

Data Mining Approach for Target Marketing SMEs in Nigeria

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Abstract: Presently, in addition to the lack of funds experienced by SMEs in Nigeria, the main challenges experienced by SMEs (Small and Medium Enterprises) in Nigeria has to do with them not being able to understand and the apply marketing concept. Also there are a lot of resources being wasted in marketing campaign which does not target anybody in particular. This study is therefore focused on finding the target market of SMEs using the K-means clustering technique in combination with sentiment analysis, also known as opinion mining. The study also aims at recommending the best medium to market these SMEs as discovered from the output of the analysis. The result of this research will give positive direction to improving the profit of small and medium business through target marketing. Also, this study is not trivial because it will help to reduce marketing cost through target marketing. The study also helps to discover the opinion of the populace on the small and medium business and the medium through which they can be targeted. This discovery will definitely form solid foundation for further marketing action and improve their profit.

Keywords: Data Mining, K-means Clustering, Target Marketing, Sentiment Analysis, SME, Opinion Mining,

1. Introduction

According to Gulani and Aisha (2012), SMEs has no universally accepted definition, the grouping of enterprise as small, medium or large, is different from country to country. In Nigeria, in 2004, Chukwemeke defined a small scale business as one which has a total asset including capital, equipment, plant and working capital as less than N250,000. Such business is said to employ fewer

than 50 full time workers. SME was defined by the Central Bank of Nigeria (CBN, 2011) as an enterprise whose annual turnover is between N25, 000- N50, 000. NIDB (Nigerian Industrial Development Bank) is also noted to have defined Small business as enterprises that their investment and working capital is not more than N750,000. On the other hand it defined as medium business, such that have

projects costs that ranges between N750,000 to N3 million (Ogbadu, 2012). According to (Pusatli and Misra, 2011), SMEs (involved in software development) can be described to have financial and employee Constraints.

According to (Eniola, 2014), SMEs have taken a leading role in the growth of the Nigerian economy; it is the driving force and establishes an important mainstay of the Nigerian economy. Also, SMEs has the ability to provide employment to the populace, improve local technology, diversify output, develop indigenous entrepreneurship and provide forward integration with large scale industries (CBN, 2011b). Despite this claim, SMEs has not been able to meet up to expectation (Osotimehin et al., 2012). Research also reveals that surviving challenges of SME managers tend to overshadow the importance of marketing (Scheers, 2010).

Nigeria SMEs have not done so well despite the fact that it constitute more than 90% of Nigerian businesses, its contribution to the nation's GDP is below 10% (Gbandi and Amissah, 2014). This could be attributed to poor performance of SMEs as regards making profits, through customer patronage amongst others such as lack of adequate financing and so on. This study is therefore aiming to help such business make more profit by improving their customer base through target marketing. In this research paper, we refer to target marketing as the ability to segregate a market into smaller groups. These groups of buyers will have clear needs, characteristics, or behaviors who might require different products or marketing mixes." (Sulekha, 2011).

According to (Sulekha, 2011), there are four main segmentation bases which includes the following; geographic segmentation (refers to geographic region, population density or climate); demographic segmentation (refers to age, sex, size and family type, etc.); psychographic segmentation (refers to life-style variables); and behavioural segmentation (refers to purchase occasion, benefits sought, user status). According to (Ogundele et al., 2013), the Nigeria marketing environment contains unique characteristics that are quite different from the developed economies and other developing countries. These include infrastructural problems, poor government support programmes for SMEs, attitude based problems on the part of the operators of SMEs and the officials of government supervisory agencies.

According to (Ogechukwu et al., 2013), The main problems of marketing encountered by SMEs in Nigeria has to do with the fact that they do not understand, and do not know how to apply marketing concept. These businesses do not have the knowledge and skills required for basic marketing. Important marketing ingredients which include marketing research, market segmentation, and marketing planning and control are often overlooked as not important. This will ultimately lead to poor quality products, unawareness of competition, poor promotion, poor distribution, and poor pricing methods. It is therefore important for SMEs to focus on target marketing in order to grow your business. This growth involve increased sales, a larger set of employees or capital resources (land, buildings and other improvements), or

the diversity and number of enterprises integrated into the operation (Thilmany, 2008). Target marketing also contributes to the design strategy for profitability and provides the chosen segments that can improve the company's competitive edge (Raicu, 1998).

