facilities and by criteria that involves a series of social utilities. Contrary, Semih and Seyhan (2011) focused their study on identifying the best gas station site. Besides the modelling research processes being undertaken by some researchers, it appears of late interest on filling station locations have shifted and focused more on site suitability or potentiality using Geographic Information System (GIS) particularly applying Analytic Hierarchy Processes (AHP) (Njoku & Alagbe, 2015; Mohammed et al., 2014; Khahro, et al., 2013; Aslani & Alesheikh, 2011; Semih & Seyhan, 2011; Hamid et al., 2009).

A study by Hamid et al. (2009) on site potentiality for petrol station business based on traffic volume counts using a regression and Geographic Information System (GIS) based spatial system stressed that, site potentiality is an important factor that influences business success of a petrol station which relies on customer visits. On this note, Kearny (1998) disclosed that, it was empirically found in the United States of America that site location was the primary factor for drivers to choose a petrol station (see also Hamid et al., 2009, p.11).

Another study conducted in Ipoh, Perak, Malaysia, by Khahro, et al (2013), geospatial data collected from mapping and surveying was used in analysing the viable land parcels for installing new petrol filling stations. However, the standards used in practice for the site selection for petrol filling station were collected from City Planning Department, Ipoh. Furthermore, Analytic Hierarchy Process (AHP) was used as a Multi-Criteria Decision Making (MCDM) technique to Aid in the location decision choices. Expert Choice (EC) was used to analyse the qualitative results. At the end, to achieve the main objective of the research, the spatial data was used to identify the suitable land parcels for installing new petrol filling stations using GIS. One significant revelation from this study was that the responses from the public were analyzed to generate the land suitability map for petrol filling stations location and to validate the final land suitability map for petrol filling station, the overlay technique was adopted. The data layer of existing petrol filling stations was generated by using the coordinates. The coordinates were collected from the online available source provided by the Malaysian Geospatial Data Infrastructure. The coordinates were validated by using the hand Global Positioning System (GPS) (ibid).

Using the Geographic Information System (GIS), Mohammed et al. (2014) conducted a study in Kano Metropolitan Area in northern Nigeria to establish the compliance of Petrol filling station entrepreneurs to the Physical Planning Standards set by the Department of Petroleum Resources (DPR) (2007). The results produced some unique and significant revelation on the non-compliance of some of the petrol filling stations to the standards. Similar results were reported by Njoku and Alagbe (2015). Applying Geographic Information System (GIS) approach in site suitability assessment of petrol filling stations in Oyo Town in Oyo State in Nigeria, Njoku and Alagbe concluded that, despite the local and national standards, petrol filling stations are not suitably sited whilst in most cases the locations contravene planning standards. To that effect, the substandard requirements compromised by Local Planning Authorities increase the threats on the health and safety of users and residents in the vicinity of the petrol filling stations. Interestingly, another significant study done by Olapeju (2017) assessing the location and spatial distribution of petrol filling stations in Ilaro in Ogun State in Nigeria, reported that the locational pattern of petrol filling stations tends to cluster. This presumes that standards and principles were violated, suggesting that the local authority and the planning institutions do not seriously adhere to the regulations, standards and principles guiding town planning and development mechanisms.

From a study carried out in Maiduguri and Jere, Borno State, Nigeria, Mshelia, Abdullahi and Dawha (2015) discovered that, the workers in the petrol stations and the residents living nearby the petrol stations had in one time or the other suffered various health effects as a result of working in petrol stations or living close to the

facility. The results showed that, respiratory problems (diseases) to have the highest percent with 38.05%. This by implication means, it was the most prevalent health problems affecting both the workers and some of the residents as a result of the inhalation of fuel contaminated air. However, skin and sight problems alongside other health complications were also issues of concern. If the situations continue thereafter, such could lead to narcotics effects with symptoms including headache, nausea, dizziness and mental confusion (Mshelia, Abdullahi & Dawha, 2015, p.7). Furthermore, the study highlighted that, 74% of the sampled petrol stations did not adhere to the 400 meters distance between them as required by DPR. From the result obtained, only 26% were located in conformity with the standards and guidelines.

