Consumer preference for cement brands used in concrete production: the Ghanaian perspective

Stanley Owuotey Bonney¹, Jianxue Song¹*, Zhang Jingwei¹ and Yi Peng²

Abstract: The cement industry is rising rapidly along with the building industry globally. This makes it possible for more competitions that provide customers with preference considerations. The study aimed to contribute to knowledge by exploring consumer preferences for cement brands and factors that influence their selection of cement used for concrete production in Ghana. The study employed a quantitative survey approach. The study comprised of private homeowners (70.7%) and construction/estate companies (29.3%) in four major cities in Ghana. Purposive and accidental non-probability sampling techniques were adopted. There were 741 respondents to the study survey. The study found that consumers’ preference for a particular cement brand were significant for Ghacem (F = 0.81, P < 0.01), Diamond (F = 0.71, P < 0.01), Dangote (F = 0.70, P < 0.01), CEMAF (F = 0.69, P < 0.01), Dzata (F = 0.62, P < 0.01), SOL (F = 0.61, P < 0.01), Supacem (F = 0.57, P < 0.01) and Savannah Cement (F = 0.55, P < 0.01). The findings further showed that the majority of consumers are influenced by factors such as brand name, durability, easy to work with, well packaged, available in nearby shops, and external factors such as recommendations from professionals, and friends/family. Among the demographic factors, gender (F = 0.686, P < 0.01), age (F = 0.577, P < 0.01), the duration of cement usage (F = 0.358, P < 0.01), and educational background (F = 0.038, P < 0.01) were found to have a significant influence on consumers’ preference of a cement brand. This indicates that brand preference exists among consumers due to demographics and influencing factors, implying that manufacturers and marketers could introduce product differentiation using these variables.

ABOUT THE AUTHORS
Stanley Owuotey Bonney is a doctoral fellow at the Zhengzhou University, China, His area of interests is; ready-mix concrete production, health and safety monitoring of projects. Song Jianxue is a professor of industrial engineering, at the Zhengzhou University. His area of interest includes project management, construction safety. Zhang Jingwei, is a senior engineer of civil engineering, main area of interest includes infrastructure rehabilitation material and technique. Yi Peng, is the general manager of Jingwei Construction Material Co., Ltd. main area of interest includes; production management of ready-mix concrete.

PUBLIC INTEREST STATEMENT
The availability of different cement brand products in the Ghanaian construction industry creates problems for consumers in their tastes and decision-making processes. Understanding the needs and desires of consumers by advertisers is, therefore, key to directing the competitive landscape and targeting consumer segments in the Construction industry of Ghana. The study assessed the consumer’s preference for cement brands and the factors leading to their preference for a specific brand for concrete production. The paper suggests that brand preference exists among consumers due to demographics and influencing factors such as trusted brand name, the durability of cement, ease to work with, well packaged, availability, and external factors such as recommendations from professionals implying that manufacturers and marketers could introduce product differentiation using these variables.
1. Introduction

In construction engineering, two major issues have always been the subject of research: one is the need for cement as a raw material for concrete, which is the most important building factor in the field, and the other is how to enhance the design requirements for corrosion resistance and the lifetime of concrete (Karaşin & Doğruyol, 2014). Concrete is the most commonly used man-made building material that is second only to water as the most commonly used substance on the earth (Gambhir, 2005). Concrete demand in 2019 amounted to USD 656.1 billion and is expected to increase over the coming years as a result of rapid global infrastructure expansion (Grand View Research Inc, 2020).

Ghana is one of several African countries supplying Portland cement at a commercial stage. Its local factories can produce about 7.4 million tonnes of cement per year, which is 2.4 million tonnes higher than the annual consumption of the commodity in Ghana, with the housing sector being the main driver of demand. However, the local industry faces tough competition as hundreds of thousands of tonnes of bagged cement are imported into the country each year (CSI, 2009). This has however exposed consumers to alternative preferences of cement brands for concrete production in the Ghanaian markets.

The availability of branded cement products on the market creates problems for customers in their tastes and decision-making processes (Halkias et al., 2016; Kotler et al., 2009). Understanding the needs and desires of consumers by advertisers is, therefore, key to directing the competitive landscape and targeting consumer segments (Brassington & Pettitt, 2003). Consumer expectations for products include the rating of goods and services according to how much they gain from the products (Hinson et al., 2006; Solomon et al., 2014). As a result, customer expectations for a product are seen as representing their inner views and perceptions (Cao et al., 2010). Basavaraj et al. also added that customers must compare the characteristics of all competing goods before making a final decision (Balabanis & Siamagka, 2017; Basavaraj et al., 2015). Consumers expect consistency, instant drying, price, packaging, distribution, and delivery methods from branded cement products (Amutha & Vinayak, 2015). Since different brands of cement products are increasingly available on the market, consumers can pay due attention to certain features when making their preferences.

The brand conveys various elements of the product or service to different people. In other words, the perceptions and wishes of individuals regarding a brand or an object are different. Brand positioning is central to consumer awareness and preference decision-making. Various attributes are applied to the product or service offering and these attributes are known to make up the image or personality of the product in the consumer’s mind and to help the customer choose or reject the product. At the end of the day, the attributes that make up the image of the product in the mind of the customer also percolate in the mind of the consumer to form the image of the brand and thus allow the consumer to establish a preference for the brand. As the product under consideration is cement, which is a homogeneous material, the study will therefore assesses the consumer’s preference for cement brands and the factors leading to their preference for a specific brand for concrete production.

