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FOOD CLUSTERS, FOOD
SECURITY AND THE
URBAN FOOD SYSTEM OF
NORTHERN NAMIBIA

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Abstract

A central feature of the transformation of urban food systems in cities of the Global South is the growing presence of supermarkets and their supply chains, often termed supermarketization or a supermarket revolution. A key issue in the African context is whether supermarkets are a threat to other sources of food including informal sector vendors. Most research on the supermarket revolution and competition with other food retailers focuses on large urban conurbations with little attention paid to the role of supermarkets in secondary urban centres. This paper aims to rectify this situation through a case study of the role of supermarkets in three smaller urban centres in Northern Namibia. The paper uses data from a representative household food security survey in 2018 which collected detailed information on household food consumption and food purchasing patterns. We show that supermarkets have established a dominant role in the local food system and are patronized by almost all households. However, the informal food sector displays considerable resilience and is patronized on a regular basis by low-income households. Future research on the impact of the secondary supermarket revolution should examine the experience and strategies of informal food vendors and whether the relationship with supermarkets is truly symbiotic or not.

Keywords

supermarket revolution, food sourcing, food security, food source clusters, Namibia

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Introduction

Urbanization is unfolding at an unprecedented pace in Sub-Saharan Africa, fuelled by natural population growth and rural-urban migration, with some projections estimating that the urbanized population of the continent will exceed 55% by 2050 (Lall et al., 2017; UN-Habitat, 2014). The urban population of Sub-Saharan Africa will likely triple by mid-century, increasing from less than 400 million in 2015 to 1,200 million in 2050. While the greatest numerical increases are occurring in large cities, urban growth is not confined to large primate cities. Virtually every urban centre up and down the continental urban hierarchy is experiencing significant growth (Christiansen and Kanbur, 2016; Roberts, 2014). The total number and proportion of the urbanized in small and medium size cities (of less than 500,000 inhabitants) now exceeds that of larger primate cities. As many as 162 million people (or 55% of the total urban population) live in secondary cities and towns of less than 500,000, compared with 60 million (20%) in cities of 500,000 to 2 million, and 73 million (25%) in cities of greater than 2 million (Satterthwaite, 2017).

A recent UN-Habitat (2020) report concludes that the residents of secondary cities in Sub-Saharan Africa experience ‘multiple deprivations’ in relation to governance, economics, water and sanitation, the living environment, education, health and crime (UN-Habitat, 2020). Food is mentioned only once in a 56-page report and food insecurity and deprivation not at all. The absence of any discussion of secondary city food insecurity by the UN agency responsible for urban development and governance leaves the misleading impression that it is not an important challenge for residents and local government in Africa’s secondary cities. Part of the reason for this silence is the bias of the international food security agenda which tends to see food insecurity as a rural not urban challenge (Crush et al., 2012; Crush and Riley, 2019). However, a growing body of research by the African Food Security Urban Network (AFSUN) and others shows that food insecurity is a growing crisis in Africa’s secondary cities (Battersby and Watson, 2019; Crush

and Battersby, 2016; Frayne et al., 2018; McCordic and Abrahamo, 2021; Mackay, 2019; Riley and Crush, 2022).

In major cities, urban food wholesaling and retailing and food environments are undergoing rapid change (Battersby and Haysom, 2019; Frayne and Crush, 2018; Tacoli, 2019, Hannah et al., 2022). Over the past decade, South African supermarkets have expanded to over 25 countries in SSA, aided by the accessibility of supermarket outlets to global and South African supply chains (das Nair, 2021). The proliferation and growing influence of South African as well as other supermarkets is seen in visible changes to the built environment as well as the food sourcing and consumption behaviour of urban residents (Battersby, 2017; das Nair, 2018, 2019). Conventional wisdom suggests that supermarkets in Africa target and serve the middle and upper-classes and higher income neighbourhoods in large cities (Reardon and Gulati, 2008).

Evidence for the patronage of supermarkets by the urban poor is more mixed. Wanyama et al. (2019), for example, argue that relatively few households in informal settlements in Kampala and Nairobi buy any of their food in supermarkets. In contrast, Owuor (2018) shows that most Nairobi households, including those in the lowest income brackets, purchase some of their foods in supermarkets. Other research confirms that the urban poor do patronize supermarkets, but primarily to purchase staple foods such as mealie meal and rice in bulk (Caesar and Crush, 2016; Crush and Frayne, 2018; Odunitan-Wayas et al., 2018). In turn, supermarket chains have responded by creating budget subsidiaries with limited product ranges and tapping into mass consumer markets in townships and informal settlements (Battersby and Peyton, 2016). In Namibia, the expansion of the supermarket sector has been rapid and dramatic, and a powerful exemplar of the ability of a supermarket revolution to fundamentally reshape the food system, purchasing patterns and dietary intake in the capital city, Windhoek (Kazembe et al., 2022; Nickanor et al., 2021). In the Namibian capital, Windhoek, a symbiotic rather than competitive relationship between supermarkets and informal food vendors

has emerged, primarily because the latter have shown considerable ingenuity and agency in the face of local government policy to contain their spread (Crush et al., 2019; Kazembe et al., 2019; Nickanor et al., 2019).

To date, research on the supermarket revolution in Africa cities has tended to focus on large cities. As a result, there has been limited assessment of whether a secondary supermarket revolution is also in progress, with supermarkets moving down the urban hierarchy to secondary towns and cities in search of new markets. Nor is there much research on their reception from municipal governments, informal sector retailers and more traditional food suppliers in urban and peri-urban food markets. In three small towns in Kenya, (Rischke et al. (2015) did find that supermarkets had established a strong presence, with over 80% of households shopping at supermarkets although the average share of total food expenditure was less than 20%. In another study in Msunduzi, South Africa, Caesar and Crush (2016: 54) found “extraordinarily high levels of reliance on supermarkets, especially compared with the informal food economy.”

