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Charcoal movements in Zambian cities of Lusaka and Kitwe: from peri-urban markets to low and medium suburbs

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ABSTRACT

Most research has unjustifiably under reported the contribution of low and medium density suburbs to charcoal consumption and demand inside Zambian cities. This is the first systematic study to investigate a full range of charcoal movements inside urban cities in Zambia and sub-Saharan Africa. The study used rapid assessment surveys at two intervals to examine dynamic charcoal movements in two Zambian cities of Lusaka and Kitwe between 2012 and 2019. A total of 941 individual con-sumers of charcoal at active charcoal markets in peri-urban areas were the units of analysis. The units of analysis were selected to clearly demonstrate the movement of charcoal to the consumers' areas of residence. Semi structured questionnaires guided the data collection, and used a quantitative and qualitative analysis and discussion of data. This study finds that charcoal is widely distributed to low, medium and peri-urban households for purposes of household use. Furthermore, we found that peri-urban areas were mainly receiver and distributor points for onward charcoal movement into low and medium density suburbs of Zambian cities. The study used a postcolo-nial analytical framework to assert that information should not be distorted nor rooted in any historical imbalance of knowledge and power generation, but within local communities in which charcoal consumption occurred. Overall, this study is an em-pirical analysis that contributes to the existing body of literature in order to inform practice and perhaps change policy frameworks. The study recommends policy changes to focus on sources of efficient, cheaper and environmentally friendly ener-gy alternatives.

Keywords: Charcoal, movements, energy, alternatives, consumers, markets

INTRODUCTION

Charcoal is an important energy source that accounted for over 70% of the energy consumed in Zambia in the 1990s (Hibajene and Kalumiana, 2003) and estimated to be around 90% by 2020 (Energy Regulation Board Report, 2021; 2020; Gonzalez, 2020). The production of charcoal as an energy source has been encouraged by prolonged droughts in the recent past that contributed to low harvests for the majority of rural poor who largely depend on agriculture leading to food insecurity thereby taking up charcoal production as an immediate solution (Kazungu, 2021; Kazungu, et al 2021a; Kazungu, et al 2021b; Gonzalez, 2020). In addition, the erratic rains reduced levels of dam water on which hydroelectric power depends as

Zambia's energy supply effected load shedding of up to 16hrs a day in 2022 thereby forcing low and medium households to rely on charcoal for their energy supply (ZESCO, 2023; Gonzalez, 2020; Dlamini et al, 2016). It is also to be noted that the provision of alternative and more efficient energy sources such as hydroelectric power (electricity) has increased across the country to an urban and rural access rate of 75% and 6.6% in 2021 from 44% and 2.2% in 2008, respectively (MoE, 2023; National Assembly, 2021; Energy Regulation Board Report, 2021; 2020; 2019; 2012). The overall country increment of households in Zambia with access to electricity stood at 35% in 2021 compared to 17% in 2008 (National Assembly, 2021; Energy Regulation Board Report, 2021; 2020; 2019; 2012). Inevitably, electricity does not appear to be an immediate option for many households in Zambia. For those with access to electricity, there are serious supply challenges associated with electricity such as frequent disruptions and high tariffs (Gumbo et al, 2012). Further, Zambia has a high urbanisation rate of 3.2% (Zambian Census, 2010). Urbanisation in Zambia finds its roots in the economic activities of towns and cities situated mostly along the line of rail from North to South. To this effect, electricity challenges and increased urbanisation in Zambian cities have increased the demand for charcoal (Energy Regulation Board Report, 2021; 2020; Gonzalez, 2020).

However, this study emerged out of concern that a huge body of literature indicate that charcoal consumption in urban areas is greatest among consumers (85%) in peri-urban areas compared to those in low and medium urban households (Gumbo et al, 2012; Mwitwa and Makano, 2011; Nyembe, 2011; FNDP 2006 – 2010; Hibajene and Kalumiana, 2003; Chidumayo et al, 2001). International literature on charcoal attribute factors influencing demand and type of energy used to urbanisation, proximity to the energy source, climatic conditions and weather aspects and income level of the households (Kazungu, et al 2021a; Kazungu, et al 2021b; Chidumayo, 2019; Adeniji, et al 2015; Djurfeldt, 2015; Ainembabazi, et al 2013; Pandey, 2002). Local (Gonzalez, 2020; Gumbo, et al 2013; Mwitwa and Makano, 2011) and regional literature (Djurfeldt, 2015) is in agreement on urbanisation, proximity and weather as factors that trigger demand in urban centres. For example, charcoal taken to Lusaka from Nyimba, Luangwa and Chongwe including other areas like Mumbwa were a result of proximity (Mwitwa and Makano, 2011). The charcoal is also taken to Lusaka and several other urban centres in Southern Africa due to urbanisation and to some extent weather aspects especially for heating purposes (Kazungu, et al 2021a; Kazungu, et al 2021b; Chidumayo, 2019; Adeniji, et al 2015; Nyembe, 2011; Chidumayo, 1997; Siedel, 2008; Falcão, 2008; Mugo and Ong, 2006).

This body of literature suggests that household income influences charcoal consumption (Chidumayo, 2019; Adeniji, et al 2015; Djurfeldt, 2015; Gumbo et al, 2012; Mwitwa and Makano, 2011; Nyembe, 2011). It is argued that higher income households are more likely to consume cleaner and alternative energy sources than charcoal (Kazungu, et al 2021b; Chidumayo, 2019; Adeniji, et al 2015; Djurfeldt, 2015; Ainembabazi, et al 2013; Pandey, 2002). Unequal income distribution, urbanisation, and serious electricity supply challenges such as power disruptions and high tariffs weaken this argument in the Zambian case (Kazungu, et al 2020; Gumbo et al, 2012; Mwitwa and Makano, 2011). While there is a plethora of literature on charcoal in Zambia, majority of studies analysed charcoal at the production point (see, for example, Kazungu et al 2021). There are no known studies that have investigated charcoal consumption, especially in urban Zambia (see Mwitwa and Makano, 2011). The following questions guide our study: Which households consume the charcoal in urban areas of Zambia? Does the charcoal end up in peri-urban areas? If not, where does the charcoal go to from peri-urban areas? In the main, this study aims is to establish how charcoal moved inside Zambian cities and contribute to a wider literature infrastructure on theoretical debates and policy implications. The study applied simple descriptive statistics and brief narrations, experiences and personal views to explore a range of informal activities involved in charcoal trade in the Zambian cities of Lusaka and Kitwe.