In another empirical study done by Iman, Ismail and Martin (2009) it was reported that, location of petrol filling stations is usually associated with the type and volume of traffic flows passing the site, proximity to a major travel route, visibility from the road, time taken by drivers to slow down to enter the petrol station, general ability to attract customers, road direction or movement, artery types, and distance of catchment areas from residential neighbourhoods. Such physical factors in a site location can make the difference between excellence, mediocrity, or failure in use for service station purposes. With respect to the distance of catchment areas from residential neighbourhoods, site proximity to the surrounding residential neighbourhoods can be expected to exert significant influence on a petrol station business (ibid). This explains the location preference of petrol filling stations owners' which is based on profit maximization (O'Sullivan, 2005).

Notwithstanding the findings of most of the research done on locations of filling stations in other parts of the world, Taylor, Sichinsambwe and Chansa (2016) on an empirical study of public perceptions of locations of filling stations in the city of Kitwe in Zambia, stressed that the location of filling stations is basically determined by the preferential location choices entrepreneurs or owners of the filling station make. The outcome of this study significantly supported a similar conclusion made by Mohammed et al. (2014).

5. Conceptual Framework

The formulation of the conceptual framework for the study was underpinned by four theoretical expositions and planning principles and standards (see Taylor, Sichinsambwe & Chansa, 2016, p.141). The first theoretical construct perceived to be significant in the location of petrol filling stations is the obnoxious facility model described by (Rana & Garg, 2014). The criteria enshrined in the model are considered to be the foundational guide in the location of petrol filling stations. The main criteria include locating filling stations:

1. 50 meters away from residential and private building
2. 40 meters buffer zone of open space or 40 meter frontage from the road.
3. 500 meters away from the nearest petrol filling station.
4. 100 meters away from water bodies.

The second theoretical underpinning is the satisficing concept of firm location. The principle underlying this ideology is that entrepreneurs always make their location choices based on the idea of maximizing sales as well as ensuring security of their business. The rationale for considering the satisficing concept and principles in the conceptual formulation was underpinned by the much discussed phenomenon of price differentials and competitiveness between sales points of petrol filling stations. Entrepreneurs always prefer to select strategic locations that will ensure business growth and sustainability. The other significant factor underlying the conceptual construct is the adherence and compliance of the Town and Country planning standards and principles. From the literature, it was quite evident that a number of both developed and developing countries have evolved planning standards and criteria to guide the location of petrol from Jamaica, India, Hong Kong, Australia, New Zealand, Mauritius, Nigeria, Uganda and Zambia all highlight some common strands which have been outlined by Rana and Garg (2014) under the obnoxious facility model.

The fourth factor of consideration for the conceptual framework is the importance and relevance of the Environmental Impact Assessment (EIA) Criteria and Report demanded by the Environmental Protection Agencies and Institutions of various countries before consent and approval is given to investors to start the construction of the petrol filling station. Based on the four criteria the following hypotheses were generated (See Taylor, Sichinsambwe & Chansa, 2016):

- H₁: Environmental Impact Assessment Criteria (EIA) is positively related to the location of fillings station in the City of Kitwe
- H₂: Entrepreneurial preferential locational choices is positively related to the location of filling stations in the City of Kitwe
- H₃: The principles and standards enshrined in the locations of obnoxious facilities should be positively related to location of filling stations in the City of Kitwe
- H₄: Town and Country planning standards, principles, and regulations positively influence locations of filling stations in the City of Kitwe.

6. Research Methodology

The research employed the qualitative descriptive cross-sectional survey. The sampling frame constituted residents, motorists, business owners and the investors or entrepreneurs running the petrol filling stations. Residents considered in the research were those who reside within the proximity of the filling station, i.e., 100 to 150 meters radius. Motorists were sampled as they stop by to re-fuel their vehicles. Systematic random sampling method was used. The approach was that every other fifth vehicle that enters the filling station is politely approached to answer the questionnaire. It must be pointed out that only motorists who are residents of Kitwe were requested to answer the questionnaire. The filling stations that were used for the sampling are listed in Table 1. The number of motorists sampled, though less than the number of residents was as result of the limitations such as inadequate time to be spent at the filling station by the motorists. However, the motorists who accepted to support the research had the opinion that, it was an exciting research and thus, were willing to spend more time especially those who have had tertiary education and seem more enlightened on the risks associated with filling stations.

