Differential Pricing of Concrete Products within the Ghanaian Construction Industry

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Abstract Concrete is an essential widely used material in the construction industry worldwide. Notable concrete products used in Ghana's construction industry are precast septic tanks, box and pipe culverts, fence posts, concrete poles, roof tiles, precast beams and columns, pavement blocks and slabs etc. Though the variety is large, there exists significant price disparities for the same materials across markets in Ghana. This study assessed differential pricing of concrete products on the Ghanaian construction market with the objective of ascertaining the determinants and causes of differential pricings, and the effects of these differentials on the construction industry in three major cities (Accra, Kumasi and Sunyani) in Ghana. Price data was collected, collated and analyzed from the three cities and the determinants, causes and effects of differential pricings were assessed and ranked based on existing literature. An overall assessment indicated that the main determinant of differential pricings was material input, whereas cost of production was the highest ranked cause of differential pricing. Uncertainties during project estimation which include taxes was also seen to be the highest ranked effect of differential pricing. It is recommended that drastic steps be taken by Government to reduce the uncertainties such as subsidizing some taxes on the importation of raw materials and the use of other inputs in producing concrete products.

Keywords Ghanaian construction industry, Concrete, Accra Metropolis, Kumasi Metropolis, Sunyani Municipality, Differential pricings

1. Introduction

Concrete plays a vital part in our daily lives in any functioning society. It's benefits to society are immense; they are used to build schools, hospitals, apartment blocks, bridges, tunnels, dams, sewerage systems, pavements, runways, roads and many more (Baikerikar, 2018). Twice as much concrete is used around the world than the total of all other building materials, including wood, steel, plastic and aluminum (Petkar, 2014). Few people realize that concrete is in fact the most widely used fabricated material in the world, with nearly three tons used annually for each man, woman and child (Morsali, 2019). No other material can replace concrete in terms of its effectiveness, price and performance. To put it simply, Banthia et al, (2014) wrote "concrete is the material mostly used in the construction industry and is one of the foremost strong building materials". It gives predominant fire resistance compared with wooden structures and picks up quality over time.

Concrete is a blend of smashed stone, sand, cement and water that solidifies as a result of chemical responses between the cement and water (Kumar, 2009). Additionally, it is the basis of an expansive commercial industry, with all its positive and negative properties. Within the United States alone, concrete generation may be a $30 billion per year industry, considering, as it were, the esteem of the ready-mixed concrete sold each year (Syverson, 2008). Designers from around the globe incorporate concrete products in construction projects ranging from commercial and educational through to residential. Concrete products used in the construction industry could be precast concrete beams, pavement slabs, wall copings, precast columns, concrete curbs, concrete pavement blocks, prestressed concrete pressure pipes (PCCP) and concrete hollow and solid blocks (Lopez-Mesa et al. 2009). Given the measure of the concrete industry, and the basic way concrete is utilized to shape the foundations of the construction world, it is troubling to underrate the part this fabric plays nowadays.

Most developing countries including Ghana, face acute housing problems, especially in the larger cities (Atiemo, 2013). The degree of housing shortage varies from location to location and has indirectly contributed to the varying

prices of concrete products and components. In marketing, a product is anything that can be offered to a market that might satisfy a want or need (Kotler and Amstrong, 2011). Prices of concrete products are dictated by components of the economy other than components that trigger prices of these products in the construction industry. Field and Ofori (1988) stated that construction makes a clear contribution to the economic output of a country; it generates employment and incomes for the people. Relatively, the effects of changes within the housing industry on the economy occur in the least levels and in virtually all aspects of life (Chen, 1998; Rameezdeen et al, 2006).

Most contractors in the industry are victims of various price differences on individual concrete products. Difference in prices in various cities affects contractors tendering processes for different localities. Today, most construction works have been abandoned due to rapid and varying prices of concrete products. The initial perception fails to take into account the negative impact of the variation in prices throughout the construction process. Different prices will result in delays of consumers' plan to build houses, add more rooms and renovate (Dipasquale, 1999).