CONCEPTUAL FRAMEWORK FOR CHARCOAL MOVEMENTS INSIDE ZAMBIAN CITIES

The study examines charcoal movements inside Zambian cities of Lusaka and Kitwe using the theoretical model presented in figure 1 below. Five different pathways are established: (1) from rural producer areas to peri-urban areas mostly by

wholesalers; (2) from rural producer areas to peri-urban, low and medium density households. Mostly one or two bags bought on road sides by individuals; (3) from peri-urban area to another smaller peri-urban area; (4) from peri-urban area to another peri-urban area and then to low and medium density areas; and, (5) from peri-urban area directly either to low or medium density areas. The numbers 1 – 5 indicate the pathways in the model.

The first pathway largely transports charcoal on trucks, vans and bicycles from producer areas to peri-urban markets in urban centres (Mwitwa and Makano, 2011; Von and Vis, 2010). To some extent, Mwitwa and Makano (2011) also identify the second pathway. In order to present the first evidence of charcoal urban demand dynamics and movements, the third, fourth and fifth pathways are theoretical assumptions used to demonstrate charcoal movements inside Zambian cities. It is assumed that charcoal moved from peri-urban areas to low and medium density households due to frequent disruptions in power and limited availability of other cleaner alternative energy sources. Factors such as social events like funerals and weddings, business considerations like managing poultry activities, cooking and heating assume an important role in characterizing charcoal movements from peri-urban areas to low and medium density suburbs. This model assumes that peri-urban areas largely become receiving and distribution points of charcoal for onward movement and consumption in low and medium density areas in the Zambian cities.

Previous research has not systematically investigated charcoal movements in urban centres to justify that 85% of peri-urban households consume charcoal (see, for example, Chidumayo, 1997; 2001; Nyembe. 2011). Following the theoretical framework in figure 3 below and the findings presented above, this study hypothesized that charcoal and firewood moved and was consumed in low and medium density suburbs than remain in peri-urban areas due to demand pull factors (i.e. social events, cooking, heating, etc).

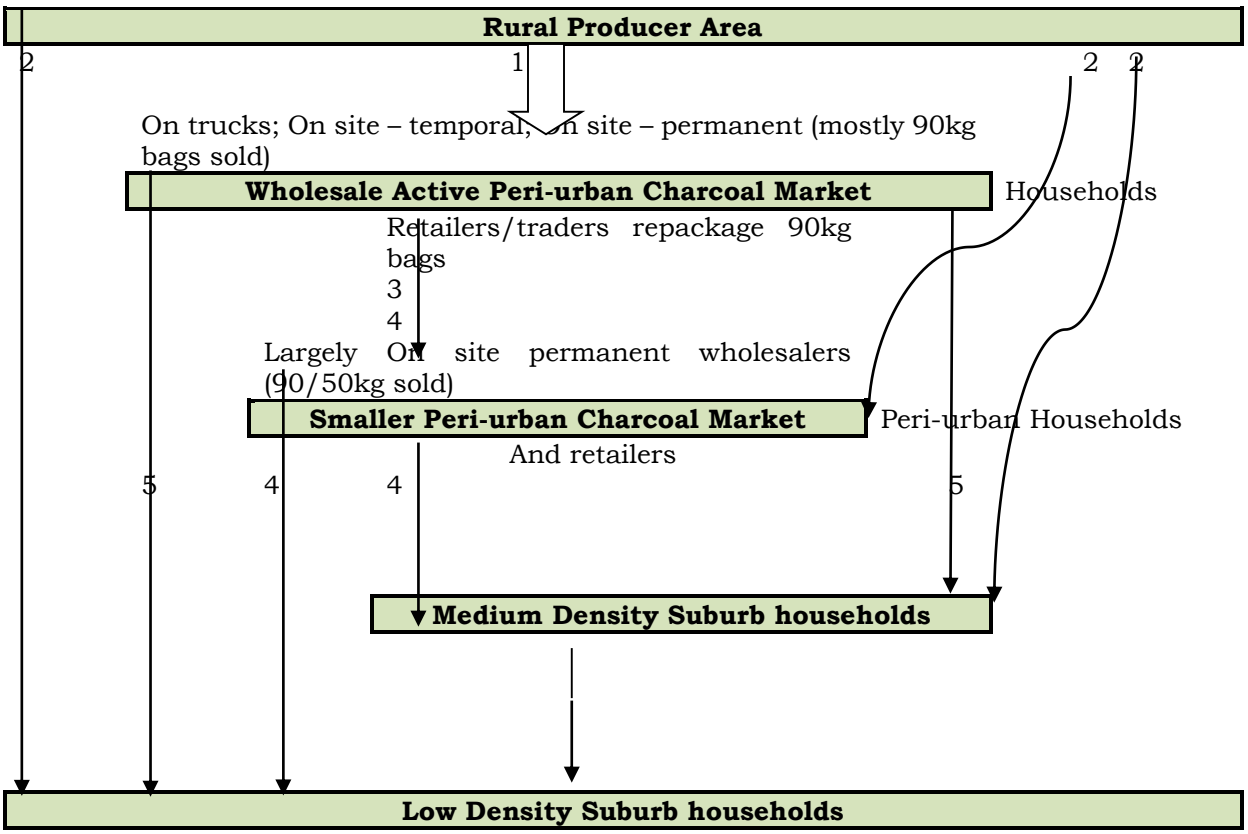


Figure 1: Charcoal Movements from Peri-urban Areas to Low and Medium Density Suburbs in Lusaka and Kitwe

MATERIALS AND METHODS

Description of the study sites

The study sites were the urban cities of Lusaka and Kitwe. Lusaka is the capital city of Zambia hosting administrative and commercial activities of the country. It is located 15°25′S and 28°17′E on the plateau about 1,300 metres above sea level. Lusaka is situated on a 70 km^2 stretch of land and holds more than 2.2 million people with 40% estimated to reside in peri-urban areas (Zamstats, 2022). The peri-urban areas were important sites to this study given assertions in literature that charcoal ends up in these areas. The peri-urban areas are also analytically located along the main roads to the city of Lusaka. In Lusaka, it is the Great North road through both from Northern direction into Mandevu and from Southern into Chawama peri-urban areas. There is the Great East road that is absorbed into Mutendere peri-urban area. The last major entry point into Lusaka is through Mumbwa road from the western direction into Kanyama peri-urban area. Within Lusaka, Mandevu, Chawama, Kanyama and Mtendere have the largest populations.