2. Methodology

2.1 Population and sampling technique

The study population consisted of private homeowners and construction/building companies in four major cities in Ghana, namely Accra, Kumasi, Sekondi-Takoradi, and Cape Coast. These four metropolises have been chosen because they are the main metropolises in Ghana, where most contractors and construction activities are highly concentrated (Akomah et al., 2010). Purposive and accidental
non-probability sampling techniques were adopted. The purposive sampling technique was employed because we wanted to subjectively select only private homeowners and construction/estate companies and their users who were readily accessible to participate in the study. Accidental sampling technique was also adopted to select the respondents from each selected Metropolis because the population of private homeowners and workers on a construction site cannot be well defined due to issues like the complex mix of different trades and activities at any given time. Although nonprobability sampling has a lot of limitations due to the subjective nature in choosing the sample which may not provide a good representation of the population, it is, however, useful, especially when randomization is impossible in a population with very large sample size and also when the population is not well defined (Ilker et al., 2016; Neuman, 2000).

2.2. Questionnaire development and administration
The final questionnaire was based on a draft questionnaire that was created and reviewed. The opinion of experts on the relevance of the questions was obtained. Pilot testing of questionnaires was also performed in two steps. The first phase involved the completion of the pilot questionnaire, and the second phase involved a follow-up feedback interview on the thoughts of the respondents during the pilot survey. The pilot respondents were asked whether they understood the instructions for completing the questionnaire and whether the wording and places to mark responses to each question were clear. Another issue that was raised was the average time taken to complete the questionnaire, as it was understood that if it took a long time for the respondents to complete the questionnaire, they would be hesitant to participate, and this would harm the collection numbers and the nature of the responses (Willar, 2012).

The final questionnaire was divided into three sections. The first sub-section of the questionnaire described the demographic characteristics of the surveyed respondents. The demographic characteristics of the respondents that were collected included age, gender, consumer type, years of cement usage, and level of education. The second sub-section of the questionnaire sought to elicit data on the awareness level of respondents on the cement brands in the Ghanaian market. Respondents were asked to rank their preferences for the various cement brands on a scale of 1 to 8. The third sub-section focused on the factors that influenced consumers’ selection criteria of cement brands using five-point Likert scale questions (1—Strongly Disagree, 2—Disagree, 3—Not sure, 4—Agree, 5—Strongly Agree). The questionnaire administration and data collection were carried out within a five (5)-months period (see supplementary material).

2.3. Data analysis
The data collected was refined, coded, and fed into SPSS version 21 for both descriptive and inferential data analysis. Frequencies, percentages, relative importance index (RII), means, and standard deviations were used to summarize the data. A Levene’s test was used to test whether the differences in the preference of cement brands among the various consumer types met the assumption of equal variance. A Spearman correlation analysis was performed to ascertain the relationship between demographics, influencing factors, and a consumer’s preference for a particular cement brand. Furthermore, regression analysis was conducted to make a prediction model on factors that influence consumers’ preference for cement brands at a 5% level of significance. Figure 1 shows a flow chart of the methodology procedure used for this study.

2.4. Descriptive statistics of the survey participants
Out of 1000 questionnaires distributed, 741 representing 74.1% were correctly completed and retrieved. As shown in Table 1, 95.3% of the respondents were males, while 4.7% were females with most of the respondents falling between the ages of 31 and 40 years. A closer look at Table 1 reveals that almost 78% of the respondents have at least first-degree education with the rest possessing various technical and vocational qualifications. It was imperative to determine the consumer type of respondents to help establish how unpretentious their responses to the survey questions are. Approximately seventy-one percent (71%) of the total number of respondents were
private homeowners and the rest were contractors/estate developers who had considerable years of experience in the usage of cement brands.

3. Results

3.1. Consumers' awareness of cement brands in Ghana

To assess consumer awareness of cement brands used in concrete production in the Ghanaian construction industry, it was imperative to define respondents’ perceptions of cement brand awareness. Respondents were asked to rate 8 brands of cement according to their level of awareness using a five-point Likert scale, i.e., 1—not very aware, 2—not aware, 3—neutral, 4—aware, 5—very aware. These cement brands were the ones available on the Ghanaian market at the time of the study. Brand awareness refers to whether consumers can remember or identify a brand, or simply whether consumers know of a brand (Keller, 2008). From Figure 2, it can be seen that “Ghacem” (Mean = 4.76, SD = 0.428), “Diamond” (Mean = 4.48, SD = 0.500), “Dangote” (Mean = 4.41, SD = 0.493), “CIMAF” (Mean = 3.36, SD = 1.295), “Dzata” (Mean = 3.26, SD = 0.942) and “Savannah” (Mean = 3.06, SD = 1.259) were the most popular brands in the Ghanaian construction industry. However, “SOL” and “Supacem” are less known by consumers in the Ghanaian markets. The results further indicate that at a 5% level of significance, the mean ratings regarding the awareness of consumer types (i.e. individual/private developer, and contractor/estate developer) on various cement brands were Ghacem ($F = 17.374, P < 0.01$), Diamond ($F = 1.965, P = 0.161$), Dzata ($F = 2.303, P = 0.130$) and SOL ($F = 2.702, P = 0.101$) (See Appendix A.).
3.2. Consumer preference of cement brands in Ghana

The consumer's preference for a commodity represents his or her inner views and perceptions (Cao et al., 2010). It is therefore the consumer's attitudes and expectations of a product or company that decide their preferences. Consumer preferences include the rating of products and services according to how much value they receive from them before they decide to buy them (Kotler et al., 2009). For this reason, respondents were presented with eight (8) brands of cement and were asked to rank their preferences from 8 to 1; 8—most preferred and 1—least preferred. Figure 3 shows that the means for the preferences on the various cement brands range from 3.42 to 5.62. The results further indicate that Diamond had the highest mean (mean = 5.62, SD = 2.156), followed by “Dangote” (mean = 5.45, SD = 2.410) as the most preferred brand by consumers. However, “Ghacem” (mean = 4.99, SD = 2.831), “Savannah” (mean = 4.50, SD = 2.084), “Supacem” (mean = 4.10, SD = 2.356), “Dzata” (mean = 4.09, SD = 2.413), “CIMAF” (mean = 3.79, SD = 2.365) and “SOL” (mean = 3.42, SD = 2.671) were ranked between 3rd and 8th suggesting a moderately high preferred brand by consumers. From Levene’s test, the variances among the various consumer types were equal as it had non-significant Levene’s statistics at p-value >0.05 (see Appendix B).

