Market Need and Target Location analyser for Micro, Small and Medium Enterprises

Nathaniel O. Solomon

Photo Source: N. Bashkaran

About

There are a large number of small-scale businesses in Nigeria, with many entrepreneurs looking to capitalise on range selling products and products in an increasingly prosperous country. However, new companies face many challenges in succeeding, and as a result, it is reported that over 80% of new businesses fail within their first 5 years.

This document proposes a platform which could be used to assess market needs, helping new businesses understand the potential demand for a range of products and services. A proof-of-concept has been developed showcasing some of the key features of such work.

Background

Micro, Small and Medium Enterprises[1] (MSMEs) account for 80% of trade in Nigeria (ITC, 2013), and these have created 59.6 million jobs across the country (NBS, 2017). However, there are risks

[1] Businesses are classified based on their number of employees. Guidance for Nigeria recommend Micro: 0-9, Small 10-49, Medium, 49-250 (SMEDAN, 2017)

in starting businesses, and analysis from Nigeria shows that over 80% of Nigerian startups fail within their first five years (Stanbic IBTC, 2013).

A fundamental question for businesses when starting up is whether there will be a demand for the service they are producing. Globally, it was stated that the number-one reason for startups failure, cited by 42% of polled startups, is the lack of a market need for their products (CBInsight, 2019). The demand for products can be highly influenced by the location within the country, and a product which is needed in one location may not be needed in another. For example, in creating a clean water supply business, the product (clean water) might not be needed in urban regions where piped water may be available, whilst there is a high market drive for the same product in the rural regions of the same country.

Figure 1 highlights how the market channels are used by businesses based on their geographic extent. 70.5% of businesses responded saying that localities were a key market channel for their business. Again, this highlights the large reliance that businesses have on their location for business.

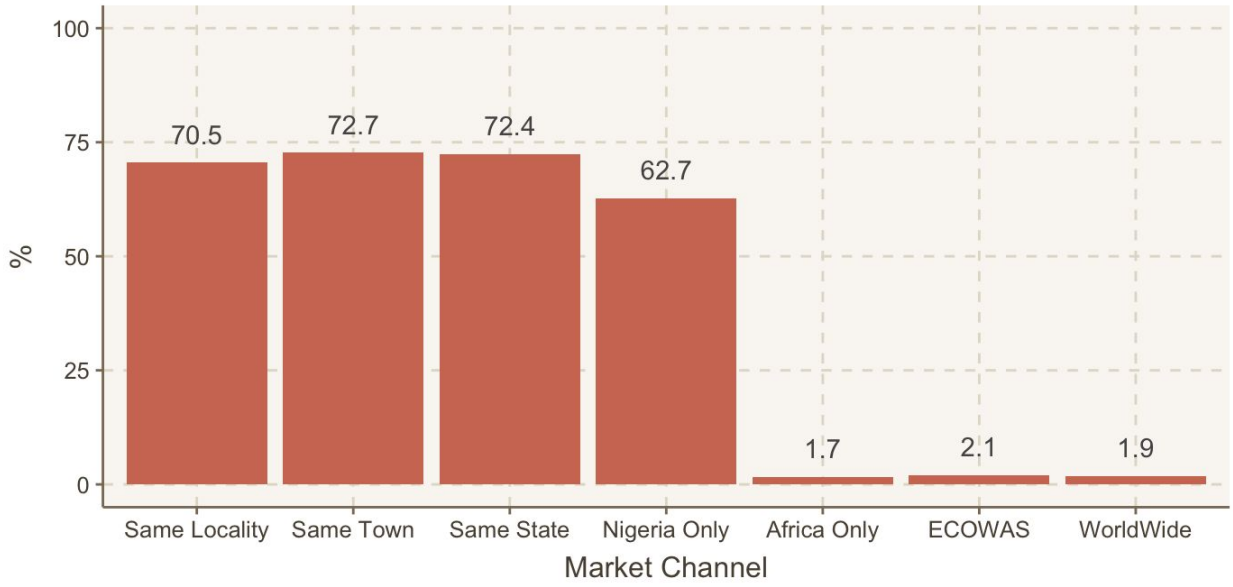

Figure 1: *Market Channels of Products (adapted from NBS, 2017)*

Whilst it is understood the importance of local trade, it can be very hard to predict. The use of location analytics to support decision making has been established previously[2], however, to the author's knowledge, there are few tools available for potential entrepreneurs to assess the potential for a business in Nigeria, and to understand the optimal location for a site to be placed.