Since independence in 1990, Namibia has experienced three decades of uninterrupted urban growth. The urban population of the country increased from 390,000 (28% of the total in 1991 to 886,000 (42% of the total) in 2011, and is projected to increase to 2.3 million (67% of the population) by 2041 (NSA, 2014). In 2016, Windhoek, the capital city, had an estimated population of 440,000 (or 43% of the urban population). The other 57% of the urban population resided in 27 secondary urban centres ranging in size from 2,000 to 260,000 (Ottolenghi and Watson, 2017: 22-23). Windhoek has also experienced a fundamental transformation of its food system with supermarkets playing an increasingly dominant role (Nickanor et al., 2021). A key question is whether secondary urban centres in Namibia have experienced a similar transformation of their food system and whether the supermarket revolution has diffused down the urban hierarchy.

In this paper, we examine the case of small urban centres in the Oshakati-Ongwediva-Ondangwa urban corridor of northern Namibia. The study aimed to examine the association between food security and food sourcing patterns among a representative sample of households in the Corridor. The paper addresses three main questions: first, is the Corridor undergoing a secondary supermarket revolution as the urban population grows in size? Second, are there regular or discernible patterns in the food sourcing strategies of households in the Corridor? And third, which households are most likely to patronize the various formal and informal food retail outlets? The next section of the paper discusses the methodology and data source for addressing these questions. The following section presents the results of the data analysis, which is followed by a discussion of the significance of the findings.

The Corridor

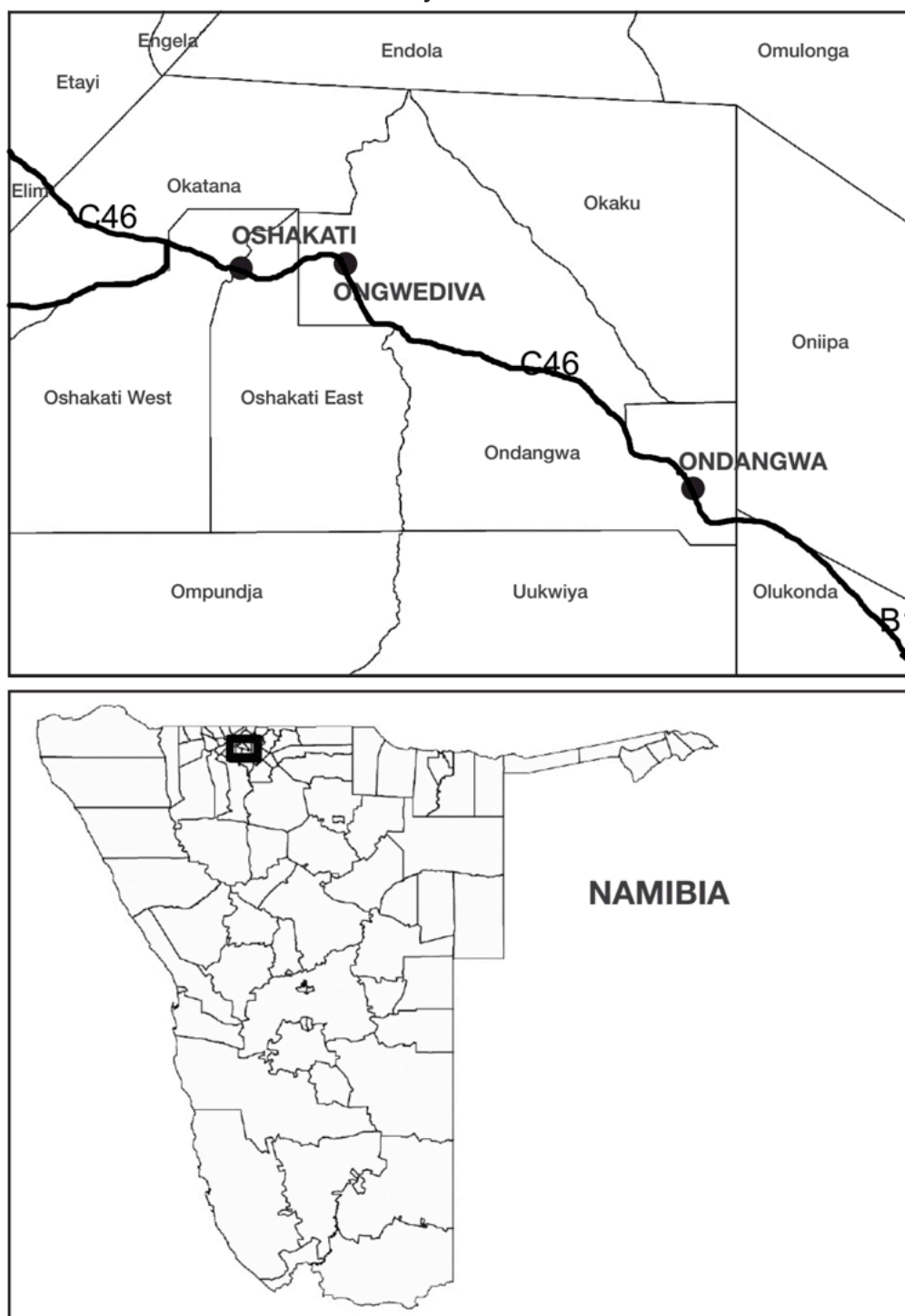
All of Namibia’s secondary urban centres are growing rapidly through rural to urban migration, including those in the north of the country close to the border with Angola (Table 1). The three towns of Oshakati, Ongwediva and Ondangwa are relatively close to one another along a major road transportation route (C46) and increasingly constitute a single urban corridor (Figure 1). Oshakati and Ongwediva are 5km apart and Ondangwa is a further 30km away from Ongwediva. The Corridor had a combined population of nearly 80,000 in 2011 (an increase of 122% since independence from South Africa in 1991) and numbers an estimated 120,000 at the present time resident in 26,800 households (Table 1). The Corridor has been a major focus of post-independence economic development in the north of the country and the hub of trans-border trade with Angola, only 60 km away (Figure 1). The rural population around the towns and further to the south live in scattered villages and primarily engage in communal cultivation of staple crops such as pearl millet (*mahangu*), livestock-rearing and the harvesting of wild foods.