3.3. Influencing factors on consumer preference for cement brands

The factors that influence consumers’ preference of cement brands for concrete production in Ghana were analyzed. The internal consistency of the questionnaire variables was initially

| Table 1. Descriptive statistics of the survey participants |
|---------------------------------------------------------|
| **Characteristics** | **Frequency (%)** |
| **Gender** | |
| Male | 706 (95.3) |
| Female | 35 (4.7) |
| **Age (years)** | |
| 21–30 | 177 (23.9) |
| 31–40 | 416 (56.1) |
| 41–50 | 69 (9.3) |
| 51–60 | 32 (4.3) |
| 61 and above | 4 (6.3) |
| **Educational Background** | |
| Tertiary Level | 578 (78) |
| SSCE/Technical/Vocational | 125 (16.9) |
| BECE | 38 (5.1) |
| No Formal Education | - |
| **Consumer Type** | |
| Individual/Private developer | 524 (70.7) |
| Contractor/Estate developer | 217 (29.3) |
| **Duration of cement usage** | |
| Under 1 year | 52 (7) |
| 1–5 years | 451 (60.9) |
| Above 5 but less than 10 years | 97 (13.1) |
| 10–15 years | 60 (8.1) |
| Above 15 but less than 20 years | 29 (3.9) |
| Above 20 years | 52 (7) |

Note(s): SSCE = senior secondary certificate examination; BECE = basic education certificate examination.

Source: Authors’ field survey
assessed. According to Straub et al. (2004), Cronbach’s alpha is the traditional criterion for internal consistency which gives an estimate of the reliability based on correlations of the observed indicator variables. Rahman et al. posited that Cronbach’s alpha values must be higher than 0.70 (Rahman et al., 2013). In this study, Cronbach’s alpha value was 0.948 indicating a higher internal consistency and the reliability of the questionnaire. In this section, respondents were asked to rate the factors that influence their decision on the selection of a particular brand using a five-point Likert scale (1—strongly disagree, 2—disagree, 3—not sure, 4—agree, 5—strongly agree). From Table 2, 10 out of 12 influencing factors presented to the respondents were reported to influence the decision on the selection of a particular brand. It is interesting to note that “trusted brand name” (mean = 3.99, SD = 1.347), “durability of cement” (mean = 3.98, SD = 1.404), “most preferred by builders” (mean = 3.84, SD = 1.395), “recommended by professionals” (mean = 3.83, SD = 1.086), “easy to work with” (mean = 3.80, SD = 1.480) and “good for all construction works” (mean = 3.80, SD = 1.459) are the six (6) most influencing factors. However, “most advertised cement” (mean = 2.73, SD = 1.292) and “relatively less expensive” (mean = 2.67, SD = 1.442) were not seen by respondents as factors that may influence their preference for cement brands. It
### Table 2. Influencing factors on consumer preference of cement brands

| Factors /attribute                    | ΣW | Mean (ΣW/N) | Std. Dev. | RII | Levene's test for equality of variances |
|--------------------------------------|----|-------------|-----------|-----|----------------------------------------|
|                                      |    |             |           |     | F   | Sig         |
| Trusted brand name                   | 2956 | 3.99    | 1.347 | 0.798 | .053  | .818       |
| Durability of cement                 | 2949 | 3.98    | 1.404 | 0.796 | .371  | .542       |
| Most preferred by builders           | 2845 | 3.84    | 1.395 | 0.768 | .195  | .659       |
| Recommended by professionals         | 2838 | 3.83    | 1.086 | 0.766 | .456  | .500       |
| Easy to work with                   | 2815 | 3.80    | 1.480 | 0.759 | .357  | .551       |
| Good for all construction works      | 2815 | 3.80    | 1.459 | 0.759 | .014  | .905       |
| Well packaged                        | 2697 | 3.64    | 1.374 | 0.728 | .920  | .338       |
| Available in nearby shops            | 2571 | 3.47    | 1.429 | 0.694 | .280  | .597       |
| Recommended by friends/family        | 2571 | 3.47    | 1.047 | 0.694 | .796  | .372       |
| Free delivery from shop/ factory     | 2223 | 3.00    | 1.498 | 0.600 | .081  | .776       |
| Most advertised cement               | 2022 | 2.73    | 1.292 | 0.546 | .252  | .616       |
| Relatively less expensive            | 1978 | 2.67    | 1.442 | 0.534 | 1.209 | .272       |

Source: Authors field survey
Table 3. Correlation matrix and prediction models of influencing factors against demographic variables