Shekhar (2013) discovered various factors responsible for pricing building materials such as cost of production, competition, product substitution, exchange rate and demographics. Cost of product or service is an important consideration for pricing decisions. Total cost includes cost of raw materials, labour, transportation cost, fixed cost and variable cost among others. For the short term, recovery cost may be ignored in order to capture maximum market share. In case of monopoly or less competition, international companies could set high prices. However, in case of intense competitions, lower prices may be set. Non-availability of substitute products will obviously lead to high pricing. Nevertheless, if there are better and cheaper substitute products, prices will be forced downward. Different currency exchange rates result in different values at different times thereby affecting product pricing. Demographics of targeted customers will indisputably influence pricing of products. Demographic factors to consider before product pricing include targeted age bracket of customers, business location and educational status among others.

Differential pricing allows retailers to gain sales and profits (Yuan-shuh and Erin, 2009). According to Carrol and Coates (1999), most industries and companies adopt this technique of varying prices of the same product based on customer location. This is purposely aimed at gaining higher rates of profit from the market. Differential pricing is used in solving production issues. Prices of products are set to aid in establishing sales ratios which may subsequently reflect production ratios (Odlyzko, 2003).

Differential pricing is the strategy of selling the same product to different customers within different locations at different prices. It can also mean charging relatively higher rates to customers who have fewer competitive options than to customers with more competitive options (A.A.R, 2013). The most straightforward form of differential pricing consists of charging different consumers different prices to access the same good or service. A more subtle form consists of charging different consumers different prices for different versions of the same good or service when the price gap is greater than can be explained by differences in the cost of the versions (Huan and Jianhua, 2013). The immediate impact is that it increases the bid prices (Miti and Chanda, 2013) and creates competitions among contractors and suppliers. The essence of this research is to investigate and determine the various derivatives affecting differences in concrete product pricing in the Ghanaian construction industry.
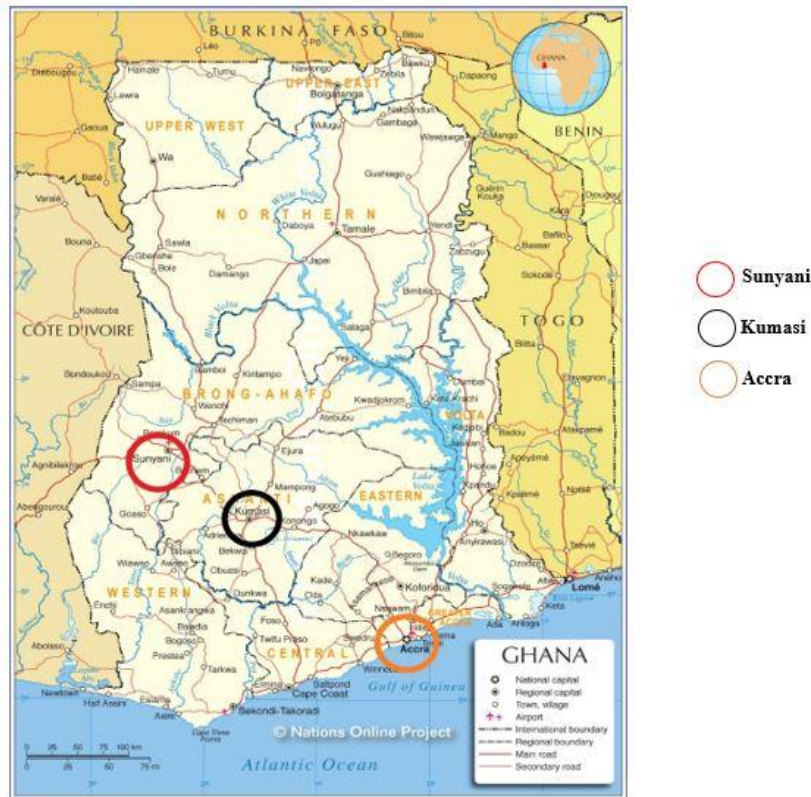
2. Materials and Methods