The Proposal

This document outlines the idea of a platform to verify the potential opportunity for a market's scalability. Such a platform will predict the potential demand for a product, integrating a range of datasets, and help inform users of the most suitable demand. These insights gained from the

[2] See https://www.latentview.com/blog/using-location-analytics-for-optimal-site-selection/

platform will harness proper decisions that will foster the growth of the business, and in doing so help reduce the chance of failure.

The proposed concept can be subdivided into the following steps:

1. **Collect potentially relevant datasets.** Datasets including demographic and geographic are collected which could be used within the analysis. The aim would be to build an extensive library of datasets which could be used across different types of startup. If available, this data would also include the location of existing businesses in that market.
2. **Develop profiles of consumers who are likely to buy the specified product.** As specified by the user, they will select the target audience for their products based on parameters such as sex, age range, wealth etc. If existing business locations were provided, machine learning techniques will extract key parameters of what makes a site successful automatically.
3. **Statistical modelling / Machine learning.** Based on the target audience and the datasets collected, analysis calculates the spatial distribution of potential demand. This will produce a suitability map which indicates the area of higher and lower demand.
4. **Competitor analysis.** The tool will aim to identify competing businesses within the specified region. If no data of competitors is available within the collected datasets, the user will have the opportunity to manually specify their locations.
5. **Recommend best locations from the specified region where the new business has a market drive.** Based on market needs and existing competition, the tool will suggest the optimal locations for placement.

The proposed methods are designed to be generic enough to be applied to a range of different technologies and markets, while also being providing specific enough guidance to enable decision-making. Example applications include:

1. **Sales of sanitary pads:** Targeting female population between the ages of 15-45. Due to the cost of these products, it would be recommended to target more affluent areas, and areas where education (and therefore sexual health) is more prevalent.
2. **Power generation products** (solar-inverter, windmill etc): Will be aiming for areas of medium wealth, potentially distant from the national power network. Purchasers would likely be more affluent and have an existing power system (i.e. a diesel generator).

Online Platform

A key part of the proposed tool is a web platform. The tool would be designed to allow users to input information about the business (i.e product, market target, business region preference etc.), and allow them to interact with the results to inform their decision-making. The platform would minimise the technical requirements for users to complete the statistical modelling which provides the recommendations.

The web platform could also enable the collection of data to support the modelling. Although the primary audience for the tool is the business owners, it would be suggested that ways enable crowdsourcing data from consumers. For example, the web platform can be used by product consumers to indicate whether they need certain types of products and services in their locality.

Proof of concept

In order to test the concept, initial analysis will be conducted on relevant datasets, to test the idea of identifying target locations for sanitary pad sales. This example was selected as a rapidly expanding market with scope for expansion (IMARC, 2018), led by increased economic prosperity and as there is an increase in education in Nigeria around the use of sanitary products, which has created an increased demand for the products.

Data collection

Several datasets were used for the analysis, as summarised in Table 1. Firstly, GRID3 age and sex population estimates (WorldPop, 2020) were used to determine the number of people within the target region, with females between the age of 15 and 49 considered.

Additional data were used which relate to the purchasing power/wealth of the population will be utilised, to inform areas to target the product. Firstly, Gross Domestic Production (GDP) was used, derived from GDP per capita (PPP) (Kumma et al, 2020). There is a strong relationship between wealth and accessibility to sanitary products and therefore regions of higher wealth are more likely to need a product. Secondly, Female Literacy (DHS, 2020) was used to provide a further indicator of potential demand for a product, as it is suggested that higher levels of literacy is correlated with the use of sanitary pads (Omo-Aghoja, 2013; Kanyandi, 2018).