|          | 1   | 2    | 3   | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   |
|----------|-----|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Gender   | 1   | 0.27 | -0.04 | 0.09* | 0.017 | -0.209 | -0.293* | -0.209 | 0.052 | -0.008 | 0.044 | 0.307* | 0.036 | 0.025 | 0.035 | -0.011 |
| Age      | 1   | 0.00 | -0.513* | -0.009 | -0.130 | -0.163* | 0.020 | -0.024 | -0.273* | 0.173* | 0.160 | 0.129 | 0.223 | 0.379 | 0.060 | 0.158 |
| Consumer Type | 1   | 0.008 | -0.160* | -0.015 | -0.034 | -0.043 | 0.006 | -0.036 | -0.012 | 0.013 | 0.003 | -0.000 | 0.019 | 0.010 |
| Duration of cement usage | 1   | 0.025 | -0.220 | -0.300 | -0.195 | -0.043 | -0.065 | -0.062 | -0.066 | 0.024 | 0.127 | 0.107 | -0.153 | -0.056 |
| Education | 1   | -0.079 | -0.031 | -0.023 | -0.020 | -0.068* | -0.062* | 0.022 | 0.054 | -0.111* | 0.026 | -0.005 | -0.068 |
| Relatively less expensive | 1   | 0.666 | 0.780 | 0.54 | 0.519 | 0.517 | 0.267 | 0.386 | 0.505 | 0.307 | 0.440 | 0.544 |
| Free delivery to shops/ factory | 1   | 0.527 | 0.746 | 0.769 | 0.464 | 0.446 | 0.591 | 0.607 | 0.749 | 0.749 |
| Available in nearby shops | 1   | 0.363 | 0.388 | 0.410 | 0.335 | 0.481 | 0.334 | 0.465 | 0.445 |
| Most advertised cement | 1   | 0.500 | 0.757 | 0.900 | 0.759 | 0.956 | 0.775 | 0.801 | 0.807 | 0.917 |
| Most preferred by builders | 1   | 0.713 | 0.527 | 0.798 | 0.777 | 0.834 | 0.930 |
| Trusted brand name | 1   | 0.701 | 0.512 | 0.879 | 0.903 | 0.722 |
| Well packaged | 1   | 0.690 | 0.726 | 0.666 | 0.636 |
| Recom. mended by friends/family | 1   | 0.702 | 0.666 | 0.840 |
| Recom. mended by Professional | 1   | 0.856 | 0.811 |
| Easy to work with | 1   | 0.889 |
| Good for all construction works | 1   | 0.889 |
| Durability of cement | 1   | 0.889 |

R² Adjusted | 0.86 | 0.577 | -0.002 | 0.358 | 0.038 | 0.884 | 0.191 | 0.093 | 0.000 | 0.121 | 0.062 | 0.060 | 0.025 | 0.057 | 0.057 | 0.051 |

F-Value | 13.59 | 83.1 | 0.889 | 35.4 | 3.4 | 34.5 | 36.0 | 15.8 | 0.994 | 21.7 | 10.8 | 10.5 | 4.8 | 10.0 | 27.2 | 9.9 | 8.9 |

*P < 0.01, **P < 0.05

Gender: male = 1 (Negative coefficient), female = 2 (Positive coefficient)
Age: Young consumer = 1 (Negative coefficient), Older consumer = 2 (Positive coefficient)
Consumer Type: Individual/Private developer = 1 (Negative coefficient), Contractor/Estate developer = 2 (Positive coefficient)
Duration of cement usage: short duration = 1 (Negative coefficient), long duration = 2 (Positive coefficient)
Academic qualification: Higher academic qualification = 1 (Negative coefficient), Low academic qualification = 2 (Positive coefficient)
d: 1 = strongly disagree to 5 = strongly agree
Cell entries are the standardized beta coefficient
became evident that at a 5% level of significance and the mean ratings of consumer preference of cement brands were insignificant (p-value > 0.05).

3.4. Prediction models of influencing factors against demographics

Male consumers who patronize cement believe that free delivery to shop/factory ($r = -0.293, P < 0.01$) has an influence on their preference and selection of cement brand as sex associated negatively. However, female consumers believed that relatively less expensive ($r = 0.205, P < 0.01$), available in nearby shops ($r = 0.220, P < 0.01$), and recommended by friends/family ($r = 0.107, P < 0.01$) has a great influence on their preference and purchase intention of cement brands as sex associated positively.

Young consumers are of the view that “relatively less expensive” ($r = -0.130, P < 0.01$) and “free delivery to shop/factory” ($r = -0.163, P < 0.01$), are the factors that influence their decision with regards to selecting a particular cement brand whereas older consumers perceived factors that influence their preference and purchase intention are “most preferred by builders” ($r = 0.271, P < 0.01$), “trusted brand name” ($r = 0.173, P < 0.01$), “well packaged” ($r = 0.160, P < 0.01$), “recommended by friends/family” ($r = 0.129, P < 0.01$), “recommended by professionals” ($r = 0.223, P < 0.01$), “easy to work with” ($r = 0.379, P < 0.01$), “good for all construction works”($r = 0.086, P < 0.05$), and “durability of cement”($r = 0.158, P < 0.01$).

The consumer type (see, Table 3), the results indicate that there was no association on their choice of cement brands whether being an individual/private developer or contractor/estate developer with regards to the influencing factors. Consumers who have used various cement brands for a short period asserted that, “relatively less expensive” ($r = -0.220, P < 0.01$), “free delivery to shop/factory” ($r = -0.300, P < 0.01$), “available in nearby shops” ($r = -0.195, P < 0.01$), “well packaged” ($r = -0.086, P < 0.05$), and “good for all construction works” ($r = -0.153, P < 0.01$) are the factors that influence their preference of a particular brand of cement. However, consumers who have used cement for a longer duration believe that “recommended by professionals” ($r = 0.127, P < 0.01$) and “easy to work with” ($r = 0.101, P < 0.01$) influence their decision when making preferences and selection for a particular cement brand.

Educational level of respondents correlated negatively with “relatively less expensive” ($-0.078, P < 0.05$), “most preferred by builders” ($r = -0.086, P < 0.05$), “trusted brand name” ($r = -0.062, P < 0.05$) and “recommended by professionals” ($r = -0.111, P < 0.01$). This is an indication that consumers with higher academic qualifications are mostly influenced by professional recommendations and the brand name of cement as the variables that affect their preference and selection criteria.

Demographic variables were used to predict the factors that influence consumers’ preference for cement brands in the Ghanaian markets. Seventeen (17) models including demographic variables were used (see Table 3). The demographic variables (independent variable) and factors that influence consumer preference (dependent variables) were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The explained variance was from 35.8% to 68.6% (Models 1, 2, 4, and 5) with demographic variables, whereas the explained variance for factors influencing consumer preferences increased from 2.5% to 19.1% with all variables except for Model 9 when it entered the equation. Thus, the preference of consumers on cement brands is largely influenced by their attributes.