6.1. Reliability and Validity Tests

Before the analysis the data collected using structured questionnaire based on likert scale was subjected to both the reliability and validity tests (See Taylor, Sichinsambwe & Chansa, 2016, p.142) were computed. The cumulative Cronbach Alpha for all the four thematic concepts was .901. However, for the thematic concepts, Environmental Impact Assessment Criteria was .846; Entrepreneurial Preferential Locational Choice was .851; Principles enshrined in the locations of obnoxious facilities was .881 with Planning principles, standards and regulations attaining .946. The factor analysis reduced the original 16 items in the questionnaires to 10 with all of them having extraction coefficients greater than .500.

Table 1: Sampling sizes of Residents and Motorists from Ten Stations

No.	Name of Filling Station	Location	Residents' Sample size	Motorists' Sample size	Location Characteristics
1	Puma	Central Business District	40	15	Near Commercial area, Company Clinic. Located at a T-junction
2	Puma	Kabala Shopping Centre Nkana East	40	15	Located in a shopping area sandwiched between shops and there is a passage way between the filling station and residential buildings
3	Puma	Wusakile	40	15	Located along the Kitwe Ndola Highway
4	Total	Parklands Shopping Centre	40	15	Located in a shopping area at a round about.. Closer to the service station are commercial businesses
5	Kobil	Chemwemwe	40	15	Located at a T- Junction near highway, i.e., Kitwe Chingola Highway
6	Kobil	Central Business District	35	15	Located at a T-junction near Traffic lights, near a commercial area,
7	Engen	Parklands	35	15	Located at a T-Junction near highway, i.e., Independence Avenue a dual carriage way
8	SGS	Riverside Shopping Area	40	15	Located in the middle of other plots designated for commercial use. Separated from a Bread factory, G&G bread Factory
9	Petroda	SOS Village	35	15	Located along the Kitwe-Ndola Highway near the SOS Village. There is a bit of buffer zone between the station and residential developments
10	Eco-Petroleum	Buchi	40	15	Located along the Kitwe-Chingola Highway. The station is separated from the Buchi township by a buffer
	Total		385	150	

Generated by the Authors from field survey (2016)

The results also showed that, most sampled residents and motorists were male representing 85.5 percent and 80 percent respectively, females were represented by 14.5 percent and 20 percent respectively. In terms of marital status, it was ascertained that for the residents, singles were represented by 8.7 percent, whilst those married constituted 85 percent, whilst those divorced were 2.9 percent and widowed were represented by 3.4 percent. For the motorists, singles represented 11.3 percent, married 81.3 percent, divorced by 4 percent and

widowed represented 3.3 percent. Out of the 28 petrol filling stations, 10 were sampled with respect to the different residential location characteristics, i.e., low, medium and high income residential areas. Business owners were identified and sampled by applying purposive sampling technique. The business owners operating businesses within the vicinity of 100 meters radius of the petrol filling station were those included in the sample. The owners of filling stations were of two categories, i.e., corporate establishment and private entrepreneurs. The corporate owners included Puma, Kobil, Total and Engen. With the Corporate ownership only one questionnaire was given to the management to respond to

7. Results and Discussions

The demographic characteristics focused on the Age, Educational Level, Employment status, Gender and Marital Status. On the comparison of the views expressed by both residents and motorists indications were that, in terms of age, both the residents and the motorists, had more people within the age group of 31-40 represented by 34 percent and 62 percent respectively, while the smaller proportion fell in the age group of 61 and above representing 6.9 percent and 4 percent respectively.