On its part Kitwe is a mining town with a population of 661,901 people and divided into a number of peri-urban areas, low and medium suburbs with three main entry points for Kitwe. The first is through the Ndola-Kitwe dual carriage way where charcoal finds its way into Chamboli peri-urban area. Chamboli is on the Southern part of Kitwe. The second is through Mufulira-Kitwe road where charcoal finds its way into Chimwemwe and Kamitondo peri-urban areas. The final entry point is

through the Chibuluma road which supplies St. Antony market in St. Antony/Cha Cha Cha and Kamitondo peri-urban areas.

Table 1: Different Residential Areas by Population in the Cities of Lusaka and Kitwe

Lusaka City		Kitwe City	
Peri-urban Area	**Population**	**Peri-urban Area**	**Population**
Mandevu	467,744	Chimwemwe	166,283
Chawama	208,419	Chamboli	101,130
Kanyama	525,902	Buchi	63,884
Matero	320,580	Miseshi	56,001
Low Density Area	**Population**	**Low Density Area**	**Population**
Roma	64,120	Parklands	21,548
Kabulonga	68,103	Riverside	35,590
Medium Density Area	**Population**	**Medium density Area**	**Population**
Kamwala	110,049	Mindolo	52,574
Chilenje	118,022	Ndeke	68,314

Source: Zamstats (2022)

Sampling design and data collection

Site selection

The cities selected were Lusaka and Kitwe with specific charcoal selling points as sites selected for this study. Lusaka and Kitwe were selected because they host some of the largest charcoal markets (selling points) in the country. The selling points in Lusaka were located at Kazimai Market in Mtendere, Chawama market in Chawama, Masauko and Sekelela markets in Kanyama, Lupili market in Mandevu, Matero market in Matero, and Garden market in Garden. The sites in Kitwe were located at Nakadoli Market in Chimwemwe, Chamboli market in Chamboli, Kamitondo market in Buchi and St. Antony market in St. Antony/Cha Cha Cha.

Sampling

The sampling process followed a purposive sampling approach used to target peri-urban areas in both Lusaka and Kitwe since the largest selling points in Zambia are located in these cities. The study conveniently sampled 3 charcoal sellers or traders at each selling point (charcoal market) in Lusaka (48 charcoal sellers) and Kitwe (42 charcoal sellers). A total of 90 charcoal sellers were conveniently sampled in the two cities of Lusaka and Kitwe as data collection points for purposes of tracking charcoal movements information, which helped to validate the conceptual framework. Further, the buyers or consumers at selling points approaching charcoal sellers became automatically sampled to provide information. To this effect a total of 941 buyers or consumers were conveniently sampled to enable understanding of where the charcoal moved from each selling point. Any person buying charcoal at any of the selected charcoal markets was eligible for inclusion in the study. Consent was sort from each buyer on whether to proceed with questions or not. Only upon verbal consent did the interview proceed with a full awareness that time was highly limited as most buyers were busy. As each buyer approached the charcoal selling point, data collectors had to proceed with tact and diplomacy to capture the buyers' attention in the few minutes they had to complete the transaction. This was because different buyers visit charcoal selling points at different times of the day.

There were a total of 16 and 14 peri-urban areas in Lusaka and Kitwe, respectively. These were identified after consultations with district officials in both Lusaka and Kitwe, including a review of the 2010 Census of Households and Housing Population in Zambia. The peri-urban areas of Lusaka included Chainda, Mtendere, Kalingalinga, Chaisa, Mandevu, Chipata, Ng'ombe, Bauleni, Kanyama, Misisi, John Howard, George, Kamanga, Kaunda Square, Chibolya and Garden. In Kitwe, these included Lubuto, Buntungwa, Kawama, Twatasha, Itimpi, Chimwemwe, Ipusukilo, Lubwa, Bulangililo, Kwacha, Buchi, Luangwa, Chamboli, and Wusakile. From the total number of peri-urban areas in each city, 6 peri-urban areas were selected for Lusaka and 4 in the case of Kitwe. The selected peri-urban areas for Lusaka were Mandevu, Chawama, Mtendere, Kanyama,

Matero and Garden. In Kitwe, the selected peri-urban areas were Chimwemwe, Chamboli, St. Antony, and Kamitondo. All the peri-urban areas were selected because they had large and active charcoal markets.

A large and active charcoal market was identified in each peri-urban area selected. Each peri-urban area had several small charcoal selling points. In Mandevu, the largest selling point was at Lupili charcoal market right on the Great North Road. Chawama charcoal market situated at Chawama main market was the largest in Chawama peri-urban area. Kazimai charcoal market was identified in Mtendere, while Kanyama peri-urban area consisted of two large charcoal markets at Masauko and Sekelela. Matero and Garden charcoal markets were situated at Matero and Garden main markets in Matero and Garden peri-urban areas, respectively. Chamboli charcoal market was the largest selling point in Chamboli peri-urban area while Nakadoli charcoal market was in Chimwemwe peri-urban area. Kamitondo charcoal market was situated at a confluence of Buchi and Kamitondo peri-urban areas on the Western and Northern ends while Parklands and Riverside low housing suburbs were on the South-east and North-east ends, respectively. St. Antony charcoal market was situated on Chibuluma road, also known as the Kitwe – Kalulushi road, in St. Antony peri-urban area just opposite Cha Cha Cha mine medium density area.

Data collection

The data collection employed a semi structured questionnaire to collect both quantitative and qualitative data. The semi structure questionnaire enabled collection of data in English and local Zambian languages. The data collectors took notes in notebooks. They translated questions from English to local languages and back in this data collection process. The data collection at each selling point took place at three different days per week. This was meant to examine demand trends in a day and week. The largest volumes of charcoal were bought between Thursdays and Sundays. The field work was undertaken in two phases between September and December of 2012, and between April and June in 2019. This data collection at two different points examined changes over time as indicated in the discussions of findings.