The rest of this paper is structured as follows; section 2 is a review of literature, section 3 is the methodology, Section 4 is the presentation of the findings in the research, section 5 is a discussion of the findings and it also includes appropriate recommendation. Section 6 is the conclusion; Section 7 is the appendix while section 8 is the references.

2. Literature Review

Target marketing has been viewed as a major marketing concept and has been one of the main target of marketing research literature since 1960 (Wind and Bell, 2007). It is offering the right product/services to the customer at the right time, in the right location and using the proper channel. It is also a very important opportunity provided for small businesses forced to compete against larger competitors to be able to succeed. Conceptually any business strategy is usually founded on understanding, meeting and even exceeding the expectations of target segments" (Wind and Bell, 2007). The following are the components of target marketing (1) data collection, (2) application of models and frameworks and (3) resource allocation and differential action based on segment (customer) value. According to (Sulekha, 2011), the second component which is also known as Segment congruence analysis usually progresses in the following manner:

1. Fundamental dimension-reducing techniques which includes factor and cluster analysis are involved in identifying a number of segmentation bases .
2. These segmentation bases will serve as categorical variables and a multidimensional, contingency table is formed.
3. Various categorical data analysis tests will be performed on the multi-way table in order discover the nature and extent of relationships its dimensions.
4. A segmentation base is that discovered as the distinguished base and a model is developed for predicting this base from other variables.

Some approaches to discover target marketing in literature includes using Independent sample t-tests to categorizing products to understand the resulting marketing communication outcome measures (Meyers, 2005). Understanding customer needs by analysing interviews and field notes using Atlas.ti, a quantitative data analysis software application (Overton et al., 2008). Other methods of analysing data for target marketing involves testing hypotheses concerning tests of group means. These tests are performed using "parametric tests" and include such techniques as the F, t, and z tests (Smith and Albaum, 2010).

In their research on Knowledge management and data mining, Shaw et al. 2001, recommended that, data mining will improve knowledge management process. They also observed that marketers will have better knowledge of their customers through

data mining, ultimately leading to better service to customers.

According to (Radhakrishnan et al., 2013), Data mining techniques have been used to uncover hidden patterns and predict future trends and behaviors as regards target marketing in financial markets. (Rajagopal, 2011) was able to identify the high-profit, high-value and low-risk customers by using data mining technique called customer- clustering. IBM I-Miner was used to develop the algorithm. (Rossi et al, 1996) used purchase history data for target marketing using random effects choice model to measure household preferences and sensitivities. Their technique was based on Bayesian method of inference.

YongSeog (2004) proposed a data mining approach for customer targeting using artificial neural networks (ANNs) guided by genetic algorithms (GAs). Their model is able to predict an optimal target point where expected profit from direct mailing is maximized. (Abari et al., 2012) selected target market based on fuzzy analytic hierarchy process (FAHP) and technique for order preference by similarity to ideal solution (TOPSIS) methods. FAHP method was used to determine the weights of the criteria by decision target market and then rankings of the target market was determined by the TOPSIS method.

Finally, (Geloven, 2002) combined existing target selection such as linear and logistic regression, a feed forward back propagation neural network and a fuzzy modeling algorithm to analyse data for direct marketing. The strength of the approach is that the structure and specific characteristics of each feature subset are maintained and scored individually.

In 2011, Rajagopal was able to identify high-profit, high-value and low-risk customers using clustering algorithm which was done using the IBM I-Miner. In this work, further work was suggested on using more detailed behavioural data and opportunity identification using association algorithms within the segments discovered. (Raicu, 2003) proposed a theoretical data mining framework for automatic gathering of consumer data for companies and methods for discovering the relationships between customers' preferences and the product's physical characteristics. (Ayetiran and Adeyemo, 2012) was able to identifying customers who are more likely to respond to new product offers using Naïve Bayes. Finally, (Sing'oei and Wang, 2013) provided a comprehensive framework for direct marketing research using data mining and used a case study of bank marketing campaigns to evaluate the feasibility of the framework.