TABLE 1: Urbanization in Namibia, 1981-2011

	1981	1991	2001	2011	2021 (est.)
Oshakati	3,684	21,603	28,255	36,541	54,150
Ondangwa	1,000	7,926	10,900	22,822	33,781
Ongwediva	-	6,197	10,742	20,260	29,988
Total corridor	4,684	35,726	49,897	79,623	117,919

Source: Namibia Statistics Agency. Note: Estimates for 2021 based on national average urban growth rate of 4% per annum

FIGURE 1: Location of the Secondary Urban Corridor in Northern Namibia



Survey Methodology

The data on which this paper is based comes from a representative household survey conducted by the African Food Security Urban Network (AFSUN) in 2018. A two-step cluster sampling design was adopted. In the first step, primary sampling units (PSU or clusters) were selected from a list of all PSUs from the 2011 Population and Housing Census the probability proportional to size method. The second involved a random selection of a fixed number of households within each PSU using a map created by NSA that positioned each PSU using GPS. The final sample size was 853 households of an estimated 23,550 households in 2018 (or 3.6% of the total) (Table 2). The AFSUN household food security survey instrument was mounted on tablets using ODK Collect and administered to the selected household heads or their spouse/partner by fieldworkers from the University of Namibia. The survey instrument collected a wide range of demographic, economic, food consumption and food sourcing behaviour at the household level.

Household food sourcing was captured by the inclusion of the Hungry Cities Food Purchases Matrix (HCFPM) in the survey instrument. Crush and McCordic (2017) argue that the HCFPM is a unique tool for tracking patterns of household procurement of 30 or more staple, fresh, frozen and processed food items. The HCFMP collects information on the number of households that obtain each item, how often and where they obtain it, and the spatial location of the source, with a one-year recall period. Crush and McCordic (2017) themselves use HCFPM data from Maputo in Mozambique to demonstrate its potential in the descriptive identification of food procurement patterns. This is the first paper to make systematic use of the HCFPM in a study of household food procurement in secondary cities and to identify sourcing patterns

by applying bivariate and multivariate statistical analysis to data generated by the HCFPM.

In order to measure the prevalence of household food insecurity in the corridor, validated assessment tools were used (Haysom and Tawodzera, 2018; Leroy et al., 2015). Food access was measured using the Household Food Inadequacy Access Scale (HFIAS), which is based on the idea that the experience of food insecurity causes predictable reactions and responses at the household level that can be quantified through a summary score for each household (Coates et al., 2007; Jones et al., 2013). The Household Food Inadequacy Access Prevalence (HFIAP) categorizes households into four levels of food insecurity based on their HFIAS scores: food secure, and mild, moderately, and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently. In this paper, the four HFIAP categories were binned into food secure and food insecure.

The nutritional deficit dimension of food insecurity was captured using the household dietary diversity scale (HDDS) (Swindale and Bilinsky, 2006). The HDDS is defined as the number of unique food groups consumed within the household in a given time period, and is seen as a validated proxy for both the quality and quantity of food consumption (Jones et al. 2013; McCordic and Frayne, 2018; Ruel 2003). The HDDS scores were binned into two categorical variable: low diversity (HDDS=0-5) and higher diversity (HDDS=6+). Household economic status was measured using two variables: total household income quintiles and the Lived Poverty Index (LPI). The LPI measures on a scale of 0 to 4 how frequently a household went without certain five separate essential goods and services in the previous year (Mattes et al., 2016).

TABLE 2: Corridor Households and Sample Size

	Total households (2018 est.)	Sampled households	%
Oshakati	10,928	491	57.6
Ondangwa	6,059	216	25.3
Ongwediva	6,563	146	17.1
	23,550	853	

For the analysis of HCFPM data, we first generated frequency distributions for household variables and descriptive summaries of food sourcing by type of outlet and frequency of patronage. Second, we used K-means cluster analysis to group like sources (Everitt et al. 2011; Dolnicar et al. 2018; Pedraza et al. 2021).. The main advantage of this clustering technique is that it allows us to push the analysis beyond the more usual formal-informal dichotomy. The initial iteration for the k-means clustering analysis started with seven food sources. However, the relative change in AIC between clusters of 4 or more was not optimal ($\Delta AIC \leq 10$) (Santos-Pereira and Pires 2013). Instead, three clusters were found to be optimal: 1=Convenience; 2=Supermarkets; and 3=Traditional. Third, all households were allocated to only one of the three clusters, based on where they predominantly purchased a 33-item food basket. This metric was computed based on

the probabilities derived from the average distance of dissimilarity of each household belonging to a particular food source. Finally, we modelled cluster membership as the dependent variable using bivariate analysis and a multinomial logistic regression with household factors as explanatory variables. Variables from the bivariate correlations ($p < 0.10$) were simultaneously entered into regression models. All statistical analyses were conducted using R statistical software (R Core Team, 2020).