Data analysis

The data analysis in the study applied simple descriptive statistics and brief narrations, experiences and personal views of traders and buyers to explore a range of informal activities involved in charcoal trade in the Zambian cities of Lusaka and Kitwe. The data was collated using Ms excel to produce descriptive statistics to establish narratives across the peri-urban areas. The unit of analysis was both the selling points and targeted buyers (consumers) in Lusaka and Kitwe that captured a total of 941 traders and buyers. The rationale was to analyse data from traders and buyers at selling points using a postcolonial analytical framework arguing that the data is not distorted nor was it rooted in any historical imbalance of knowledge and power generation (Tinsley, 2022; Lev de Souza, et al 2018; Briggs & Sharp 2004). As Briggs and Sharp (2004) have argued, this is an attempt to include the views and experiences of the traders and buyers in the selling points in peri-urban areas in a meaningful way to devise possible alternatives on charcoal consumption, trade and movements.

RESULTS

Mapping charcoal markets in peri-urban areas

The study mapped charcoal selling points in all 30 peri-urban areas of Lusaka and Kitwe. Mapping focused on identification of large and active charcoal selling points as a justification of peri-urban areas for inclusion in the study. Of the 30 peri-urban areas assessed for inclusion, 10 were identified and these are Mandevu, Garden, Matero, Kanyama, Chawama and Mtendere in Lusaka while Chamboli, Chimwemwe, Kamitondo, and St. Antony were found in Kitwe. The study found that charcoal moved from peri-urban areas to low and medium density areas in many ways. Charcoal finds its way into the peri-urban areas major selling points through major roads (i.e. Great North road; Mumbwa road). From the main selling points (located in peri-urban areas), both charcoal moves further into different small selling points within the same peri-urban area and into other peri-urban areas. These selling points are strategically placed to capture buyers. For example, a charcoal selling point in Kaunda Square on the road from Chamba Valley is specifically targeted at Chamba

Valley consumers[1]. Consumers from low and medium density areas also buy charcoal from the main selling points.

Charcoal movements in peri-urban areas

This study hypothesized that charcoal moved and was consumed in low and medium density suburbs than remain in peri-urban areas due to demand pull factors (i.e. social events, cooking, heating, etc). Institutional supply needs were met by the Forestry Department. Table 2 shows the major selling points for charcoal in peri-urban areas of Lusaka and Kitwe. Most charcoal wholesalers and traders in Lusaka claimed to source the charcoal from Kapiri Mposhi (common at Lupili market in Mandevu and at Garden market in Garden), Chongwe (common at Kazimai market in Mtendere and at Chawama market in Chawama) and Nangoma or Mumbwa (common at Masauko and Sekelela markets in Kanyama). In Kitwe, it was claimed to be sourced mainly from Lufwanyama, Mpongwe, Kalulushi, and Solwezi, and from the forests on the Mufulira-Kitwe road.

Table 1: Buyers in all Selling Points

Selling point/market		Peri-urban Area	Buyers in absolute Nos (%)
Lusaka	Mtendere	Mtendere	128 (14%)
	Chawama	Chawama	91 (10%)
	Masauko	Kanyama	72 (8%)
	Sekelela	Kanyama	66 (7%)
	Lupili	Mandevu	110 (12%)
	Garden	Garden	98 (10%)
Kitwe	Nakadoli	Chimwemwe	93 (10%)
	Chamboli	Chamboli	124 (13%)
	Kamitondo	Kamitondo	75 (8%)
	St. Antony	St. Antony/Cha Cha Cha	84 (10%)
Total			**941 (100%)**

Wholesalers and traders mainly defined these major selling points in peri-urban areas as indicated in table 2. However, the majority of charcoal traders established several smaller selling points away from these major selling points either within a peri-urban area or in another peri-urban area. Table 2 also presents the number of charcoal buyers contacted during the field study period. An interaction with buyers was meant to allow for greater appreciation in the movement of charcoal within peri-urban areas and into low and medium areas.

Residential areas of buyers for charcoal

Tables 3 to 8 present the movements of charcoal from each specific selling point to several residential areas of Lusaka while tables 9 to 12 indicates movements of charcoal in Kitwe. The study asked, 'do you live in this residential area?' The rationale of this study was to systematically examine the contribution of low and medium density urban households to charcoal consumption since their contribution has mainly remained unrecorded. For this reason, the study targeted buyers and collected information on their residential areas. The aim of collecting information on the buyer's residential area was to associate the selling point to the next area within the city where the charcoal would be further redistributed or finally consumed.

Table 2: Charcoal Movement from Mtendere Market, Lusaka

Selling Point	Residence of buyers	Sub-urb	Nos(%)
Mtendere's Kazimai Market	Mtendere	Peri-urban	22 (17%)
	Kaunda Square	Medium	10 (8%)
	Kalingalinga	Peri-urban	8 (6%)
	Woodlands	Low	10 (8%)
	PHI	Low	16 (13%)
	Helen Kaunda	Medium	11 (9%)
	Chelston	Medium	10 (8%)
	Maploti (Mtendere)	Peri-urban	9 (7%)
	Chiparamba	Peri-urban	7 (5%)
	Airport Road	Low	11 (9%)
	Kabulonga	Low	14 (11%)

[1] Chamba Valley is low density area and has smallholder leaseholds

Total	**128 (100%)**

Table 3 presents the movement of charcoal from Mtendere peri-urban area to low, medium and high density areas of Lusaka based on the residences of buyers as indicated. Mtendere's Kazimai market is a typical charcoal selling point just off the Great East Road with a good road connection to several other peri-urban areas, as well as medium and low density areas such as PHI, Kabulonga, Chelston and Helen Kaunda. The larger percentage of buyers was from low density areas at 41%, followed by those from peri-urban areas at 34% while those from medium density areas stood at 25%.

The movements of charcoal from Chawama peri-urban area to other peri-urban areas including low and medium density suburbs are indicated in table 4. Of all the buyers, 68% were from within Chawama or from other peri-urban areas such as Kuku, John Howard, Jack, and Koumboka while only a combined 32% were from Makeni and Kamwala South. Makeni is a low density suburb west of Chawama whereas Kamwala South is a medium density area on the eastern side. Noteworthy is that most of the charcoal sold at Chawama market passes through either Kanyama or Mtendere markets.