Table 2. Demographic Characteristics of Residents and Motorists

		Residents		Motorists	
A	Age	Frequency	Percent	Frequency	Percent
1	19-30	83	21.9	31	20.7
2	31-40	129	34.0	62	41.3
3	41-50	89	23.5	27	18.0
4	51-60	52	13.7	24	16.0
5	61 and Above	26	6.9	6	4.0
Total		379	100.0	150	100.0
B	Education Level	Frequency	Percent	Frequency	Percent
1	Grade 12 Certificate	139	36.7	20	13.3
2	Certificate	91	24.0	29	19.3
3	Diploma	72	19.0	49	32.7
4	First Degree	35	9.2	37	24.7
5	Second Degree	6	1.6	7	4.7
6	Other	36	9.5	8	5.3
Total		379	100.0	150	100.0
C	Employment Status	Frequency	Percent	Frequency	Percent
1	Formal	210	55.4	99	66.0
2	Informal	90	23.7	39	26.0
3	No Employment	79	20.8	12	8.0
Total		379	100.0	150	100.0
D	Gender	Frequency	Percent	Frequency	Percent
1	male	324	85.5	120	80.0
2	female	55	14.5	30	20.0
Total		379	100.0	150	100.0
E	Marital Status	Frequency	Percent	Frequency	Percent
1	Single	33	8.7	17	11.3
2	Married	322	85.0	122	81.3
3	Divorced	11	2.9	6	4.0
4	Widowed	13	3.4	5	3.3
Total		379	100.0	150	100.0

Generated by the Authors from Field survey (2016)

In terms of educational level, the largest proportion of residents has had Grade Twelve (12) Certificate representing 36.7 percent while a smaller proportion had obtained Second Degree representing 6 percent. For the motorists, the largest proportion had obtained a Diploma representing 24.7 percent while a smaller proportion had obtained Second Degree. It can also be seen in Table 2 that, under employment status, the majority of the residents was in formal employment representing 55.4 percent while a smaller proportion was not in employment representing 20.8 percent. For the motorists, the results showed that the largest number was in formal employment representing 66 percent while a smaller number was not in employment representing 8 percent.

7.1. Filling Stations located based on Environmental Impact Assessment Criteria

The results from the data supporting this view as depicted in Table 3 depict that, the mean for the residents near filling stations was 2.4413; the mean for motorists was 2.7100; the mean for businesses near petrol filling stations was 2.6750; and the mean for filling stations managers and/ or owners was 4.0455. The results indicate that the sampled residents, motorists, and business owners near filling stations was normally distributed and skewed to the left with more responses below the mean. This means that, the respondents disagreed to the statement. On the contrary, the statistics for filling stations owners and or managers were also normally distributed but skewed towards the center with more responses closer to the mean. This meant that the respondents were neutral to the statement.

Table 3. Descriptive Statistics for Residents, Motorists, Businesses Owners, and Filling Stations' Owners

	Variables	Residents				Businesses			
		Mean	Std. Dev	Skewness	Kurtosis	Mean	Std. Dev	Skewness	Kurtosis
1	Filling stations in Kitwe are located based on EIA Criteria	2.4413	.57851	.090	-.354	2.6750	.54199	-.520	1.043
2	Filling stations are located in Kitwe based on Guidance from the Planning Experts at the Local Planning Authority.	3.9749	.57278	-.085	-.222	4.4000	.96624	-.618	1.953
3	Filling stations are located by owner's choice	4.6834	.53050	-.190	-.167	4.2833	.76770	.325	-.652
4	Filling stations are located by Obnoxious Facility Principles and Standards	5.7513	.60367	-.402	-.215	3.9000	.95502	.541	-.504
		Motorists				Owners of Filling Stations			
1	Filling stations in Kitwe are located based on the EIA Criteria	2.7100	.78315	.908	1.448	4.0455	.84275	-.134	-.058
2	Filling stations are located in Kitwe based on Guidance from the Planning Experts at the Local Planning Authority.	3.6733	.54799	-.129	-.284	5.5455	.49772	-.212	-1.295
3	Filling stations are located by owner's choice	5.0517	.52560	-.189	-.027	3.4773	.79415	.330	-1.258
4	Filling stations are located by Obnoxious Facility Principles and Standards	5.8933	.79604	-1.140	.979	3.5455	1.05959	.347	-.492

Generated by the Authors from Field survey (2016)

5.2. Filling stations located in Kitwe are based on Guidance from the Planning Experts at the Local Planning Authority

The statistics from Table 3 indicate that, the mean for the residents near filling stations is reflected by 3.9749; the mean for motorists is 3.6733; the mean for businesses near petrol filling stations is 4.4000; and the mean filling stations managers and/ or owners is 5.5455. The results indicated that the distribution from the sampled residents and business owners of filling stations was skewed toward the mean implying neutrality to the statement. On the other hand, the distribution for motorists was skewed to the left with more responses below the mean. Thus, the results indicate that the sampled motorists disagreed to the statement; whilst the responses from the filling station owners were skewed to the right with more responses above the mean. This meant that, filling station owners and/or managers agreed to the statement. This shows some sort of bias in perception and judgment.