Among the demographic factors, gender ($F = .686, P < 0.01$), age ($F = .577, P < 0.01$), duration of cement usage ($F = .358, P < 0.01$) and educational background ($F = .038, P < 0.01$) were found to be significant on consumers preference. Additionally, relatively less expensive ($F = .084, P < 0.01$), free delivery to shop/factory ($F = .191, P < 0.01$), available in nearby shops ($F = .091, P < 0.01$), most preferred by builders ($F = .123, P < 0.01$), trusted brand name ($F = .062, P < 0.01$), well packaged ($F = .060, P < 0.01$), recommended by friends/family ($F = .025, P < 0.01$), recommended by professional ($F = .057, P < 0.01$), easy to work with ($F = .153, P < 0.01$), good for all construction works ($F = .057, P < 0.01$) and durability of cement ($F = .051, P < 0.01$) were the factors that influenced consumers
## Table 4. Prediction models for preferences of cement brand

| Metric                                      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  |
|---------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Relative less expensive                     | 666 | .780| .543| .529| .517| .263| .286| .305| .301| .440| .544| -3.31| -3.39| -2.99| -1.38| -1.12| -1.73| -2.81| .093|
| Free delivery to shop/ factory              | 52  | 174 | .552| .514| .351| .175| .326| .379| .431| .508| -1.05| .042 | -3.47| .055 | -2.04| -2.79| .153 | .207|
| Available in nearby shops*                  | 757 | 748 | 704 | 664 | 591 | .807| .749| .754| .368| -.459| -.236| -.260| -.095| -.244| -.327| -.302|
| Most advertised cement*                     | 363 | 389 | .410| .335| .481| .334| .465| .445| -2.53| -.556| .207 | -.037 | -.149| -.346| -.354| -.056|
| Most preferred by builders                 | 900 | 755 | .596| .773| .803| .807| .917| .007| -.030| -.469| -.415| .185 | -.215| -.255| -.419|
| Trusted brand name*                         | 73  | .71  | .577| .799| .777| .834| .910| .035| -.004| -.430| -.397| .226 | -.236| -.266| -.418|
| Well packed aged                            | 701 | 512 | 875 | .903| .772| .087| .073| .336| -.581| .374| -.303| -.332| -.509|
| Recommended by friends/family               | 650 | 726 | .663| .646| .065| .022| -.295| -.447| .272 | -.370| -.318| -.446|
| Recommended by Professional friends         | 702 | 646 | .840| .083| -.122| -.364| -.230| .181| -.295| -.318| -.406|
| Easy to work                                | 856 | .811| .048| .098| -.551| -.501| .270| -.354| -.349| -.517|
| Good for all construction works             | 889 | -.037| -.049| .444| -.565| .215| -.332| -.343| -.483|
| Durability of cement                        | 052 | -.069| -.448| -.442| .213 | -.278| -.309| -.448|
| Data                                       | 500 | 125| -.248| .596| -.152| -.059| -.402|
| SOL                                        | 030 | 120 | .334| .189| .225| -.073|
| Dan                                        | 59  | -.131| .257| .410| .462|

(Continued)
Table 4. (Continued)

|       | 1    | -.575<sup>a</sup> | -.664<sup>a</sup> | -.617<sup>a</sup> | -.800<sup>a</sup> |
|-------|------|-------------------|-------------------|-------------------|-------------------|
| Sup  |      |                   |                   |                   |                   |
| arcm |      |                   |                   |                   |                   |
| Gha  |      |                   |                   |                   |                   |
| cern |      |                   |                   |                   |                   |
| CIMAF|      |                   |                   |                   |                   |
| Sava |      |                   |                   |                   |                   |
| nnah |      |                   |                   |                   |                   |
| Diam |      |                   |                   |                   |                   |
| mond |      |                   |                   |                   |                   |
| R² Adjusted | 0.24 | 0.37 | 0.33 | 0.35 | 0.29 | 0.45 | 0.28 | 0.25 | 0.51 | 0.41 | 0.40 | .44 | 0.62 | 0.61 | 0.70 | 0.57 | 0.81 | 0.69 | 0.55 | 0.71 |
| F-Value | 30.5<sup>a</sup> | 55.5<sup>a</sup> | 47.7<sup>a</sup> | 50.2<sup>a</sup> | 38.9<sup>a</sup> | 75.5<sup>a</sup> | 37.5<sup>a</sup> | 32.0<sup>a</sup> | 98.6<sup>a</sup> | 66.3<sup>a</sup> | 63.9<sup>a</sup> | 73.2<sup>a</sup> | 100.5<sup>a</sup> | 97.5<sup>a</sup> | 147.1<sup>a</sup> | 83.8<sup>a</sup> | 271.8<sup>a</sup> | 137.8<sup>a</sup> | 77.2<sup>a</sup> | 148.4<sup>a</sup> |

<sup>a</sup>P < 0.01, <sup>b</sup>P < 0.05  
d: 1 = strongly disagree to 5 = strongly agree  
Cell entries are the standardized beta coefficients.
preference for cement brands. Furthermore, the change in $R^2$ was statistically significant indicating that demographics and influencing factors were in and among themselves important factors that drive consumers' preference for cement brands for concrete production in Ghana.

3.5. Prediction models for preferences of cement brand

To know the predicting factors that influence consumers’ preference for cement brands in the Ghanaian markets, 20 models comprising factors that drive consumer preference and preferred cement brands were used to predict the preferences of consumers (Table 4). The preference of cement brand (dependent variable) and factors that drive consumer's preference (independent variables) were measured using a five-point Likert scale anchored by 1 = strongly disagree to 5 = strongly agree. The explained variance was between 24% and 51% (Models 1–12) for the factors that influence consumer's preference while 55%–81% (Models 13–20) of preferred cement brand list. From the results (see Table 4), the 20 variables that entered the equation were significant in varying degrees among the factors that influence consumers preference. “Recommended by professionals” ($F = 0.51, P < 0.01$) had the highest variance followed by “trusted brand name” ($F = 0.45, P < 0.01$), “durability of cement” ($F = 0.44, P < 0.01$), “easy to work with” ($F = 0.41, P < 0.01$) and “good for all construction works” ($F = 0.40, P < 0.01$). Other influencing factors ranged between $F = 0.41$ and $F = 0.37$, ($P < 0.01$).