Table 3: Charcoal Movement from Chawama Market, Lusaka

Selling Point	Residence of buyers	Suburb	Nos (%)
Chawama market	Kuku	Peri-urban	10 (11%)
	Makeni	Low	14 (16%)
	John Howard	Peri-urban	12 (13%)
	Chawama	Peri-urban	21 (23%)
	Kuomboka	Peri-urban	11 (12%)
	Kamwala South	Medium	15 (16%)
	Jack	Peri-urban	8 (9%)
Total			**91 (100%)**

Table 5 indicates that 64% of charcoal buyers from Masauko market were from within Kanyama or from other peri-urban areas like John Laing and Chawama. Only 17% of the buyers were from a low density area of Town Centre east of Kanyama while 19% of Garden house medium density area buyers are on the western side of Kanyama.

Table 4: Charcoal Movement from Masauko Market, Lusaka

Selling Point	Residence of buyers	Suburb	Nos (%)
Masauko	Kanyama	Peri-urban	23 (32%)
	John Laing	Peri-urban	12 (17%)
	Chawama	Peri-urban	11 (15%)
	Town Centre (Lusaka)	Low	12 (17%)
	Garden House	Medium	14 (19%)
Total			**72 (100%)**

Similarly, table 6 shows that 61% of buyers were from within Kanyama or from other peri-urban areas such as Chawama and John Laing. There were 21% of buyers from a low density area of Makeni, south of Kanyama while another 17% of buyers came from the medium density area of Garden house, west of Kanyama. The findings in table 5 and 6 suggest that charcoal moved within and into other peri-urban areas where it was further redistributed to other parts of Lusaka.

Table 5: Charcoal movement from Sekelela Market, Lusaka

Selling Point	Residence of buyers	Suburb	Nos (%)
Sekelela	Kanyama	Peri-urban	19 (29%)
	John Laing	Peri-urban	11 (17%)
	Makeni	Low	15 (23%)
	Garden House	Medium	11 (17%)
	Chawama	Peri-urban	10 (15%)
Total			**66 (100%)**

Lupili charcoal market in Mandevu peri-urban area is situated on Great North Road, an entry point into the city of Lusaka from the northern parts of the country. Table 7 indicates that of all the buyers at Lupili charcoal market, half (50%) were from within Mandevu or from other peri-urban areas such SOS Village, Chipata and 6 Miles. Only 8% and 42% were from low (Villa Elizabeth) and medium (Emmasdale, Chilenje, Matero East, Matero Ext) density areas. Villa Elizabeth is a low housing suburb situated in the central business district of Lusaka while Chilenje is a medium density suburb on the South-east of Lusaka. The finding suggests the significance of a charcoal market located on the main road to distribute in far and wide suburbs of the city.

Table 6: Charcoal Movement from Mandevu Market, Lusaka

Selling Point	Residence of buyers	Suburb	Nos (%)
Mandevu	Mandevu	Peri-urban	22 (20%)
	SOS Village area	Peri-urban	12 (11%)
	Matero East	Medium	11 (10%
	Matero Ext	Medium	10 (9%)
	Chilenje	Medium	11(10%)
	Emmasdale	Medium	14 (13%)
	Chipata	Peri-urban	13 (12%)
	6 Miles	Peri-urban	8 (7%)
	Villa Elizabeth	Low	9 (8%)
Total			**110 (100%)**

Table 8 indicates that 73% of buyers at Garden charcoal market were from low density suburbs of Lusaka. Only 27% of buyers were from within Garden or from the peri-urban area of SOS Children's Village.

Table 7: Charcoal Movement from Garden Market, Lusaka

Selling Point	Residence of buyers	Suburb	Nos (%)
Garden	Garden	Peri-urban	16 (16%)
	Kabulonga	Low	10 (10%)
	SOS Village area	Peri-urban	11 (11%)
	Thorn Park	Low	13 (13%)
	North Mead	Low	13 (13%)
	Roma	Low	12 (12%)
	Nyumba Yanga	Low	9 (9%)
	Olympia	Low	14 (14%)
Total			**98 (100%)**

Unlike Lusaka where most of the charcoal traders have established selling points dotted in both peri-urban and low and medium residential areas from which buyers then moved the charcoal to different parts of the city sometimes using wheelbarrows, Kitwe presented its own unique situation. Most of the charcoal movement within peri-urban areas and to low and medium suburbs was undertaken by commissioned labour who sold charcoal using bicycles (see figure 2 below). These commissioned individuals used their bicycles to move charcoal from the main charcoal markets at Chamboli, Nakadoli, St. Antony and Kamitondo.

Nakadoli charcoal market is found in the centre of Chimwemwe peri-urban area of Kitwe, away from the main roads. Table 9 presents charcoal movement by buyers within Chimwemwe (18%) or from other peri-urban areas of Kitwe such as Leskos (13%), Buchi (12%), Twatasha (13%) and Ituna (15%). The only other buyers were from medium density suburbs (29%). The findings suggest that Chimwemwe is a supply point for further movement of charcoal to other peri-urban parts of the city.

Table 8: Charcoal Movement from Nakadoli Market in Chimwemwe, Kitwe

Selling Point	Residence of buyers	Suburb	Nos (%)
Nakadoli	Chimwemwe	Peri-urban	17 (18%)
	Mindolo	Medium	13 (14%)
	Leskos	Peri-urban	12 (13%)
	Buchi	Peri-urban	11 (12%)
	Twatasha	Peri-urban	12 (13%)
	Kwacha	Medium	14 (15%)

	Ituna	Peri-urban	14 (15%)
Total			**93 (100%)**

Kamitondo charcoal market is one of Kitwe's biggest markets and is found in Kamitondo peri-urban area. It is located on the main road that links this area to low density suburbs such as Riverside and Parklands. Table 10 indicates that of all the buyers, 49% were from low and medium suburbs of Parklands, Riverside and Kwacha while 51% were from within Kamitondo or from other peri-urban areas of Buchi and Kawama.