Household Food Security

Table 3 provides various key characteristics of the sampled households. Household size was relatively evenly distributed around the national average of 4.0 with 52% at or above this average. The most

TABLE 3: Household Variables (n=853)

Characteristics	No.	%
Household size	1 member	10.7
	2-3	36.3
	4-5	27.2
	6+	25.1
Household structure	Female-centred	40.0
	Male-centred	18.5
	Nuclear	15.6
	Extended	20.9
	Single person	4.0
Housing type	Formal	62.5
	Informal	36.6
Social grants	No	80.8
	Yes	18.4
Monthly income (n=687)	\leq N\$1,100	23.3
	1,101–2,100	17.3
	2,101–4,200	18.9
	4,201–12,000	21.7
	12,001+	18.2
Lived poverty index	\leq 1.00	49.7
	1.01-2.00	19.5
	2.01-3.00	7.0
	3.01+	1.9
Food security	Secure	22.7
	Insecure	76.8
Dietary diversity score	Less diverse	63.7
	More diverse	34.0

common household type was female-centred (i.e. households with a female head and no male spouse or partner) at 40%. Of the male-headed households, more were extended and male-centred than nuclear. Nearly 40% of the households live in informal housing (corrugated iron or tin shacks). Only 20% of households said they receive any type of social grant (mainly child, old age or disability grants). Table 3 also shows income quintiles for the 687 households who answered the question. These range from a low of less than N\$1,100 (USD73) per month to a high of more than N\$12,000 (USD795) per month. The majority of households (60%) reported incomes below N\$4,200 (USD278 per month). The HFIAP and HDDS categories show that only 23% of households were completely food secure and only 34% had a diverse dietary intake.

Food Source Clusters

Most households in the Corridor source different foods from multiple outlets over the course of a month. Figure 2 shows the wide variety of formal and informal, cash and non-cash sources. Purchase is the dominant form of food procurement with only 20% growing any of their food in the rural areas and less than 5% engaged in urban agriculture. The

predominant non-cash form of food consumption is food sent by relatives in rural areas, which benefits around 35% of households. Figure 2 highlights that the dominant food retail sources include supermarkets, open markets, small shops (such as grocers, butcheries and bakeries), street vendors, fast food outlets and tuck shops (small informal outlets in informal settlements). Significantly, as many as 97% of households obtain food from supermarkets compared with 50% from open markets, 29% from street vendors and 19% from tuck shops. Food secure and food insecure households patronize supermarkets at roughly equal rates. Food insecure households are more likely than food secure households to patronize open markets, small shops, street vendors and tuck shops.

An inventory of supermarkets in the urban corridor of northern Namibia indicates that there are now as many as 26 supermarkets in the three towns including 12 foreign-owned and 14 Namibian-owned outlets (Table 4). Given the heavy footprint in the corridor, the two subsidiary issues addressed in this paper are, first, the relationship between supermarkets and the food sourcing behaviour of households in the corridor, and second, the nature of the relationship between supermarkets and other formal and informal food sources.

FIGURE 2: Food Sources by Food Security Status

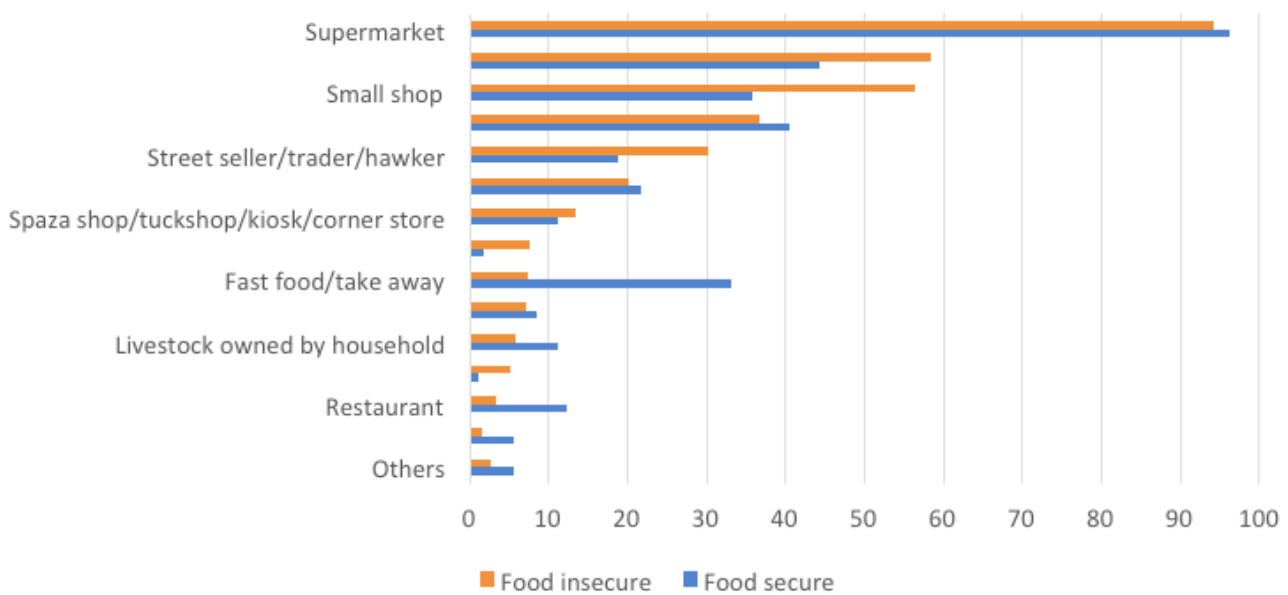


TABLE 4: Supermarkets in Urban Corridor of Northern Namibia

Companies	Ownership	Oshakati	Ondangwa	Ongwediva	Total
Choppies	Botswana	0	1	1	2
Pick n Pay	South Africa	1	1	1	3
Shoprite	South Africa	1	1	1	3
Spar	South Africa	1	1	1	3
U Save	South Africa	1	0		1
Woermann Brock	Namibia	3	1	1	5
Mini-markets	Namibia	6		3	9
Total		13	5	8	26

Figure 3 shows that there are major differences in the frequency of patronage for four of the main food retail outlets. While nearly all households purchase some of their food at supermarkets, almost 80% only shop there once per month and another 17% once per week. Both street vendors and tuck shops are patronized almost daily while open markets are predominantly patronized weekly or monthly.