2.1. Description of Study Sites

Accra, Kumasi and Sunyani (see Figure 1) were cities in Ghana selected for the study. These study areas were chosen due to their active participation in the construction industry in Ghana. Accra and Kumasi, the two most populous cities, have hosted a lot of high profited construction projects in the country which demanded the use of huge volumes of concrete and concrete products. Differential pricing has either created positive or negative impacts on construction projects undertaken in these cities. Also, Sunyani has turned out to be one of the areas now encountering a lift in the construction industry with a great deal of progressive developmental works. It has already encountered some overwhelming development works such as the Ultra-Modern Regional Hospital, the Sunyani Coronation Park, the Jubilee Park, the Cocoa Board Building and Queen of Peace Building among others. Sunyani was also chosen because of its current involvement as a new player in the construction industry so as to keep a proper balance while removing all bias.

2.2. Methods of Data Collection

Questionnaires were administered to stakeholders and designers in the construction industry in the three cities (Accra, Kumasi, and Sunyani) studied. Respondent selection was stratified based on study area population. Due to the inability to determine the actual sample size for the research, purposive sampling method was adopted. Questionnaires were designed to gather information on respondent demographics, determinants, causes, effects and prices of concrete products on the construction industry market.

Figure 1. Map of Ghana showing the study areas used for the study

2.3. Data Analysis

A total of 475 questionnaires were distributed to concrete product sellers and 394 were retrieved representing a response rate of 82.95%. This was considered adequate for the analysis based on the assertion by Moser and Kalton (1971) that the result of a survey could be considered as biased and of little value if the return rate was lower than 30-40%. Data retrieved were then analyzed using Relative Importance Index (RII) and correlation.

$$RII = \sum \frac{W}{(A \times N)} \qquad (1)$$

Where,

W = Weight age given to each factor by the respondents

A = Highest weight (i.e., 5 in this case)

N = total number of respondents

Akadiri (2011), stated RII values can be arranged in five important levels namely. high (H) ($0.8 \leq RII \leq 1$), high medium (H–M) ($0.6 \leq RII \leq 0.8$), medium (M) ($0.4 \leq RI \leq 0.6$), medium-low (M-L) ($0.2 \leq RII \leq 0.4$) and low (L) ($0 \leq RII \leq 0.2$). Based on these levels, the research adopted the high (H) value range ($0.8 \leq RII \leq 1$).

3. Results and Discussion

3.1. Socio-demographic and Work-related Characteristics of Respondents

The considerations were age and experience in the construction industry, career and occupation. These were chosen because they were deemed to have influence on peoples' perception.

3.1.1. Experience in the Construction Industry

The study conducted in the three cities showed the following results, presented in Table 1.

Table 1. Data on Experience in the Construction Industry

Experience (Years)	Accra	Kumasi	Sunyani	Total	Percentages
Below 6	36	42	25	103	26.14%
6-10	87	73	42	202	51.27%
11-15	15	20	18	53	13.45%
Above 15	22	8	6	36	9.14%
Total	**160**	**143**	**91**	**394**	**100**

Source: From Study

Table 1, shows that majority 73.86% (i.e. 51.27+13.45+9.14) of the respondents have more than six-years-experience in the construction industry in Ghana. The experience of respondents in the context of this research is determined as the number of years of practice and active involvement in the construction sector. The assumption is that a person's years of experience is likely to have a direct influence on his knowledge in the effective use of concrete products and therefore who responded to the survey are sufficiently experienced in the construction sector to provide credible data for the study (Ponto, 2015). The standard is that the greater the experience, the more credible the information

provided on the questionnaire, as such, the responses obtained are credible and useful for the analysis.

3.1.2. Career or Occupation

Table 2.   Respondent Careers in the Construction Industry

Profession	Accra	Kumasi	Sunyani	Total	Percentage
Q. S	46	39	29	114	28.93%
Contractor	30	28	14	72	18.27%
Project Manager	26	19	10	55	13.96%
Supplier	42	39	26	107	27.16%
Producers	16	18	12	46	11.68%
Total	**160**	**143**	**91**	**394**	**100**

Source: From Study

The study was conducted in three demographical areas and Table 2 depicts the profession of the respondents.