On the other hand, consumers’ preferences for the various listed cement brand were significant except that other brands were more preferred than others; Ghocem Cement ($F = 0.81, P < 0.01$), Diamond Cement ($F = 0.71, P < 0.01$), Dangote Cement ($F = 0.70, P < 0.01$), CEMAF Cement ($F = 0.69, P < 0.01$), Dzata Cement ($F = 0.62, P < 0.01$), SOL Cement ($F = 0.61, P < 0.01$), Supacem Cement ($F = 0.57, P < 0.01$) and Savannah Cement ($F = 0.55, P < 0.01$; Table 4). These variables (predictors) were in and among themselves important factors that drive consumers’ preference for cement brands used in concrete production.

4. Discussions

The study aimed at contributing to knowledge by exploring consumers’ preference for cement brands used for concrete production in Ghana, with emphasis on brand awareness, preference level, and factors that influence consumers’ decision on selecting a particular brand over the others. The findings indicate that brand awareness may have considerable effects and provide a cue for the consumer’s choice. The mean ratings for the brand awareness were between 4.75 and 2.75, respectively (figure 2); this implies that the higher the awareness, the easier it is for consumers to recognize it. This suggests that the respondents were not ignorant of the awareness and knowledge of cement brands available in the Ghanaian markets. Six hundred and eighty-nine (689) of the respondents representing 93% are experienced consumers of cement who have worked with cement for over 5 years in the production of concrete and other construction activities. The findings agree with other researchers who asserted that brands recognition and recall are important factors when consumers are making purchasing decisions (Huang & Sarigöllü, 2014; Macdonald & Sharp, 2000; Rossiter, 2014; Sun et al., 2017; Thoma & Williams, 2013; Udomkun et al., 2018).

The findings indicated that there was no significant difference among consumers’ preference for cement brands presented to them (see Appendix A). However, the mean ratings differed, thus, from 5.62 to 3.42 (Figure 3). Interestingly, the findings showed that consumers awareness of a particular brand does not necessarily suggest the preferred brand (see figures 1 &and 2), and this may be due to several factors such as pricing, availability, type of work to be done, and other external factors best known to the individual consumer at the time of the purchase. The findings agree with Smith & Swinyard (1983), who iterated that the influence of awareness as a choice tactic would decline after the first choice and that a well-known brand may be chosen on the first occasion because of a belief that it is probably the best. Then, if the experience is judged satisfactorily, the decision may shift.

Furthermore, consumers' responses indicated that they are mostly influenced by factors such as trusted brand name, the durability of cement, easy to work with, good for all construction works, well
packaged, available in nearby shops, and external factors such as recommended by professionals and most preferred by builders. However, other external factors such as recommended by friends/family and free delivery from shop/factory had little influence on consumers’ preference for cement brands used for concrete production. This is supported by studies conducted by Kumar (2013), Maity (2014), Murugan & Ganapathi (2012), Maity (2014) which found that professionals such as masons and engineers had a substantial effect on the actions of individual homebuilders and non-trade customers to buy cement. Murugan & Ganapathi (2012) also analyzed the cement industry by contrasting customer preferences for selected brands. Their studies showed that price, consistency, instant drying, availability, weight, packaging, door delivery, and proximity affect consumer preferences.

Demographic factors such as gender, age, educational level, and duration of cement usage do play important role in the selection process of consumers’ preferred brand of cement. Consumer behavior varies according to gender, which is mainly justified by role differences in cultural and social contexts (Kim et al., 2011). A significant impact of gender on the consumption of sustainable products (Costa Pinto et al., 2014) and innovative products (Kim et al., 2011) was observed. This was further demonstrated and predicted that consumers considered relatively less expensive, free delivery to shop/factory, available in nearby shops, most preferred by builders, trusted brand name, well packaged, recommended by friends/family, recommended by professional, easy to work with, good for all construction works and durability of cement as the most influencing factors when selecting a particular brand for concrete works and this aligns with the studies by Berry & Hasty (1982) and Oliveira & Dias (2019), whose findings indicated that high level of education impacted higher on consumers’ preference than lower educational level.

Additionally, age was a significant factor as young consumers’ preferred branded goods. However, there was no association between consumer type and the influencing factors that determine a consumer’s choice for a particular cement brand. This can be said that private or estate developers largely depend on external factors such as recommendations from professionals/family members and they may prefer their builders to purchase cement brands suitable for particular works. Works by Kumar (2013) and Maity (2014) opined that external influencers such as engineers, masons, distributors, and retailers of cement have a significant impact on the cement purchasing behavior of an individual.

There was a substantial significant association between the influencing factors (attributes) and cement brands that informed consumers’ preferences. This is in agreement with Chimboza & Mut (2007), which established four factors as main determinants of product choice: product promotion, price and availability, attractive packaging, and product quality.

5. Conclusions
Cement Brands, which had developed the desired brand recognition in Ghanaian markets, had strong brand knowledge that influenced consumer preference levels. All factors/attributes have greatly contributed to the preference for a brand, which means that, during the buying process, customers are making their choices dependent on the best combination of attributes for cement products. Similarly, customer preference often varies greatly from brand to brand. Ghacem, Dangote, and Diamond cement were the most preferred brand based on attribute ratings. Consumers are often affected by factors such as trusted brand name, the durability of cement, easy to work with, well packaged, available in nearby shops, and external factors such as recommendation by professionals and friends/family. Also, demographic factors such as gender, age, duration of cement usage, and educational background were found to significantly influence consumers’ preference for a cement brand. Considering the consumers’ preference of cement brands for concrete production, manufacturers and marketers should focus their strategies on convincing consumers of all ages, gender, and educational backgrounds as their purchasing decisions will go a long way in commanding brand acceptance.
Funding
This research was supported by the National Natural Science Foundation of China (No. 51909243), Key Scientific and Technological Project of Henan Province (202102310293).