Table 9: Charcoal Movement from Kamitondo Market, Kitwe

Selling Point	Residence of buyers	Suburb	Nos (%)
Kamitondo	Kwacha	Medium	12 (16%)
	Buchi	Peri-urban	10 (13%)
	Kamitondo	Peri-urban	15 (20%)
	Parklands	Low	12 (16%)
	Riverside	Low	13 (17%)
	Kawama	Peri-urban	13 (17%)
Total			**75 (100%)**

Chamboli charcoal market is the biggest in Kitwe. It is located on the Ndola – Kitwe Dual Carriage Way in Chamboli peri-urban area. Table 11 indicates that 51% of the buyers were from within Chamboli or from other peri-urban areas like Wusakile and Mulenga. Buyers from low density suburbs of Parklands, Riverside and Nkana East accounted for 35% of the buyers with only 14% coming from the medium density area of Ndeke.

Table 10: Charcoal Movement from Chamboli Market, Kitwe

Selling point	Residence of buyers	Suburb	Nos (%)
Chamboli	Wusakile	Peri-urban	24 (19%)
	Chamboli	Peri-urban	23 (19%)
	Ndeke	Medium	17 (14%)
	Parklands	Low	15 (12%)
	Riverside	Low	14 (11%)
	Mulenga	Peri-urban	16 (13%)
	Nkana East	Low	15 (12%)
Total			**124 (100%)**

St. Antony charcoal market is on the Chibuluma (Kalulushi) road in the mine peri-urban areas of Cha Cha Cha and St. Antony. The location of St. Antony is the most ideal for those with vehicles to buy charcoal and firewood. The majority of buyers at St. Antony were in vehicles. Table 12 suggests that 47% of buyers were from low housing suburbs of Riverside, Parklands, and Nkana East, while 13% of buyers were from the medium density suburb of Mindolo. Buyers from within St. Antony or another peri-urban area of Cha Cha Cha accounted for 40% of the total buyers.

Table 11: Charcoal Movement from St. Antony Market, Kitwe

Selling point	Residence of buyers	Suburb	Nos (%)
St. Antony	St. Antony	Peri-urban	19 (23%)
	ChaChaCha	Peri-urban	14 (17%)
	Riverside	Low	12 (14%)
	Mindolo	Medium	11 (13%)
	Parklands	Low	13 (15%)
	Nkana East	Low	15 (18%)
Total			**84 (100%)**

As stated earlier, this study hypothesized that charcoal moved and was consumed in low and medium density suburbs than remain in peri-urban areas due to demand pull factors. The findings suggest that charcoal movement is evidently wider across the cities – it moves within and to other peri-urban areas and into low and medium residential areas. The findings in tables 2 to 12 are consistent with the hypothesis. However, the findings are inadequate to fully explain why charcoal moves within and to other peri-urban and into low and medium density areas.

Reasons for buying charcoal

The study asked, "Why do you buy charcoal or firewood?" This question was systematically framed to examine the movement of charcoal inside the Zambian cities of Lusaka and Kitwe. Table 13 shows the relationship in the volumes of charcoal bought, their average prices, and trends. The findings are largely specific to each city. Overall, 43% of buyers used the charcoal (1-15Kg and 25kg) for purposes of household cooking and heating in both Lusaka and Kitwe due to frequent disruptions in power supply and high electricity tariffs (see table 13). Avoiding the frequent disruptions in power supply and saving on the pre-paid electricity system were the common reasons advanced among buyers as major reasons for buying charcoal.

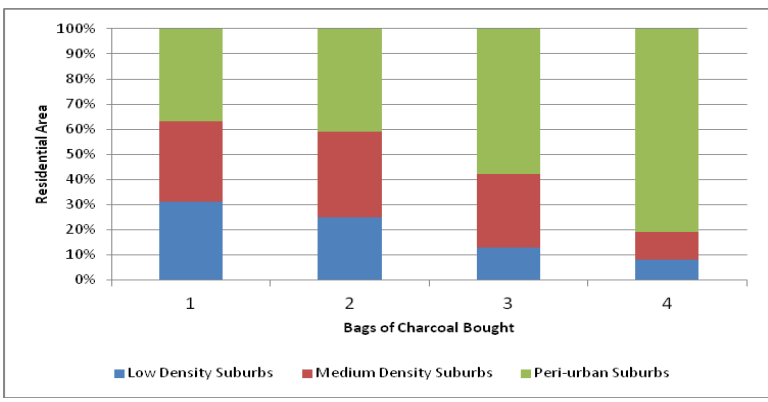
Table 12: Trends in Quantities of Charcoal Bought

Quantities bought	Purpose	Average Prices	Trends	Frequency (%)
1-15kg plastic bags	Hhd cooking	K1 – 15	Every day	245 (26%)
25kg bag	Hhd heating	K25	Every month	159 (17%)
25kg bag	Resale	K25	Every week	131 (14%)
50kg bag	Commercial use	K50 – 65	Every day	32 (3%)
50kg bag	Smoke meat, hhd	K50 – 65	Every month	122 (13%)
90kg bag	Resale	K100 – 150	Every week	41 (4%)
90kg bag	Resale	K100 – 150	Every morning	27 (3%)
90kg bag	General hhd use	K100 – 150	Every month	94 (10%)
90kg bag	Poultry/smoke meat	K100 – 150	Every week	36 (4%)
2 x 90kg bags	Poultry	K100 – 150	Every month	27 (3%)
2 x 90kg bags	Commercial use	K100 – 150	Every week	27 (3%)
Total				**941 (100%)**

However, people in Kitwe were more likely to buy large volumes of charcoal of at least 50kg bags from different peri-urban areas into low and medium suburbs of the city for purposes of smoking meat (commonly called braii in Zambia). In contrast, people in Lusaka were more likely to buy large volumes of charcoal of at least 90kg bags from peri-urban areas to low and medium density suburbs for commercial purposes such as managing poultry (chicken-runs) in their backyards as well as for use in food outlets (commonly called restaurants in Zambia). Firewood was mostly for institutional purposes in the mines, clinics and hospitals, and cremation facilities. The buyers for firewood in Chawama and Kanyama peri-urban areas in Lusaka suggest that demand is motivated by social and cultural functions such as funerals and weddings. An increase in housing construction in low and medium density areas such as Woodlands and Kamwala South facilitates the demand for firewood used to break rocky areas.