Table 2 shows more than half (61.16%) of the respondents were quantity surveyors (Q.S), contractors and project managers who are actively involved in construction projects with 38.84% being suppliers and producers of concrete products.

3.2. Determinants of Differential Pricing of Concrete Products

Respondents were asked to rank possible factors based on frequency of occurrence according to their own judgment and experience in the Ghanaian construction in the three cities. RII was computed as shown in Table 3. Respondents were required to rank each determinant on a scale of 1-5, where 1 = Highly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Highly agree. With an RII of 0.80, the three determinants of differential pricing in order of importance are material input, cost of importing concrete products and prices of products in other companies.

Table 3.   Determinants of Differential pricings of concrete products

Determinants	Total			
	∑w	Mean	RII	Rank
Material input	1698	4.31	0.86	1
Cost of Importing Concrete Products	1619	4.11	0.82	2
Prices in other companies	1575	4.00	0.80	3
Presence of substitute	1478	3.75	0.75	4
Rate of Consumer purchase	1448	3.68	0.74	5
Taste of consumers	1378	3.50	0.70	6
Exchange rate value	1329	3.37	0.67	7
Availability of resources	1320	3.35	0.67	8

Source: From Study

Material input had the highest relative importance index (RII=0.86). Material input refers to all imported goods or materials used for manufacturing and it also helps to determine the final cost of a product being manufactured or produced. This buttresses the assertion of Basheda and Chupka (2007) which states "Material input costs, including the cost of raw physical inputs, such as steel and cement increase costs of components manufactured from these inputs. Large construction projects involve large quantities of steel, aluminum and copper (and components manufactured from these metals) as well as cement for foundations, footings and structures. Commodities have experienced substantial recent price increases, due to increased domestic and global demands and increased energy costs in mineral extraction, processing and transportation of raw materials which could influence pricing determination. Companies in order not to incur losses, will be willing to sell their products at lowest prices equivalent to production and material cost inputs (Weil et al, 2014). These material inputs are otherwise called factors of production and in the event that the cost of these inputs go up, the expense of production increases (Papava, 2017).

Cost of importing concrete products ranked second with an RII of 0.82. Most companies in Ghana incur more cost during importation of concrete products which is transferred to the products. It thus differs from company to company since the cost of importation differs similarly. Prices in other companies was the third ranked determinant of concrete products (RII=0.476). Most companies use the competition-based pricing strategy to determine pricing of concrete products. Competition-based pricing strategy involves using the competitor's prices of a similar product as a basis for determining the price of their products (Deonir et al, 2017). This basically determines the prices of producer's products after the comparison.

3.3. Causes of Differential Pricing

The respondents were asked to rank factors based on frequency of occurrence according to their own judgment and the experience in the construction industry. The results are shown in Table 4.

Table 4.   Causes of differential pricing of concrete products

Determinants	Total			
	∑w	Mean	RII	Rank
Cost of production	1760	4.47	0.89	1
Demographics	1707	4.33	0.87	2
Product substitution	1699	4..31	0.86	3
Demand for products	1666	4.26	0.85	4
Competition	1612	4.09	0.82	5
Exchange Rate	1534	3.89	0.78	6

Source: From Study

Respondents ranked in order of first to fifth with a RII of 0.80 as a benchmark, cost of production, demographics, product substitution, demand for products and competition with RII of 0.89, 0.87, 0.86, 0.85 and 0.82 respectively. Cost of production was the highly ranked cause of differential pricing of concrete products. Kano et al. (2015) also discovered that cost of production is a cause of differential pricings of concrete products. Cost of

production basically refers to the total cost incurred by a producer in producing a specific product. Producers with lower costs will always be able to supply more of a product at a given price than those with higher costs. Therefore, a decrease in producers' costs will increase the supply which will subsequently affect the pricing of these prices. Conversely, if production costs increase, the quantity supplied at a given price will decrease. Higher costs mean that producers will have to produce less to be able to sell a product at a given price.