Author details
Stanley Owuoye Bonney1
Jianxue Song2
E-mail: jxsong@zzu.edu.cn
Zhang Jingwei1
Yi Peng2
1 School of Civil Engineering, Zhengzhou University, Zhengzhou, Henan, China.
2 Jingwei Building Materials Company Limited, Xiangtang, Henan, China.

Note
Cement is a major construction material used in civil engineering works due to its high demand. Interestingly, cement and concrete are not interchangeable, but they are intrinsically connected. Concrete is made from materials that are abundantly available which contributes to the circular economy by integrating industrial by-products. Consumer’s preference for a cement brand on the advice of a professional makes it easier to make informed decisions on concrete products for construction projects.

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Disclosure statement
No potential conflict of interest was reported by the author(s).

Supplementary material
Supplemental data for this article can be accessed here

Citation information
Cite this article as: Consumer preference for cement brands used in concrete production: the Ghanaian perspective, Stanley Owuoye Bonney, Jianxue Song, Zhang Jingwei & Yi Peng, Cogent Engineering (2022), 9: 2062876.

References
https://www.ghanaweb.com/GhanaHomePage/business/Sub-standard-cement-and-cement-products-flooding-Ghanaian-markets-616244?channel=D2. [Assessed 29-01-2020]
Akoma, B. B., Bookye, N., & Fugar, F. (2010). Safety on Ghanaian construction sites: The role of the employer and the employee In S. Laryea, R. Leiringer, & W. Hughes (Eds). Proceedings West Africa Built Environment Research (WABER) Conference, 477–487. Ghana: Accra.
Amutha, K., & Vinayak, P. (2015). A study on brand preference of selected cement with special reference to Dindigul districts. International Journal of Multidisciplinary Research and Development, 2(1), 263–267.
Balabanis, G., & Siamogka, N. T. (2017). Inconsistencies in the behavioral effects of consumer ethnocentrism: The role of brand, product category and country of origin. International Marketing Review, 34(2), 166–182. https://doi.org/10.1108/IMR-03-2015-0057
Basavaraj, G., Parthasarathy Rao, P., Lalith, A., Lagesh, V. G., Pokharkaraj, S., Gupta, K., & Ashok, K. A. (2015). Understanding trait preferences of farmers for post-rainy sorghum and pearl millet in India: A conjoint analysis. Indian Journal of Agricultural Economics, 70(1), 130–143.
Berry, B. W., & Hasty, R. W. (1982). Influence of demographic factors on consumer purchasing patterns and preferences for ground beef. Journal of Consumer Studies & Home Economics, 6(4), 351–360. https://doi.org/10.1111/j.1470-6431.1982.tb00612.x
Brassington, F., & Pettitt, S. (2003). Principles of Marketing (3rd ed.). Pearson Education Ltd.
Cao, D., Li, Z., & Ramani, K. (2010). Ontology-based customer preference modeling for concept generation. Advanced Engineering Informatics, 25(2), 162–176. Retrieved from: 0.1016/j.aei.2010.07.007.
Chimboza, D., & Mut, E. (2007). Measuring the determinants of brand preference in a dairy product market. African Journal of Business Management, 1 (9), 230–237. https://doi.org/10.5897/AJBM.9000402
Costa Pinto, D., Herter, M. M., Rossi, P., & Borges, A. (2014). Going green for self or others? Gender and identity salience effects on sustainable consumption. International Journal of Consumer Studies, 38(5), 540–549. https://doi.org/10.1111/ijcs.12114
CSI. 2009. Available: https://www.wbcsdce.com/index.php/key-issues/sustainability-concrete-recycling [Accessed 28-March-2020]
Gambhir, M. L. (2005). Concrete technology (Third ed.). Tata McGraw-Hill Publishing Company Limited.
Grand View Research Inc. (2020) Ready-mix concrete market. https://www.grandviewresearch.com/industry-analysis/ready-mix-concrete-market, Accessed: May 4, 2020
Halkias, G., Dovetas, V., & Diamantopoulos, A. (2016). The interplay between country stereotypes and perceived brand globalness/localness as drivers of brand preference. Journal of Business Research, 69(9), 3621–3628. https://doi.org/10.1016/j.jbusres.2016.03.022
Hinson, R., Mohammed, A., & Mensah, R. (2006). Determinants of Ghanaian bank service quality in a universal banking dispensation. Banks and Bank Systems, 1(2), 69–81.
Huang, R., & Sarigollü, E. (2014). How brand awareness relates to market outcome, brand equity, and the marketing mix. In Fashion branding and consumer behaviors (pp. 113–132). New York, NY: Springer.
Ilker, E., Sulaiman, A. M., & Rukayya, S. A. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 1(5), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11
Karajin, A., & Dogruyol, M. (2014). An experimental study on strength and durability for utilization of fly ash in a concrete mix. Advances in Materials Science and Engineering, 2014, 2014. https://doi.org/10.1155/2014/417514
Keller, K. L. (2008). Strategic brand management: Building, measuring and managing brand equity (3rd ed.). Prentice-Hall.
Kim, W., Di Benedetto, C. A., & Lancioni, R. A. (2011). The effects of country and gender differences on consumer innovativeness and decision processes in a highly globalized high-tech product market. Asia Pacific Journal of Marketing and Logistics, 23 (5), 714–744. https://doi.org/10.1108/135535811111383101
Kotler, P., Keller, K. L., Brody, M., Goodman, M., & Hansen, T. (2009). Marketing Management. Pearson Education Limited.
Kumar, S. (2013). Marketing mix strategies and Indian cement sector. *International Journal of Emerging Research in Management & Technology*, 8(1), 115–136.