Thirty-three of the 35 food items in the HCFPM are available for purchase in each cluster (Table 5). However, the Cluster Mean Square and F Statistic values show that the purchase pattern for each of items differs across the sample (with the exception of fresh fish [$F=0.002$] and dried fish [$F=0.61$]). For ease of reference, the dominant cluster for each food item is bolded in Table 5. Overall, the Supermarket Cluster is dominant for 18 of the food items, the

Convenience Cluster for another 16 and the Traditional Cluster for only 1. The Supermarket Cluster is dominant for all of the cereal staples, 60% of the fresh produce items and 50% of the processed foods. The Convenience Cluster is dominant for all of the cooked foods, fruit, vegetables, eggs, offal and frozen meat, as well as tinned produce and sweets/chocolate. While the Traditional Cluster is a minority source for all foods except vegetable, the HCPMF did not include wild or indigenous foods which are commonly obtained from these sources.

Table 6 shows how often the households in each cluster procure food from seven types of food source. The average Silhouette coefficient was 0.54, indicating fair-to-good cohesion and separation. The ratio between the largest and smallest cluster was 1.513, indicating relatively balanced

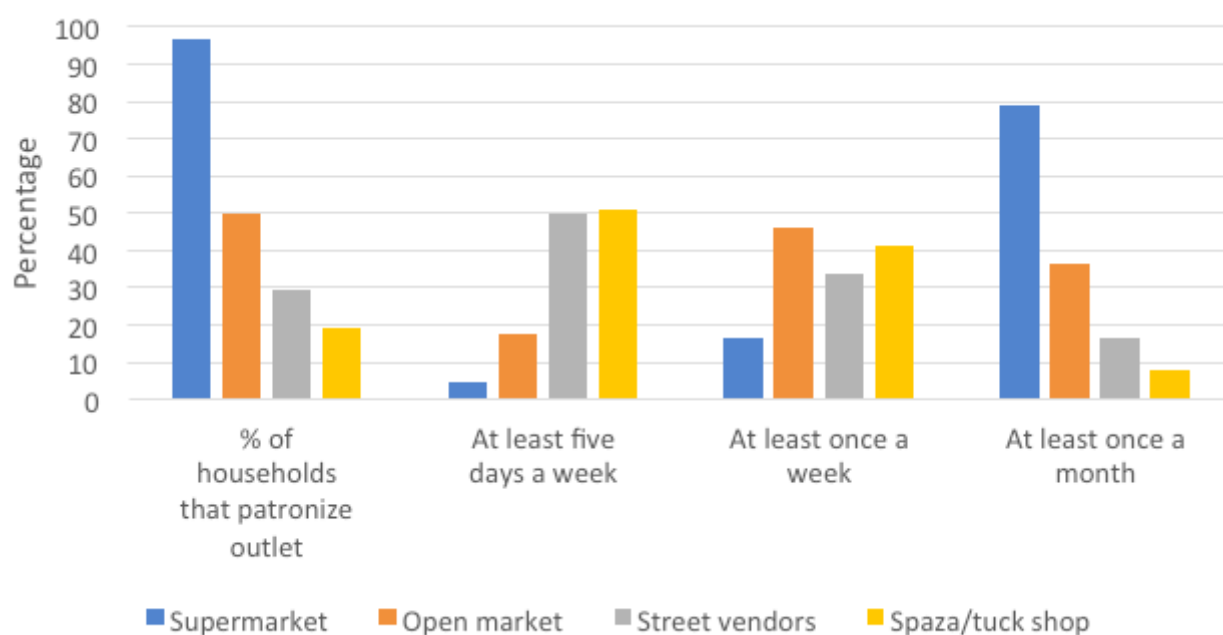
FIGURE 3: Frequency of Sourcing from Main Food Retailers


TABLE 5: Food Source Clusters

Food item	Cluster mean square	No. of households	F-statistic	Sig.	Clusters		
					Cluster 1: Convenience	Cluster 2: Supermarkets	Cluster 3: Traditional
Staples							
Mealie meal	1.424	846	9.25	0.002	14.7%	52.3%	33.0%
White bread	16.176	846	71.86	<0.001	25.8%	53.9%	20.2%
Brown bread	9.194	846	39.43	<0.001	25.0%	62.4%	12.6%
Rice	8.782	846	45.62	<0.001	20.4%	57.6%	22.0%
Pasta	18.265	846	89.74	<0.001	22.2%	58.5%	19.3%
Fresh produce							
Meat	9.161	846	39.43	<0.001	20.3%	56.1%	23.5%
Fish	0.01	846	0.002	0.966	18.3%	42.5%	39.2%
Chicken	4.94	846	40.84	<0.001	31.0%	65.1%	4.0%
Eggs	59.655	846	544.75	<0.001	50.3%	49.7%	0.0%
Milk	42.886	846	334.82	<0.001	43.7%	51.8%	4.6%
Vegetables	55.449	846	392.24	<0.001	41.3%	55.1%	3.6%
Fruit	65.668	846	670.48	<0.001	59.4%	39.6%	1.0%
Offal	3.538	846	39.32	<0.001	48.3%	41.6%	10.1%
Frozen produce							
Meat	12.99	846	114.08	<0.001	50.4%	45.7%	3.9%
Chicken	32.629	846	171.51	<0.001	32.4%	60.9%	6.7%
Fish	10.171	846	58.68	<0.001	35.1%	50.0%	14.9%
Prepared food							
Pies/samosa/vetkoek	9.413	846	56.36	<0.001	62.2%	35.2%	2.6%
Cooked meat	0.986	846	31.95	<0.001	64.3%	25.0%	10.7%
Cooked chicken	0.458	846	22.58	<0.001	66.7%	22.2%	11.1%
Cooked fish	0.298	846	15.43	<0.001	70.6%	17.6%	11.8%
Cooked vegetables	55.449	846	392.24	<0.001	41.3%	55.1%	3.6%
Chips/french fries	8.67	846	136.47	<0.001	75.0%	23.5%	1.5%
Dried food							
Meat	2.37	846	43.18	<0.001	53.8%	36.5%	9.6%
Fish	0.041	846	0.61	0.433	26.2%	45.9%	27.9%
Vegetables	0.14	846	3.85	0.05	31.3%	31.3%	37.5%
Fruit	0.724	846	27.14	<0.001	75.0%	20.8%	4.2%
Processed food							
Tinned vegetables	4.759	846	87.97	<0.001	68.5%	25.9%	5.6%
Tinned fruit	0.984	846	42.71	<0.001	85.7%	9.5%	4.8%
Tinned meat	1.772	846	44.63	<0.001	67.6%	24.3%	8.1%
Sour milk/maas	19.086	846	148.48	<0.001	49.0%	42.7%	8.3%
Tea/coffee	32.356	846	154.43	<0.001	26.2%	61.0%	12.8%
Sugar	12.564	846	76.06	<0.001	20.3%	59.5%	20.2%
Cooking oil	1.565	846	16.27	<0.001	17.7%	55.4%	26.9%
Snacks (crisps/chips)	12.419	846	78.13	<0.001	41.8%	57.7%	0.5%
Sweets/chocolate	18.365	846	238.32	<0.001	77.7%	22.3%	0.0%