The following are the inadequacies of the reviewed literature; firstly, there is need to reconceptualise problems with respect to operating in the global information age and building expert system or knowledge-based systems that can help management to select and manage the portfolio of segments (Wind and Bell, 2007), also there is need further research in market segmentation area in different specified areas to find the dominating basis of market segmentation (Sulekha, 2011) and the need to help marketers further understand how to pair up their product with visual elements in advertising that will be most conducive with meeting a marketing goal (Meyers, 2005). In

addition, Rajagopal (2011), recommends further research on segmentation (clustering) using more detailed behavioral data and opportunity identification using association algorithms, (Abari et al., 2012), did not consider other multi-criteria methods to select target market. Finally, there is the need to find out how cross validation could better be integrated into the combination of linear and logistic regression, a feed forward back propagation neural network and a fuzzy modeling algorithm for directing marketing. (Geloven, 2002).

In order to attempt some of the observed research gaps, this paper aims at finding the target market of SMEs using data mining techniques. This will help in planning marketing campaigns that will make provision for effective marketing and form the basis for marketing expert systems. The problem investigated is presented in the following research questions.

1. What kind of customers is likely to be interested in doing business with a particular SME?
2. With what medium will they want to do business with this particular SME?
3. What is the opinion of the customers on the mediums investigated in no (2)?

3. Methodology

In order to carry out this research, data was collected through a survey instrument. 400 questionnaires were administered and 348 were harvested back from the respondents. The questionnaires were administered through both paper-based questionnaire and online questionnaire survey. The

questions contained in the questionnaire are described in section 8 (Appendix).

In this research, the kind of customers that is likely to be interested in doing business with a particular SME is determined using sentiment analysis while k-means clustering algorithm will be used to determine the mediums that is best used to market these SMEs and the opinion of customers on the marketing mediums.

a) Sentiment analysis: The unstructured part of the questionnaire is used for the Sentiment analysis, free form textual response from the questionnaire was extracted and tokenized. The extracted tokens were then transformed into lower case which was followed by filtering of stopwords. In order to prepare the textual corpus for sentiment analysis, it was stemmed using the wordnet dictionary. All the above described process was achieved using the rapidMiner studio (<https://rapidminer.com/>). Sentiment analysis, also called opinion mining, is used to analyse people's opinions, sentiments, evaluations, appraisals, attitudes, and emotions towards entities such as products, services, organizations, individuals, issues, events, topics, and their attributes. It focuses on opinions which express or imply positive or negative sentiments (Bing, 2012). This research uses the "Extract Sentiment" operator in rapid miner studio to extracts sentiment based on SentiWordNet 3.0. The operator uses a WordNet 3.0 and a SentiWordNet 3.0.0 database to extract sentiment of an input document. The sentiment value is in range [-1.0,1.0] where -1.0 means very negative and 1.0 means very positive. (<https://rapidminer.com/>)

b) K-means Algorithm: Both the structured and unstructured part of the questionnaire is used to determine the best medium to market a particular SME and the opinion of respondents on the marketing mediums. According to (Satish et al., 2012), K-means algorithm is one of the most widely used hard clustering techniques.

The algorithm works as follows:

- Specify the number of clusters (k in k-means)
- Randomly pick k cluster centres in the data space
- Allocate data points to clusters according to on the shortest Euclidean distance to the cluster centres
- Re-compute discovered cluster centres by averaging the observations allocated to a cluster.
- Repeat steps three and four until convergence criterion is satisfied.

The k-means clustering was used to discover major marketing channels of selected SMEs. To achieve this, all the unstructured response is combined and rapid miner was used to cluster the data.