5.3 Filling Stations are located under the influence of Filling Station Owner's Preference Location

The results supporting this view from Table 3 indicate that, the mean for the residents near filling stations is 4.6834; the mean for motorists is 5.0517; the mean for businesses near filling stations is 4.2833; and the mean for filling stations managers and/or owners is 3.4773. The implication of the results is that, the distribution from the sampled residents, and motorists was skewed to the right with more responses above the mean. This indicated that, both residents and motorists agreed to the statement. On the contrary, the responses for businesses which are located near petrol filling stations were skewed toward the mean. This indicated that, the sampled respondents were neutral to the statement. The responses from the filling station owners were skewed to the left with more responses above the mean. This meant that filling station owners and/or managers disagreed to the statement.

5.4. Filling stations should be located by observing obnoxious facility principles and standards

Table 3 indicates that the mean for the residents near filling stations is 5.7513; the mean for motorists is 5.8933; the mean for businesses near filling stations is 3.9000; and the mean for petrol filling stations managers and/ or owners was 3.5455. The results indicate that, the distribution from the sampled residents and motorists were skewed to the right. This implies that the sampled population moderately agreed that filling stations must be located by observing the obnoxious facility principles and standards. On the other hand, the responses for business owners near filling stations were skewed toward the mean indicating neutrality to the statement. However, the responses from the filling station owners were skewed to the left with more responses below the mean. This could be inferred to as, filling station owners and/or managers disagreeing to the statement.

Table 4 shows that the EIA Criteria is not positively related to the location of filling station in Kitwe. Residents ($t = -69.28, p > 0.05$); Motorists ($t = -27.99, p > 0.05$); Businesses ($t = -18.44, p > 0.05$); Filling Stations ($t = -1.27, p > 0.05$). Thus, hypothesis 1 was not supported implying that the null hypothesis was accepted.

Table 4. Hypotheses Testing Using One Sample t-test from the Public

Hypotheses	Residents			Motorists		
	t-value	p-value	comment	t-value	p-value	comment
H ₁ : EIA Criteria is positively related to the location of filling station in Kitwe	-69.28	1.0000	Not Supported	-27.99	1.0000	Not Supported
H ₂ : Entrepreneurial preferential locational choices is positively related to location of filling stations	6.73	0.0000	Supported	12.85	0.0000	Supported
H ₃ : The principles enshrined in the locations of obnoxious facilities are positively related to filling stations	40.35	0.0000	Supported	21.44	0.0000	Supported
H ₄ : Planning principles, standards and regulations positively influence locations of filling stations in the City of Kitwe.	-17.85	1.0000	Not Supported	-18.48	1.0000	Not Supported
Hypotheses	Business Owners			Filling Stations Owners		
H ₁ : EIA Criteria is positively related to the location of filling station in Kitwe	-18.44	1.000	Not Supported	-1.79	0.9480	Not Supported
H ₂ : Entrepreneurial preferential locational choices is positively related to location of filling stations	-1.55	0.9335	Not Supported	-4.27	0.9992	Not Supported
H ₃ : The principles enshrined in the locations of obnoxious facilities are positively related to filling stations	-3.44	0.9991	Not Supported	-2.99	0.9932	Not Supported
H ₄ : Planning principles, standards and regulations positively influence locations of filling stations in the City of Kitwe.	-0.57	0.7124	Not Supported	6.97	0.0000	Supported

Generated from the statistical analysis (2015)