Finally, the distance to roads was considered (OSM, 2020). This is an important business consideration, as sites closer to a road network provide more convenient access. This would be an important consideration for a business.

Dataset	Information	Type	Resolution	Source
Gridded Population Estimates	Population estimates for females between the age of 15 -49	Raster	100m	WorldPop, 2020
Settlement locations	Locations and names of settlements in Nigeria	Point	NA	GRID3, 2020
GDP per Capita	Raster of GDP per capita of each grid cell.	Raster	1km	Kumma et al, 2020
Female Literacy	raster of % of women who are literate for each grid cell.	Raster	1km	(DHS, 2020)
Roads	Distance from primary, secondary	Vector	NA	OpenStreetMap (OSM), 2020

Table 1: *Datasets used within analysis*

The location placement is only interested in placing businesses in settled areas. The settlement point dataset was therefore used, with the data for the 4 input layers (population, GDP, literacy, roads) extracted for these locations.

Analysis

Multi-criteria-decision analysis[3] (MCDA) was used to identify the potential locations for new facilities. The intention of this analysis is to score locations against the above criteria, and to come up with an overall suitability score for a given location.

As we do not not have data on locations of known existing businesses, it is not possible to complete statistical analysis to identify parameters which makes a location suitable. Such analysis could be useful for understanding if there is a minimum threshold for the selection of the site. For example, analysing existing sites might reveal that all locations are placed in locations with at least 1000 people within 1km of the business In the absence of this data, we can instead provide threshold values, with these values used to help score sites. The following values were derived:

- **GDP per capita greater than $2000:** cost can be a major barrier for access to sanitary products.
- **Settlements within 2km of roads:** this was considered for business reasons. We would like to select sites which are easily accessible.
- **Literacy greater than 2%:** there is a strong correlation between literacy and use of sanitary pads. Areas with higher literacy are more likely to demand more products.
- **Target population greater than 500:** again for business reasons, this number was selected as a minimum threshold of potential customers required for a viable business.

The analysis was completed using QGIS, Python and R. Within the web platform, this analysis would be designed to be run automatically in response to the user requests.

Results

Figure 2 shows the results for Nigeria indicating the results of the analysis. Based on the selected cut-offs selected, there were 2327 sites which met all four conditions (as indicated in Yellow).

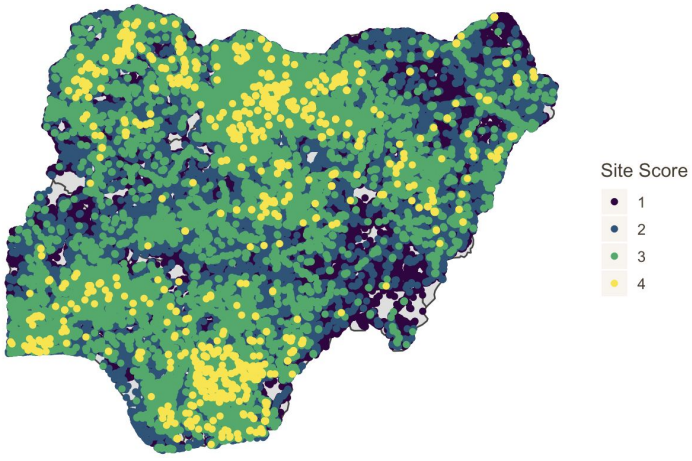

Figure 2: *Sales suitability map for sanitary pads MCDA analysis*

[3] ESRI provides a good primer on MCDA.

Note, that if the business was determined to cover a larger area, the analysis could be adjusted to include a larger buffer distance. This might apply for specialist shops. For example, energy generators plants may instead only be based in the larger towns, but cover a bigger radius of the surrounding area.