4. Findings

Sentiment Analysis: All the response to the unstructured part of the questionnaire was combined and sentiment analysis was carried out to generate sentiment values. Table 1 is a detailed report of the sentiment analysis result of the unstructured part of the questionnaire. This report is also presented as a line graph in Figure 1. A total of 35 SME

categories were investigated and listed as follows; Auto Dealers, Gas Stations, Carwash, Tailors, Business, Consultants, Rental & Leasing, Printing &, Publishing, Communications, Marketing, Employment Agency, Educational Resources, Engineers & Surveyors, Contractors Architects, Construction, Computer Programming and Web Design, Computers & Electronics, Catering & Supplies, Movies, Event Planners, Writers, Entertainment Artists, Exercise & Fitness, Dry Cleaners, Barber & Beauty Salons, Boutique, Home & Garden, Health &, Medicine, Fast Food & Restaurant, Supermarket, Real Estate, Travels Hotel & Motel, Packaging & Shipping, Transportation. Out of these 11 were selected, as revealed in table which are the SME category that have above 50% of the investigated respondents interested in doing business with them.

From Table 1 and Figure 1, it is obvious that for all the SMEs investigated, the percentage of respondents interested in them is above 50%, this gives the platform to continue further investigation on these SMEs. Also obvious is the fact that the percentage of positive opinion for all the SMEs is low ranging between 19 to 23 percent. The table also presents the demography of the respondents that favours or not favour these SMEs

Table 1: Summary of Sentiment Analysis Results

SME Category	Total% interested in the SME at all	Total % not interested in the SME at all	%Of positive Opinion	Description of the Positive Opinion demography	%Of negative Opinion	Description of the demography of Negative Opinion
Tailors	86	14	19	Both Male and Female, Mostly Single and mainly between 21-30 years, Mostly educated with an average income	81	Both Male and Female, Both married and single, But Mostly between the ages of 31-40 and stay mostly in Lagos State
Communications	68	32	19	Mostly Male, Mostly Single, mostly above 21 years with average income	81	No prominent Demography
Computers& Electronics	65	35	23	Both Male and Female, Mostly single between 21-30, average income and mostly Yoruba tribe	77	Mostly stay in Lagos
Movies	51	49	20	Mostly Male, Mostly Single	80	No prominent Demography
Exercise&Fitness	51	49	19	No prominent Demography	81	No prominent Demography
Boutique	74	26	22	Mostly B.Sc Holders with Average Income	78	No prominent Demography
Health&Medicine	75	25	19	No prominent Demography	81	No prominent Demography
Fast Food & Restaurant	71	29	18	Mostly Male, who are single between the age of 21-30	82	Both Male and Female, Between the age of 31-60
Supermarket	80	20	21	No prominent Demography	79	No prominent Demography
Travels	70	30	21	Mostly Single, Male between the ages of 21-30	79	Average Income earners
Transportation	75	25	22	No prominent Demography	78	No prominent Demography

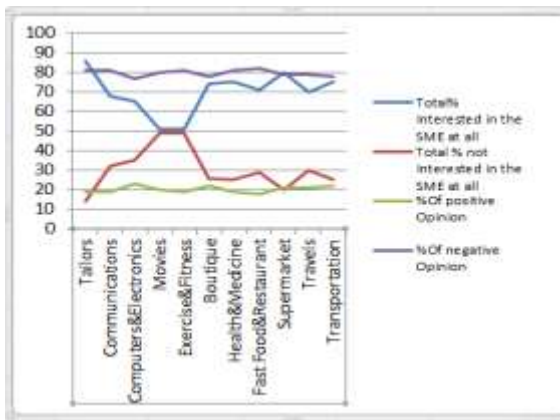


Figure 1: Graph of percentage against SMEs

Clustering: The clustering analysis result is presented as discovered from the structured data from the questionnaire response. All the attribute of the unstructured data were combined into one file and were clustered. K-means algorithm was performed 348 instances of data (total number of

respondents) with 145 attributes (number of distinct words that were clustered). The algorithm ran for 10 iterations, in which 6 clusters were generated. The choice of the number of clusters is to be able to discover at least 6 major directions of the association of marketing channels to SMEs.

A summary of the six major themes talked about in the combined responses include the following as discovered from the clusters.