Entrepreneurial preferential locational choice is positively related to the location of filling stations in Kitwe. Residents ($t = 6.73, p < 0.05$) and Motorists ($t = 12.85, p < 0.05$); Businesses ($t = -1.55, p > 0.05$); Filling Stations ($t = -4.27, p > 0.05$). Thus, according to the results obtained from residents and motorists, hypothesis 2 was supported, whilst results obtained from business owners and filling stations owners, indicated that, hypothesis 2 was not supported. Similarly, results obtained from the residents and motorists on the principles enshrined in the locations of obnoxious facilities were positively related to filling stations [residents ($t = 40.35, p < 0.05$); Motorists ($t = 21.44, p < 0.05$)]. Thus, hypothesis 3 was accepted. On the other hand, the results obtained from business owners and filling stations' owners, on the principles enshrined in the locations of obnoxious facilities were not positively related to filling stations [businesses' owners ($t = -3.44, p > 0.05$), filling stations' owners ($t = -2.99, p > 0.05$)]. Thus on the contrary, hypothesis 3 was not supported implying the null hypothesis was accepted.

Contrary, the results generated from the analysis on residents, motorists and business owners, planning principles, standards and regulations do not positively influence locations of filling stations in the City of Kitwe [Residents ($t = -17.85, p > 0.05$), Motorists ($t = -18.48, p > 0.05$), Business owners ($t = -0.57, p > 0.05$)]. Thus, hypothesis 4 was not supported. On the contrary, the results obtained from filling stations' owners on planning principles, standards and regulations positively influence locations of filling stations in the City of Kitwe ($t = 6.97, p < 0.05$). Thus, hypothesis 4 was supported.

Table 5: Differential Perceptions on Location of Filling Stations in Kitwe

	Factors	Mean	Residents	Motorists	Business	Petrol Filling Stations Owner
1	Petrol filling stations are located at a minimum distance of 50 meters away from residential buildings	Mean Remark	1.82 Moderately Disagree	2.53 Moderately Disagree	2.20 Moderately Disagree	3.91 Neutral
2	Petrol filling stations are located at a minimum distance of 100 meters away from water bodies	Mean Remark	2.80 Disagree	2.94 Disagree	4.10 Neutral	5.18 Agree
3	Petrol filling stations are located at a minimum distance of 500 meters away from the nearest petrol filling station.	Mean Remark	2.77 Disagree	2.27 Moderately Disagree	2.07 Moderately Disagree	3.82 Neutral
4	Petrol filling stations are located at a minimum distance of 40 meters away from the road	Mean Remark	2.38 Moderately Disagree	3.09 Disagree	2.33 Moderately Disagree	3.27 Disagree
5	Petrol filling stations are located according to approved land use propositions in accordance with Local Authority Structure Plan Planning Standards	Mean Remark	3.47 Disagree	3.41 Disagree	4.30 Neutral	5.84 Moderately Agree
6	Petrol filling stations are located bearing in mind the planning standards and regulations	Mean Remark	3.57 Disagree	3.59 Disagree	4.30 Neutral	5.82 Moderately Agree
7	Petrol filling stations are located after Environmental Impact Assessment reports have been approved by Zambia Environmental Management Agency and Local Planning Authority	Mean Remark	4.02 Neutral	3.91 Neutral	4.03 Neutral	5.27 Agree
8	Petrol filling stations are located solely on the decisions made by the Planning Authority in Kitwe in accordance with Planning Standards	Mean Remark	4.83 Agree	3.79 Neutral	4.97 Agree	5.45 Agree
9	Owners decide the location of petrol filling stations based on locational preference	Mean Remark	5.23 Agree	6.01 Moderately Agree	4.93 Agree	4.00 Neutral
10	Owners locate their petrol filling stations without getting EIA clearance and approval	Mean Remark	3.99 Neutral	3.72 Neutral	4.10 Neutral	2.18 Moderately Disagree
11	Owners locate their petrol their petrol filling stations on locational profit maximization principle	Mean Remark	4.64 Agree	5.88 Moderately Agree	4.30 Neutral	2.73 Disagree
12	Owners locate their petrol filling stations after area has been rezoned by Local Authority	Mean Remark	4.87 Agree	4.79 Agree	3.90 Neutral	5.00 Agree
13	Petrol filling stations must not be located at a minimum distance of 50 meters away from the nearest residential or public building	Mean Remark	6.27 Moderately Agree	5.92 Moderately Agree	3.43 Disagree	3.00 Disagree
14	A petrol filling stations must be located on a minimum of 1600 meter squared area having a minimum buffer zone of 40 meters of open space	Mean Remark	5.44 Agree	6.05 Moderately Agree	4.07 Neutral	3.73 Neutral
15	A petrol filling stations must be located at a minimum distance of 500 meters away from a closest petrol filling station	Mean Remark	5.48 Agree	5.57 Agree	3.63 Neutral	3.73 Neutral
16	Petrol filling stations must be located at a minimum distance of 100 meters away from the nearest water bodies	Mean Remark	5.82 Moderately Agree	6.03 Moderately Agree	4.47 Neutral	3.73 Neutral