Future Developments

It would be possible to extend the MCDA analysis to help priortise areas. This would extend the existing cut-off values, and place higher priority on areas which have higher values for the selected parameters. For example, higher priority will be placed on areas with higher population densities.

Within the existing analysis, it was required that the suitability criteria for a new site was manually specified using personal insight. While this provides useful indicators, such insights are inherently subjective, and therefore are at risk of being less reliable than empirical assessments. It is therefore proposed that regression analysis is used to assess the locations of known facilities for the sales of the product, to identify the key parameters which these sites have. These parameters could then be used as the basis of the MCDA tool for placement.

Additional Datasets

This analysis so far was based on geographical variables. In addition to extending the analysis, it would be valuable to add additional data into the model. This would include Psychographic variables (such as attitudes, opinions, interests, and values) and behaviours (such as media habits, purchase frequency, brand loyalty, and channel usage).

Modelling Techniques

Although the current work utilises MCDA, the availability of more data would enable the work leverages machine learning for industrial efficiency. The concept possesses the ability to give real time market insights from a few product's information supplied by primary users (a representative of a startup business). Most importantly, it will help startups recognize the best market target location that will harness the growth of their products.

Measuring Performance

To measure the success of the concept, after about five years of getting users on the platform, a survey on the state of business from 100 - 500 businesses that started within five years can be carried out with users of the platform being 50% of respondents and the other 50% for non-users of the platform. Also, a review from users of the platform on the quality of the service rendered and how the platform has harnessed growth and expansion in their businesses.

Acknowledgements

This concept note was developed by Nathaniel O Solomon, with the support of Alina Game, Michael Harper and Wole Ademola Adewole from GRID3 / Flowminder. This work was part of the GRID3 Data Challenge, a competition organised by GRID3 to mentor and strengthen capacity in geospatial analytics of selected participants of Data Science Nigeria's 2019 Artificial Intelligence Bootcamp.

References

Brownson, C. (2020). Internal Factors that Stimulates Business Startups in Southern Nigeria. *European Journal of Business and Management Research*, *5*(4). https://doi.org/10.24018/ejbmr.2020.5.4.356

Camilleri, M. A. (2018). Market Segmentation, Targeting and Positioning. In *Travel Marketing, Tourism Economics and the Airline Product* (Chapter 4, pp. 69-83). Springer, Cham, Switzerland.

Johnson, Jacob B. 2010. Using GIS as a Marketing Decision Support System to Help Amari Studios Locate New Customers and Effectively Direct Marketing and Advertising Efforts. Volume 12, Papers in Resource Analysis. 13 pp. Saint Mary's University of Minnesota University Central Services Press. Winona, MN. http://www.gis.smumn.edu.

Kummu, Matti; Taka, Maija; Guillaume, Joseph H. A. (2020), Data from: Gridded global datasets for Gross Domestic Product and Human Development Index over 1990-2015, v2, Dryad, Dataset, https://doi.org/10.5061/dryad.dk1j0

Lynn, M. (2011). *Segmenting and targeting your market: Strategies and limitations* [Electronic version]. Retrieved [insert date], from Cornell University, School of Hospitality Administration site: http://scholarship.sha.cornell.edu/articles/243

Musyoka, S.M. & Mutyauvyu, Maithya & Kiema, John & Karanja, Faith & Siriba, David. (2007). Market segmentation using geographic information systems (GIS): A case study of the soft drink industry in Kenya. Marketing Intelligence & Planning. 25. 632-642. 10.1108/02634500710819987.

McKinlay S, Jefferys M, Thompson B. An investigation of the age at menopause. *J Biosoc Sci*. 1972;4(2):161-173. doi:10.1017/s0021932000008464

SMEDAN, 2017. National Policy on Micro, Small and Medium Enterprises

WorldPop. 2020. Bottom-up gridded population estimates for individual age-sex groups in Nigeria, version 1.2.1. WorldPop, University of Southampton. doi:10.5258/SOTON/WP00661