Volumes of charcoal transactions

Chart 1: Residential Area of Buyers by Volume of Charcoal Bought



Note: 1 = 90kg; 2 = 50kg; 3 = 25kg; 4 = 1-15kg

Chart 1 indicates that 63% of buyers of 90kg bags of charcoal were from low and medium density suburbs. Of all the buyers of 50kg bags of charcoal, 59% were from low and medium density areas. Conversely, 81% of all the buyers of 1-15kg bags of charcoal were from peri-urban areas. The findings suggest that big volumes of charcoal

moves from peri-urban areas to low and medium density areas. Most buyers of smaller bags of charcoal were from within peri-urban areas. For example, although 56% of all buyers were from peri-urban areas (table 14), those from low and medium density suburbs bought 22,500kg of charcoal compared to 18,805kg bought by those from peri-urban areas.[2]

Table 13: Residential Area of Buyers by Volume of Charcoal Bought

	90kg	50kg	25Kg	1-15Kg	Total
Low	31% (78)	25% (38)	13% (38)	8% (19)	18% (173)
Medium	32% (80)	34% (53)	29% (83)	11% (28)	26% (244)
Peri-urban	37% (94)	41% (63)	58% (169)	81% (198)	56% (524)
Total	100% (252)	100% (154)	100% (290)	100% (245)	100% (941)

In addition, the pricing for bags of charcoal ranged between K100 and K150. However, Kitwe has relatively higher prices (K120 – K150) compared to Lusaka (K100 – K130). It should be noted that these were retail prices. Wholesale prices for self-reported 90kg bags ranged from K70 to K100.

DISCUSSION

This study found four main findings. Firstly, a review of literature and the analyses of charcoal movement in Lusaka and Kitwe found the argument that 85% of the charcoal is consumed by poor urban households in peri-urban areas of Zambian cities inadequate. In most of this literature (see, for example, Kazungu, et al 2021b; Chidumayo, 2019; Adeniji, et al 2015; Djurfeldt, 2015; Ainembabazi, et al 2013; Hibajene and Kalumiana, 2003; Nyembe, 2011; Chidumayo et al 2001; 1997; GRZ FNDP, 2010), there is limited explanatory power to justify their claim since the argument is based on estimates that are highly uncertain and without a systematic understanding of demand dynamics, trends and movements within urban areas. Clearly, the argument is premised on the understanding that while medium to low density households bring in charcoal and firewood into the cities by road, the majority still go to peri-urban based charcoal and firewood markets for the energy used in urban households. Little is known about the movement of charcoal through purchases from the peri-urban areas.

The application of the conceptual framework (Figure 1 above) to systematically identify five multiple ways of charcoal movements in Lusaka and Kitwe was an enlightening analytical category. The five pathways in the conceptual framework are consistent with the findings in this paper providing a postcolonial analytical framework (Tinsley, 2022; Lev de Souza, et al 2018; Briggs & Sharp 2004). The five different pathways highlight the importance of moving away from the claims of much charcoal research to a more nuanced understanding based on evidence (Briggs & Sharp 2004). This study finds growing evidence of charcoal movement within and between peri-urban areas and into low and medium suburbs in Lusaka and Kitwe. These movements include, firstly, charcoal movement from rural areas to peri-urban areas, which act as receiver points for the cities. Secondly, charcoal movement within a peri-urban area, mostly distributed by traders to other selling points and into households. Thirdly, the charcoal is also distributed from one peri-urban area to another and into low and medium density areas. For example, table 4, 5 and 6 shows charcoal movement from Kanyama to Chawama peri-urban areas and into Makeni low suburb area or Kamwala medium suburb area. Fourthly, the charcoal moves directly from the peri-urban area to low and medium density areas. Fifthly, the charcoal moved directly from rural producer areas to peri-urban, low and medium density areas. This provides indication that peri-urban areas are no longer the major consumer areas, but are simply receiver and distributor points.

Secondly, it was hypothesized that charcoal moved and was consumed in low and medium density suburbs than remain in peri-urban areas due to demand pull factors. The analyses are consistent with the hypothesis and indicate that buyers from low and medium suburbs purchased bigger volumes of charcoal than those from peri-urban areas. For example, although 56% of all buyers were from peri-urban areas (Table 14 and Chart 1), those from low and medium density suburbs

[2] The volumes were calculated by multiplying (78 + 80) 158 buyers from low and medium suburbs by 90kg to get 14,220kg. Then (38 +53) 91 buyers by 50kg is equal to 4,550kg. Further, (38 + 83) 121 buyers by 25kg is equal to 3,025kg. An additional calculation of (19 + 28) 47 buyers by 15kg is equal to 705kg. These totals are equal to 22,500kg. Repeating the same for peri-urban areas found 18,805kg.

bought 22,500kg of charcoal compared to 18,805kg bought by those from peri-urban areas. The findings indicate that charcoal is the single most important energy source for most urban areas in Zambia, but contrasts with findings of many studies showing that use is mainly limited to peri-urban areas and under report use in low and medium suburbs (Mwitwa and Makano, 2012; Nyembe, 2011; Chidumayo et al 2001; 1997). The contribution of low and medium density suburbs to charcoal consumption and demand inside Zambian cities is grossly understated (Briggs & Sharp 2004).

Thirdly and more related to the above, the analysis of the contribution of medium and low density suburbs to charcoal movement and consumption found a few consistent factors. Most buyers advanced reasons for use of charcoal and firewood linked to household, institutional, economic, social and cultural factors. Charcoal movement into low, medium and high density suburbs was largely associated with household use such as cooking and heating, which is consistent with most research both in Zambia and internationally (Hibajene and Kalumiana 2003; Siedel, 2008; Pereira *et. al.*, 2001; Pandey, 2002; Herd, 2007, Malimbwi, *et. al.*, 2005; Mulombwa, 1998; Kalinda *et. al.*, 2008; Kambewa *et. al.*, 2007; Siedel, 2008; Von and Vis, 2010; Gumbo et al 2012). However, the majority of this charcoal movement was necessitated by institutional factors such as high electricity tariffs and frequent erratic supply in power, which contrasts largely with international literature (Siedel, 2008; Pandey, 2002). This suggests that charcoal continues to be an important energy source in the absence of cleaner and cheaper alternatives. The specific institutional use for firewood in hospitals, clinics, and mines is also to be underlined.