Generated from Statistical Analysis (2015)

8. Conclusions and Recommendations

The summary of the main findings of the perceptions of the different stakeholders on the location of filling stations in the City of Kitwe are highlighted in the Table 5. Interestingly, there was no single conditional variable that all the stakeholders had a common consensus. A critical reflection on the conditional variables from Nos. 11 to 16 from Table 5 indicated that whilst the perceptions of Residents and Motorists seem to relate a bit closer; the perceptions of the Business Owners and Filling Station Owners seem to diverge. Strangely, it was observed that, whilst the residents seem to agree or moderately agree to the quantitative standards that should be observed in the location of filling stations in Kitwe, business owners and owners of filling stations have either the neutral perception or disagreement. On the quantitative measurements regarding the state of filling station locations in the City of Kitwe, it was conspicuous that the perceptions of Filling Station Owners were at variance from that

of the Residents, Motorists and Business Owners (see Nos. 1 to 4 from Table 5). Similarly, on the conditional variables for Nos. 5 to 7, the perceptions by the Residents and Motorists seem to be in agreement whilst that of the Business Owner portrays neutrality, the perceptions expressed by the filling station owners is contrary to that of the perceptions of Residents and Motorists. Finally, the reflections on the conditional variables of Nos. 8 to 12 revealed that Business Owners were not very sure with the conditions. The results were very fascinating. In as much as the owners of filling stations have their location preferences, other stakeholders think differently and otherwise.

The results from the hypotheses testing showed variations in perceptions between the different stakeholders. The results for the public with exception of business owners showed compelling support for the hypothesis that, entrepreneur's preferential location choices is positively related to location of filling stations. The principles enshrined in the locations of obnoxious facilities should be positively related to filling stations. The perceptions of the four stakeholders are not the same. In as much as the residents and motorists seem to virtually have similar perceptions, business owners and filling station owners are divergent. The two seem to have different perceptions. Basically, in their views it is business first. It must be understood and appreciated that business owners locate businesses at strategic locations that will maximize their profits. In the case of filling stations, locating the facility close to the consumer is very ideal. The other planning principles and standards are in most cases ignored. Though Taylor, Sichinsambwe and Chansa (2016) stressed that most of the filling stations within the city were built before standards, policies and regulations were developed, it appears the general public and motorists are very much aware of the non-compliance with the standards and principles related to town planning.

It is thus recommended that, the Energy Regulation Board, the Local Authorities and Zambia Environmental Agency must engage in collaborative structures that will be mandated to streamline the applications for filling station establishment and operations. In that way, location of new filling stations within the country will be strictly controlled vis-à-vis the approved structure plans of the Local Authority. It is also important to stress herein that, all the legislative instruments concerning energy regulation and their service stations under the different institutional establishment must be harmonized. The essence of this proposal is that planning and implementation are mutually interdependent activities that require all stakeholders to interlink, collaborate and participate fully without any conditions to promote a better living environment for Zambia. It is also important for the Ministry of Energy to be seriously involved in ensuring that the national policies and regulations are enforced. Perhaps the Government of Singapore's structures could be adopted with modification to ensure that strategic locations are identified for such services in the country. This will eliminate the problem of clustering of filling stations as highlighted by Olajepu (2017) on his study of filling stations and their distribution pattern in Ilaro in Nigeria. The suggestion is to avoid the location of filling stations in residential areas which has become a common feature.

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