TABLE 6: Food Sourcing Frequency by Food Cluster

	Frequency of shopping	Clusters			Chi-square
		Cluster 1: Convenience	Cluster 2: Supermarkets	Cluster 3: Traditional	
Supermarket	At least five days a week	6.5	2.0	2.0	30.104a
	At least once a week	29.6	15.4	23.3	
	At least once a month	63.9	82.7	74.8	
Small shop	At least five days a week	12.2	6.6	7.4	13.56a
	At least once a week	58.8	46.7	60.2	
	At least once a month	30.0	46.7	32.4	
Fast food/ take away	At least five days a week	7.7	4.0	16.7	6.652b
	At least once a week	39.7	32.0	46.7	
	At least once a month	52.6	64.0	36.6	
Restaurant	At least five days a week	10.0	0.0	20.0	4.878b
	At least once a week	48.7	44.4	50.0	
	At least once a month	43.3	55.6	30.0	
Market	At least five days a week	4.2	2.6	5.9	13.990a
	At least once a week	28.4	26.3	31.6	
	At least once a month	67.4	71.2	62.6	
Street sellers	At least five days a week	43.4	19.5	28.8	13.893a
	At least once a week	32.1	57.1	51.5	
	At least once a month	20.8	23.4	16.7	
Food transfer	At least five days a week	1.0	0.0	0.0	13.862a
	At least once a week	3.1	1.0	2.1	
	At least once a month	95.9	99.0	97.9	

Note: a=significant at $p < 0.05$, b=Not significant at $p < 0.05$

cluster sizes. Within all three clusters, food shopping in supermarkets is primarily an infrequent (monthly) occurrence. However, Convenience Cluster households (and to a lesser extent Traditional Cluster households) do shop more frequently at supermarkets (36% and 25% respectively at least once per week). Both also shop more frequently at small shops, although Supermarket Cluster households do patronize these outlets on a more frequent basis too (53% at least once a week). All three Clusters show a similar pattern of more infrequent patronage of fast-food outlets and restaurants. They also share a common approach to food shopping at open markets with monthly visits more the norm. By contrast, patronage of street vendors differs considerably between Clusters with Convenience Cluster households purchasing food far more frequently from street vendors. Food transfers from rural areas are infrequent in all three Clusters.

Clusters and Characteristics

Table 7 shows the association between the three clusters and household characteristics. Household size and household type have a weak relationship with cluster type as the proportional distribution is relatively consistent across the three clusters. Female-centred households, the dominant type overall, are almost equally important in each cluster. The relationship between housing type and cluster membership appears stronger. Traditional Cluster households most likely to be in informal housing and Convenience Cluster households least likely. In the Convenience Cluster, membership increases with increased income as 10% of households fall in the lowest quintile and 41% in the upper. This may seem counterintuitive since poor households are more likely to frequently patronize convenience outlets such as street sellers. However, the Convenience Cluster also includes fast-food and restaurant

patronage which are far more likely to be patronized by higher-income, less poor households. The opposite is true with the Traditional Cluster households that have a greater chance of being in the lowest two income quintiles. Supermarket Cluster households are most evenly distributed across the income quintiles, evidence that patronage is not strongly related to household income but that supermarkets appeal to all income groups.

The variation in the relationship between income and procurement in the three clusters is reflected in the lived poverty, food security and dietary diversity variables. In addition to lower incomes, households in the Traditional Cluster are most

likely to have higher lived poverty (51% \leq 1.00), to be food insecure (76%) and to have lower dietary diversity (86%). Households in the Convenience Cluster are most likely to have low lived poverty (86% \leq 1.00), to be food secure (50%) and to have higher dietary diversity (71%). The Supermarket Cluster households fall between the two in relation to all three indicators with intermediate lived poverty (65% \leq 1.00), food security (29%) and dietary diversity (64% less diverse).