Macdonald, E. K., & Sharp, B. M. (2000). Brand awareness effects on consumer decision making for a common, repeat purchase product: A replication. *Journal of Business Research*, 48(1), 5–15. https://doi.org/10.1016/S0148-2963(98)00070-8

Moity, A. (2014). Impact of external influencer recommendation in purchase behavior process of selection of cement for construction. *International Journal of Business and Management Invention*, 3(8), 01–11.

Murugan, M., & Ganapathi, R. (2012). Consumers’ preference on various brands of cement in Gobichettipalayam taluk of Erode district. *International Journal of Scientific Research*, 1(5), 89–97. https://doi.org/10.15373/22778179/OCT2012/32

Neuman, W. L. (2000). Social research methods: qualitative and quantitative approaches. Allyn & Bacon.

Oliveira, G. D., & Dias, L. C. (2019). Influence of demographics on consumer preferences for alternative fuel vehicles: A review of choice modelling studies and a study in Portugal. *Energies*, 12(2), 318. https://doi.org/10.3390/en12020318

Rahman, M. M., Sykiotis, G. P., Nishimura, M., Bodmer, R., & Bohmann, D. (2013). Declining signal dependence of N r2-M of S-regulated gene expression correlates with aging phenotypes. *Aging Cell*, 12(4), 554–562. https://doi.org/10.1111/ace.12078

Rossiter, J. R. (2014). 'Branding'explained: Defining and measuring brand awareness and brand attitude. *Journal of Brand Management*, 21(7–8), 533–540. https://doi.org/10.1057/bm.2014.33

Smith, R. E., & Swinyard, W. R. (1983). Attitude-behavior consistency: The impact of product trial versus advertising. *Journal of Marketing Research*, 20(3), 257–267. https://doi.org/10.1177/002224378302000304

Solomon, M. R., Dahl, D. W., White, K., Zaichkowsky, J. L., & Polegato, R. (2014). Consumer behavior: Buying, having and being (Vol. 10). Pearson.

Straub, D., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information Systems*, 13(1), 63. https://doi.org/10.17705/1CAIS.01324

Sun, L., Zheng, X., Su, M., & Keller, L. R. (2017). Intention–behavior discrepancy of foreign versus domestic brands in emerging markets: The relevance of consumer prior knowledge. *Journal of International Marketing*, 25(1), 91–109. https://doi.org/10.1509/jim.15.0123

Thoma, V., & Williams, A. (2013). The devil you know: The effect of brand recognition and product ratings on consumer choice. *Judgment and Decision Making*, 8(1), 34–44. http://journal.sjdm.org/12/12703/jdm12703.pdf

Udomkun, P., Ilukor, J., Mackshell, J., Mujawamuryi, G., Okafor, C., Bullock, R., Nabahungu, N. L., & Vanlouwe, B. (2018). What are the key factors influencing consumers’ preference and willingness to pay for meat products in eastern DRC? *Food Science Nutrition*, 6(8), 2321–2336. https://doi.org/10.1002/fsn3.813

Willar, D. (2012). Improving Quality Management System Implementation in Indonesian Construction Companies (Doctoral dissertation, Queensland University of Technology). http://eprints.qut.edu.au/59202/1/DebbyWillarThesispdf
Appendix

**Appendix A. Consumer awareness of cement brands in Ghana**

| Cement brands | ΣW  | Mean (ΣW/N) | Std. Dev. | RII | Levene’s test for equality of variances |
|---------------|-----|-------------|-----------|-----|----------------------------------------|
|               |     |             |           |     | F          | Sig      |
| Ghacem        | 3527| 4.76        | 0.428     | 0.952| 17.374    | .000<sup>a</sup> |
| Diamond       | 3319| 4.48        | 0.500     | 0.896| 1.965     | .161<sup>c</sup> |
| Dangote       | 3267| 4.41        | 0.493     | 0.882| .198      | .657     |
| CIMAF         | 2489| 3.36        | 1.295     | 0.672| .405      | .525     |
| Dzata         | 2415| 3.26        | 0.942     | 0.652| 2.303     | .130<sup>c</sup> |
| Savannah      | 2267| 3.06        | 1.259     | 0.611| .259      | .611     |
| SOL           | 2089| 2.82        | 1.203     | 0.563| 2.702     | .101<sup>c</sup> |
| Supacem       | 2037| 2.75        | 1.148     | 0.549| .473      | .492     |

<sup>a</sup><sup>P < 0.01</sup>, <sup>b</sup><sup>P < 0.05</sup>, <sup>c</sup><sup>P < 0.1</sup>.

**Appendix B. Consumer preference of cement brands in Ghana**

| Cement brands | ΣW  | Mean (ΣW/N) | Std. Dev. | RII | RANK | Levene’s test for equality of variances |
|---------------|-----|-------------|-----------|-----|------|----------------------------------------|
|               |     |             |           |     |      | F          | Sig      |
| Diamond       | 4164| 5.62        | 2.156     | 0.703| 1st  | .193       | .661     |
| Dangote       | 4038| 5.45        | 2.410     | 0.681| 2nd  | 1.261     | .262     |
| Ghacem        | 3697| 4.99        | 2.831     | 0.624| 3rd  | .110       | .741     |
| Savannah      | 3334| 4.50        | 2.084     | 0.563| 4th  | .890       | .346     |
| Supacem       | 3038| 4.10        | 2.356     | 0.513| 5th  | .063       | .802     |
| Dzata         | 3030| 4.09        | 2.413     | 0.511| 6th  | .002       | .967     |
| CIMAF         | 2808| 3.79        | 2.365     | 0.474| 7th  | .323       | .570     |
| SOL           | 2534| 3.42        | 2.671     | 0.428| 8th  | 1.200     | .274     |