Cluster 0: focused mainly on the following attribute Supermarket = YesSupermarket, Barber&BeautySalons = YesBarber&Beauty, InternetSubscriptionAmount = 1000-5000, OLX = NoOLX, Whatsapp = YesWhatsApp, Yahoo = YesYahoo, Facebook = YesFacebook, EmailCheck = YesCheckEmail, Google = YesGoogle. This can be interpreted that the SMEs in the category of Supermarkets and Barger and Beauty shops will be greatly favoured if they target their clients through the following medium, Yahoo, whatsapp, Facebook, Email and google.

Cluster1: Facebook = focused mainly on YesFacebook, DoingBusinessThroughSMS = NoDoBusinessSMS, DailyCommunicationMedium = Mobile phones, Google = YesGoogle, Tailors = YesTailors. This can be interpreted as targeting SMEs in the Tailoring categories through Facebook, mobile marketing (SMS) and google.

Cluster2: focused on Google = YesGoogle, Facebook = YesFacebook, EmailCheck = YesCheckEmail, Whatsapp = YesWhatsApp, Catering&Supplies = NoCateringnumber, This can be interpreted as marketing Catering and supplies business through google, email, whatsapp and facebook.

Cluster3: focused on Google = YesGoogle, Transportation = YesTransport, Whatsapp = YesWhatsApp, Supermarket =

YesSupermarket, Facebook = YesFacebook, Health&Medicine = YesHealth&Medicine. This can be interpreted as marketing Transportation, supermarket aand Health& Medicine through facebook, google and whatsapp.

Cluster4: This cluster focuses attributes such as: DoingBusinessThroug Email = NoDoBusinessEmail, Engineers&Surveyors = NoEngineers, AutoDealers = NoAutoDealers, BusinessConsultants = NoBusinessConsultant, Writers = NoEventWriters, Movies = NoMovies, Home&Garden = NoHome&Garden. This can be interpreted as people who are not interested doing business in the following SMEs..... are also not interested in doing business through the email.

Cluster5: This cluster focuses attributes such as: Facebook = YesFacebook, Google = YesGoogle, AutoDealers = NoAutoDealers, Hotel&Motel = NoHotels. This can be interpreted as even though respondents do not do business with AutoDealers and Hotels and Motels, they are very active on face book and Google.

The unstructured data used for sentiment analysis was also clustered to discover the opinions of respondents on the marketing medium. The results will also help to clarify the reason for the high negative opinion value generated in the sentiment analysis. The clustering generated 2 clusters as described below;

Cluster0: This cluster focuses attributes such as: *Single, read, dancing, particular, education, chat, cook, God, listening, family, study, idea, music, sew, play, tennis, movie, sleep.*

These are majorly hobbies, meaning these are the hobbies that majority of the respondents engage in. This cluster does not reveal much as regards the reason for the high negative opinion..

Cluster0: This cluster focuses attributes such as: *fraudulence, easy, access, speed, network, failure, scam, delivery, low, wrong.*

These words reveal the reason for the high in negative opinion in the sentiment value analysis.

5. Discussions and Recommendations

In order to answer the first research question; *What kind of customers is likely to be interested in doing business with a particular SME?* We discovered that out of the 11 SMEs investigated, as presented in Table 1, young people between the ages of 21 to 30 years old are interested in doing business with the following SME categories Tailors, Computer and Electronics, Fast food and Restaurant and the Travels. These age group are not particularly opposed to any kind of business. Older people above 30 years old expressed negative opinion towards Fast food and Tailors. Also, despite the low income, average income earners are interested in doing business with Tailors, Communications, Computer Electronics and boutiques. Also of interest is that, singles males expressed high interest in Communications, Movies, Fast food and Resturants and Travels.

For the second research question; *with what medium will they want to do business with this particular SME?* We discovered that they would do business with Supermarket, Barber & Beauty Salons, through WhatsApp, Yahoo, Facebook, Email and they visit google

alot. They will do business with Tailors through Facebook, SMS (mobile phones) and they visit google a lot., They will do business with Catering & Supplies through Facebook, Email, Whatsapp, and visit google a lot. They will do business with Transportation, Supermarket, Health & Medicine through facebook, google and whatsapp. They will not do business with Engineers & Surveyors, AutoDealers, Business Consultants, Home & Garden, Writers and Movies through email. Finally, Though respondents do not do business with AutoDealers and Hotels and Motels, they are very active on face book and Google.