Multinomial logistic regression was used to model cluster membership as the response variable with household characteristics as explanatory variables. As the response variable has K categories, k-1 logit

TABLE 7: Bivariate Association Between Food Source Clusters and Household Variables

Household variables	Categories	Clusters			Chi-square
		Cluster 1: Convenience	Cluster 2: Supermarkets	Cluster 3: Traditional	
Household size	1 member	9.3	12.7	10.2	19.96 (p=0.003)
	2-3	41.3	28.1	43.4	
	4-5	25.6	30.1	25.5	
	6+ members	23.8	29.1	20.9	
Household structure	Female-centred	36.8	41.5	41.2	24.51 (p=0.002)
	Male-centred	12.3	17.6	23.4	
	Nuclear	22.2	13.0	15.1	
	Extended	25.7	24.2	15.4	
	Other	5.9	3.7	4.9	
Housing type	Formal	76.6	65.4	53.4	27.42 (p<0.001)
	Informal	23.4	34.6	46.6	
Social grants	No	82.6	82.1	80.1	0.66 (p=0.72)
	Yes	17.4	17.9	19.9	
Monthly income	\leq N\$1,100	9.9	18.6	34.6	94.79 (p<0.001)
	1,101–2,100	9.9	16.9	21.2	
	2,101–4,200	14.0	20.3	21.2	
	4,201–12,000	25.6	28.0	13.0	
	12,001+	40.5	16.2	10.0	
	Otherwise	2.5	4.4	18.0	
Lived poverty index	\leq 1.00	86.0	64.5	51.0	54.25 (p<0.001)
	1.01 - 2.00	12.4	26.6	29.2	
	2.01 - 3.00	1.6	7.2	15.2	
	3.01+	0.0	1.7	4.5	
Food security	Secure	50.3	29.2	23.7	47.37 (p<0.001)
	Insecure	49.7	70.8	76.3	
Dietary diversity	Less diverse	28.7	63.9	85.8	47.37 (p<0.001)
	More diverse	71.3	36.1	14.2	

models were required with the kth category as the reference. Traditional Cluster was set as the reference category which gives two logit models, one for Traditional versus Convenience and the other for Traditional versus Supermarket. Table 8 presents the results of the modelling exercise. Household size and housing type did not significantly increase the odds of food shopping at either convenience outlets or supermarkets as opposed to traditional food sources. Household type did have a more significant effect. For example, nuclear households had 13.236 times the odds of shopping at convenience outlets and 9.093 the odds of shopping at supermarkets as opposed to traditional food sources when compared to single person households, controlling for the other independent variables in the model. Similarly, female-centred households had 7.873 and 10.577 times the odds of shopping at convenience outlets and supermarkets respectively

as opposed to traditional food sources when compared to single person households, controlling for the other independent variables in the model.

Household income did not significantly increase the odds of food shopping at convenience outlets as opposed to traditional food sources controlling for the other independent variables in the model. However, there were increased odds of food shopping at supermarkets for almost all income classes as opposed to traditional sources when compared to the highest income quintile controlling for the other independent variables in the model. Of the two food security metrics, the most significant finding was that households that shopped at convenience outlets had 1.598 the odds of being food secure as opposed to traditional food sources when compared to food insecure households.

TABLE 8: Multiple Logistic Regression of Food Source Clusters

Household factors	Categories	Clusters	
		Cluster 1: Convenience	Cluster 2: Supermarkets
		OR (95% CI)	OR (95% CI)
Household size (ref. 6+)	1 member	1.697 (0.402, 7.157)	1.123 (0.389, 3.246)
	2-3	0.359 (0.147, 0.876)	0.241 (0.128, 0.454)
	4-5	0.453 (0.176, 1.166)	0.567 (0.305, 1.053)
Household structure (ref. single person)	Female-centred	7.873 (1.286, 48.186)	10.577 (2.632, 42.508)
	Male-centred	6.612 (1.085, 40.286)	10.789 (2.642, 44.054)
	Nuclear	13.236 (1.872, 93.598)	9.093 (2.002, 41.304)
	Extended	7.223 (1.061, 49.148)	8.222 (1.876, 36.032)
Housing type (ref. informal)	Formal	0.452 (0.19, 1.072)	0.547 (0.316, 0.946)
Net income (ref. N\$12,001+)	<=N\$1,100	0.519 (0.15, 1.793)	1.026 (0.444, 2.37)
	1,101–2,100	0.530 (0.17, 1.655)	1.169 (0.539, 2.536)
	2,101–4,200	0.411 (0.145, 1.161)	0.953 (0.463, 1.964)
	4,201–12,000	0.955 (0.391, 2.331)	2.23 (1.095, 4.543)
Lived Poverty Index		0.36 (0.221, 0.585)	0.59 (0.444, 0.784)
Food security	Secure	1.598 (0.746, 3.422)	0.94 (0.51, 1.733)
	Insecure (ref)	1.00	1.00
Dietary diversity score	Less diverse	0.111 (0.055, 0.222)	0.328 (0.197, 0.546)
	More diverse (ref)	1.00	1.00

Conclusions

The data clearly shows that virtually all of the households surveyed (over 95%) patronize supermarkets, but that supermarkets are far from being their only food source. Many households engage in what McCordic et al. (2018) call cross-platform shopping, procuring food from different types of food outlet during the course of the average month. The Hungry Cities Food Purchasing Matrix (HCFPM) and cluster analysis provide new tools for understanding these kinds of household food purchasing patterns, including in secondary urban centres. Using cluster analysis, the paper reduces a significant number of different food sources into three main types: convenience, supermarkets, and traditional. This classification contrasts with the more standard formal-informal food retail dichotomy (Crush and Frayne, 2011), as it allows the grouping together of like formal and informal sources, as well as market and non-market sources, in the same thematic cluster. The HCFPM shows the purchasing patterns for over 30 different types of staples, fresh produce, frozen and cooked food, and processed foodstuffs. Supermarkets are the most important source for all five staple foods, five fresh foods, two of three frozen foods, and five of ten processed foods. Almost all of the foods in the HCFPM matrix are also obtained by a minority of households from outlets in the Convenience and Traditional clusters, a point to which we return below.