Economic aspects such as charcoal use for commercial purposes like heating for those with poultry businesses in their backyards and food preparation for those with food outlets was common for low and medium density suburbs. This underlines economic considerations in the choice of energy sources. Charcoal appealed as a cheaper source compared to electricity. This highlights the need to invest in cheaper and environmentally friendly alternatives. It was common for peri-urban suburb households to repackage bigger bags of charcoal into smaller bags and presented for resale within peri-urban areas, which is consistent with previous research that found charcoal to make a significant contribution to household income (Mutamba, 2007; Jumbe *et. al.*, 2008; Sibale and Banda 2004; PFAP, 1998; Mickels-Kokwe, 2005). The social and cultural dimension in charcoal and firewood movements among buyers was encouraged by social visits to different suburbs, for purposes of social gatherings like weddings and funerals, and including the preparation of smoked meat (commonly known as braii in Zambia). The findings highlight the contribution of medium and low density suburbs to charcoal consumption.

Fourthly, the analysis also found interesting informal arrangements in the marketing of charcoal in Lusaka and Kitwe. Wholesalers, retailers, and vendors were highly associated with charcoal marketing which demonstrates the informality involved in charcoal movement within urban areas. The wholesalers, retailers and vendors are by no means sufficient to explain charcoal informal marketing movements. There are delivery boys in the chain of informal arrangements either using wheelbarrows or bicycles. Also, some informal marketing arrangements do take place between institutions which directly purchased charcoal from these markets. However, wholesalers, retailers, and vendors remain significant in understanding informality in charcoal markets.

There are those on trucks, those on-site and temporal, and those on-site and permanent. Wholesalers on trucks are what this current study has called a merchant type. This group is predominantly resident in low, medium or peri-urban suburbs of urban areas, but owned or hired trucks to buy and collect charcoal from rural producer areas to consumer markets in peri-urban areas. Wholesalers on-site and temporal offload and trade at big peri-urban charcoal markets. This type of wholesalers is resident in rural producer areas and is involved in production of charcoal but also transports the charcoal to peri-urban markets. They remain or 'camp' at wholesale markets until all their charcoal had been traded. Wholesalers on-site and permanent are typical charcoal traders normally resident in peri-urban areas. This type of wholesalers will mostly buy wholesale charcoal from rural producer areas for trade at peri-urban consumer markets in the cities.

The retailers are those who buy charcoal for purposes of reselling either at the same market or at another selling point within or outside the peri-urban area. The vendors are distinct and different actors in Lusaka and Kitwe. The vendors act as wholesalers at Chawama, Kanyama, Mandevu and Mtendere charcoal markets in Lusaka. Vendors enter into verbal agreements with wholesalers to sell the charcoal for a commission. Normally, the wholesaler puts a minimum amount at which a bag of charcoal can be sold. For example, it is K35 at Mtendere's Kazimai charcoal market. The vendor then assumes the role of a wholesaler, but sells a bag of charcoal at K70. The vendor delivers to the wholesaler an amount equal to K35 by the number of bags once all the bags are sold. The difference is the vendor's financial benefit. Retailers often buy charcoal from vendors at K70 per bag of charcoal, which they either resell at K100 elsewhere at Kazimai market or repackage into smaller bags. In Kitwe, the vendors used bicycles to transport charcoal in low, medium and high density areas for sale at similar mark up arrangements.

The analysis also indicate that many transactions related to charcoal purchases are not recorded as most often both 'retailers' and 'wholesalers' do not keep records of sales as the services provided fall within the informal sector. Based on the analysis of prices across the two towns, it is evident that the transactions can be recorded and proper accounting undertaken. However, further and more specific studies across cities would need to be undertaken to tease out the dynamics of accounting at charcoal and firewood selling points.

CONCLUSION AND POLICY IMPLICATIONS

This study used a rapid assessment survey approach to collect data at two different intervals to examine the dynamic charcoal movements inside Zambian cities. Individual buyers of charcoal at active charcoal markets in peri-urban areas were the units of analysis. The units of analysis were selected to clearly demonstrate the movement of charcoal based on the buyers' areas of residence. Specific survey questions were used to guide the data collection in the field, literature review, the analysis and discussion in this study. Four main findings have already been highlighted in the discussion above. Firstly, the study concludes that peri-urban areas were mainly simply receiver and distributor points for onward charcoal movements into low and medium density suburbs of Zambian urban cities. The five different pathways used to distribute charcoal as highlighted in the discussion demonstrates the significance of charcoal movements inside urban areas.

Secondly, this study finds that 56% of buyers from peri-urban households used charcoal although those from low and medium density suburbs bought larger volumes of charcoal compared to those from peri-urban areas. Therefore, under reporting the contribution of low and medium density suburbs to charcoal consumption and demand inside Zambian cities is unjustified but perhaps fits postcolonial traditions of knowledge and power generation. Thirdly, household use such as cooking and heating, high electricity tariffs, frequent disruptions in power supply, social gatherings such as funerals and weddings, including the need to break rocks in housing and pit latrine sites were found to be consistent factors that widely motivated charcoal movements in peri-urban, low and medium density areas. Fourthly, the discussion highlights that charcoal movements thrives under conditions of informal marketing arrangements.

Some implications from the above findings provide important insights into issues of charcoal movements inside Zambian cities. Methodologically, an apparent disconnect is evident between the findings of many research that base their findings on estimates and the findings in this study that assesses actual charcoal movements based on buyers. This might be explained as simply the absence of similar previous studies on charcoal movements inside urban cities to provide a basis for comparison and learning. It could also be that self-reported questions used in this study undervalued or overvalued the information from buyers. Even with these possible reasons, it is clear that the study adequately investigated charcoal movement inside Zambian cities of Lusaka and Kitwe.

However, the policy implications remain unclear. It may be that suggesting actual reflections of charcoal movement in low, medium and high density suburbs might require urgent sourcing of efficient, cheaper and environmentally friendly energy alternatives. If so, relevant parties such as the forestry and energy departments, forestry and energy regulatory institutions, interest organizations, the

media, environmental activists, and researchers need to be cognizant of the dangers of generalizations based on few specific cases. It may also be that the questions employed in this study to assess the charcoal movements in Lusaka and Kitwe did not adequately capture the full extent of the problem. If so, different questions require to be developed to measure the demand dynamics, trends and movements within urban areas.

Finally, this study is an empirical analysis that contributes to the existing body of literature in order to inform practice and perhaps change. It is the first systematic study to investigate a full range of charcoal movements inside urban cities in Zambia and sub-Saharan Africa in general.

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