To answer the third research question, which is, *What is the opinion of the customers on the mediums investigated in research question no (2)?* we discovered that the opinion of respondents are highly negative towards doing business with SMEs through the internet and mobile phones. Word like *fraudulence, easy, access, speed, network, failure, scam, delivery, low, wrong* are the focus of cluster 1 in the clustering analysis, and they help to describe the reason for this high negative opinion. It is therefore clear that the reason why most respondents have reservations about these mediums is because of frauds, network failure, scam etc.

Based on the results of the analysis, it is evident that most Nigerians investigated have come on board with the advance in technology which has introduced internet and mobile ways to dong business. They find it convenient to use the internet and mobile services though they have some reservations towards

this. It is therefore important that any SME who is aspiring to overcome the problems currently experienced by SMEs in Nigerian which includes the lack of understanding and application of concept needs to get on board the internet and mobile platform. This is because it is able to provide the necessary leverage required to overcome the challenges. Also these mediums will help improve the profit and competitive edge of these SMEs and thereby overcoming challenges such as poor quality products unawareness of competition, poor promotion, poor distribution, and poor pricing methods. More specially, we make the following recommendations:

- *SMEs should have more online presence*

Presently in Nigeria today, an average SME does not have an online presence. It is therefore recommended since it is cheaper for SMEs to market themselves online, and they are also able to better target their customers, it is recommended that SMEs should be focused more on having a stronger online presence. In addition to these, they are also to create more awareness to the general Nigerian population who still have reservation getting on board the internet and mobile medium and look for ways to make their services available online at a cheaper rate.

- *Create secured transaction process.*

Apart from having an online presence, SMEs need to review their transaction modalities to be able to accommodate models which will make the customers secure enough to do business with them.

7. References

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Examples of these include for examples payment on delivery, verifiable address on the website. Also due to the present security concerns in the country, it is important to provide security tips to their clients to that they do not fall prey of fraudulent act for example, advise them not to meet their sales representative in an hidden and unsecured place but in a public place such and Fast food joints.

6. Conclusions and Further Study

In conclusion, the discovered result of the analysis is able to give positive direction to improving the profit of small and medium business. This is because these establishments are able to discover their target market and focus their marketing campaigns on them. Also, this study is not trivial because it will help to reduce marketing cost through target marketing. The study also helps to discover the opinion of the populace on the small and medium business and the medium in which to get to them. This discovery will definitely form solid foundation for further marketing action for them to improve their profit. For example the knowledge of the fear of online fraud can help these businesses plan models in which to put the customers at ease if they do business with them through these medium. For further work, we plan to involve big data analysis so as to have a comprehensive source of the unstructured data effectively. According to Khan et.al., 2015, the new trends of research in data mining for target marketing is interactive data mining methods and real-time data mining.

market selection using fuzzy analytic hierarchy process (AHP) and technique for order preference

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8. Appendix

Structured:

1. What is your Gender?
2. What is your marital status?
3. What is your age range?
4. What is your Occupation?
5. What is your highest Academic qualification
6. What State of Nigeria do you live in?
7. What particular town in this State do you live in?
8. Are you computer literate?
9. What is your average income per month
10. What are your hobbies?
11. What is your Income range?
12. What is your tribe?
13. What is your religion?
14. How much can you afford on internet subscription per month?
15. Rate the following website according to the frequency of your visiting them.
Youtube, whatsapp, facebook, twitter, google and Personalblogs.
16. Rate the following categories of Business Enterprise according to the frequency of your doing business with them.
17. How often do you check your email?
18. How often have you been convinced to do business through SMS marketing?

Unstructured:

1. What Interests you most in life?
2. What attracts you most to doing business with the select SME on the internet?
3. What do you hate most about doing business with the selected SME on the internet?
4. What attracts you most to doing business with the selected SME on the mobile phones?
5. What do you hate most about doing business with the selected SME on the mobile phone platform?