The bivariate analysis of household income and cluster membership revealed clear differences between the clusters. For example, 10% of households in the Convenience Cluster are in the lowest income quintile and 41% are in the upper quintile. The Traditional Cluster equivalents are 35% (lowest quintile) and 10% (upper quintile). In the case of the Supermarket Cluster, by contrast, not only are the lower and upper quintile very similar (19% and 16% respectively) but it is clear that household income is not a significant determinant of whether a household shops at supermarkets. That said, just because almost all households patronize supermarkets, it does not necessarily follow that

they all do so for the same reasons or with the same frequency. Supermarkets tend to be located along the main road or one of the side roads leading out of the Corridor. They are not located in residential areas or suburban shopping malls (as in the capital Windhoek) but most households are able to reach at least one supermarket on foot given the small distances involved. Even then there are distinct patterns of patronage.

Overall, there are two broad types of supermarket patron. This distinction emerged in the multinomial logistic regression which found the odds of supermarket patronage were highest for lowest and highest income households. Another survey question added further probative value to the bimodal odds ratio distribution. All households that shopped at supermarkets were asked to rate various reasons for shopping at these outlets on a three-point scale (agree, disagree and neither). Middle and higher-income households valued the fact that supermarkets have a greater variety of foods (81% in agreement) and better quality food (80%). Lower-income households placed higher value on the fact that foods could be bought in bulk at supermarkets (67% in agreement). The question is whether the bulk purchasers only buy in bulk and, if so, when and why. This raises the issue of the frequency of purchase and the survey data makes clear that 83% of households in the Supermarket Cluster only shop at supermarkets once per month and that they do so primarily to purchase staples in bulk for household use over the course of the month. The heavy dependence on cereal staples is consistent with the low level of dietary diversity in the Cluster, but it is notable that the presence of supermarkets and supermarket shopping do not ensure overall food security for 70% of households in the cluster.

Early iterations of the global supermarket revolution model tended to see the increasing dominance of food systems by global and regional agribusiness corporations as an inexorable process which, according to Reardon and Gulati (2008), “has progressed far and will continue apace for years to come in developing countries.” Although the revolution had come late to Africa compared with other regions, supermarkets would eventually commandeer food

production, distribution, marketing and retailing in African cities. Hitherto, supermarkets had been seen as niche players targeting economic elites in large cities. Proponents of the revolution model argued that supermarkets would eventually tap emerging mass markets accompanying rapid urbanization and become the primary food procurement source for lower-income households and the urban poor as well. As Reardon and Gulati (2008) noted, supermarkets have “now gone beyond the initial upper- and middle-class clientele in many countries to reach the mass market.” They also suggested that supermarketization would fundamentally challenge, disrupt and even replace pre-existing food supply chains and smaller formal and informal producers and retailers “who are not equipped to meet the new competition and requirements from supermarkets.”

The South African supermarket experience is certainly consistent with the precepts and predictions of this model (with one notable exception). The five major supermarket chains have consistently expanded their market share and account for three-quarters of the formal grocery retail segment overall and an increasing share of the market in low-income townships and informal settlements (CCSA, 2019). However, claims about the disruptive effect of supermarkets deprive informal businesses of any agency, adaptability and innovation. Recent research has demonstrated that the informal food sector in large African cities has displayed considerable resilience, adaptability and growth in meeting the daily food needs of low-income households, despite an often hostile regulatory environment (Crush et al., 2017). As Skinner (2019: 104) observes, “despite greater supermarket penetration in many urban areas, informal food retailers – street and market traders, ‘spaza’ or small-scale shops – remain ubiquitous across the African continent.” The supermarket revolution model does not address the issue central to this paper; that is, is there such a thing as a secondary supermarket revolution in smaller urban centres and, if so, is it distinctive in some way or does it follow the path of the big city revolution? For example, a recent project on the food system of three secondary African cities – Kisumu in Kenya, Kitwe in Zambia and Epworth

in Harare – suggests that although supermarkets are present and expanding in number, more traditional sources such as small grocery shops, market vendors and the informal food sector still play the dominant role in household food provisioning (Fuseni et al., 2019; Opiyo and Ogindo, 2019; Tawodzera et al., 2019).

In Namibia, both South African and locally-owned supermarkets have closely followed the South African supermarket revolution model in the capital, Windhoek. Not only do supermarkets command a large share of food retail, they have systematically expanded their geographical reach towards the low-income and informal settlements on the north side of the city. However, studies of the informal food sector in Windhoek also suggest that supermarket penetration and domination does not automatically mean the dissolution of other forms of food retail. Despite an, at times, unfriendly regulatory environment that contrasts with the enabling conditions for supermarkets, the informal food sector has continued to grow, adapting to supermarket expansion, and entering into a more symbiotic relationship with the supermarket sector (Crush et al., 2019; Nickanor et al., 2019).

By examining the urban food system and food sourcing behaviour of households in the northern Namibian urban corridor, this paper sheds new light on supermarketization in secondary cities. The HCFPM and cluster analysis show that supermarkets have established a dominant role in the food system and are patronized by almost all households. The primary ‘loser’ in the secondary supermarket revolution are more traditional food sources with minimal urban agriculture and a potential decline in informal food transfers which will be addressed in a subsequent paper. However, lower-income households engage in monthly target shopping at supermarkets and daily food shopping from convenience outlets. Higher-income households shop for most foods at supermarkets but also regularly patronize convenience outlets such as fast-food and restaurants. Future research on the impact of the secondary supermarket revolution on the urban food system needs to examine the experience and strategies of informal food vendors and whether the

symbiotic relationship with supermarkets observed in Windhoek holds in smaller towns as well. Certainly the evidence presented in this paper for the strength of the convenience cluster strongly suggests that it might.

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