According to Selart and Patokorpi (2009), demographics is one of the business choices that must be made cautiously. Past research has demonstrated that demographics have had relationship with business' prosperity and prices of products produced by these businesses. Demographics is important because the factors greatly impact how initial customers can locate the business, visit and give vivid description of target population. According to Cai et al (2012), the area in which an item is displayed can also impact consumers' numerical gauges of item qualities (e.g., cost or prices).

Product substitution and exchange rate were ranked as third and fourth causes of differential pricing. Availability of a substitute within various locations will impact price levels of concrete products in those locations whereas non-availability of substitute products may lead to even higher prices. Nevertheless, if there are better and cheaper substitute products, companies will be forced to keep prices lower.

The next ranked cause was demand for products. When demand surpasses supply, cost tend to rise. In the event of a diminish in supply of products, costs tend to rise to a better equilibrium cost and a lower quantity of products and services (Brækkan, 2015). Competition was the fifth cause of differential pricing. In case of monopoly or less competition, international companies set high prices while lower prices are set where intense competition exists (Collet and Korman, 2018). The high ranks assigned to cost of production and demographic groups were not unexpected. See Table 4.

3.4. Effects of Differential Pricings of Concrete Products

Respondents were asked to rank factors based on frequency of occurrence according to their own judgment and experience. Results is shown in Table 5.

Ranking was done using a Likert scale of 1-5 and uncertainties during project estimations had an RII of 0.87 ranking highest. According to Rodriguez (2011), higher prices decreases material acquisition and delivery hence contractors will find it more difficult to estimate projects.

Differential pricing had a considerable effect on jobs which were put on hold at an RII of 0.82. According to Akanni, Oke and Omotilewa (2014), the implication of rising cost or prices of building materials has adverse effects on the construction industry. It increases prices of building materials which has a multiplier effect on the industry as it leads to fluctuations in construction costs and the eventual abandonment of projects and interruptions in jobs in some instances.

Table 5. Effects of Differential pricings of concrete products

Effects	Total			
	∑w	Mean	RII	Rank
Uncertainty during Project estimation	1721	4.37	0.87	1
Job Interruptions	1610	4.09	0.82	2
High prices of concrete products	1604	4.07	0.81	3
Slow pace of development	1573	3.99	0.80	4
High cost of building in some areas	1462	3.71	0.74	5
Reduction in Consumer surplus	1421	3.61	0.72	6
Transfer of welfare from consumers to producers	1352	3.43	0.69	7

Source: From Study

Resultant high prices of concrete products in some areas recorded an RII of 0.81 with slow pace of development having a RII of 0.80. Varying prices of concrete products across cities tend to favor cities with low prices; bid price is lower and may win contracts easier. Cities with lower prices tend to have more construction work and vice-versa. This could have positive implications for contractors and negative implications for suppliers within the same jurisdictions.

High cost of building in some areas, reduction in consumer surplus and transfer of welfare from consumers to producers were ranked 5th, 6th and 7th respectively signifying lesser impact.

3.5. Relationship between Causes of Differential Pricing of Concrete Products

The causes of differential pricing of concrete products were subsequently analyzed using a simple bivariate correlation to determine the level of relationship and their impact on one another. Table 6 displays the results of a two tailed spearman correlation matrix to determine the direction of the relationship.

Table 6. Relationship between causes of differential pricing of concrete products

Causes	1	2	3	4	5	6
Cost of production	1					
Competition	.365**	1				
Product substitution	.767**	.475**	1			
Exchange rate	.714**	.601**	.665**	1		
Demographics	0.172	.289*	.298**	.574**	1	
Demand for Products	0.030	.516**	0.138	.413**	.604**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The highest correlation using a significant level of 0.01 was the positive relationship between cost of production and product substitution (r=0.767; p<0.01). This basically implies that once the production cost is high, prices of final products will be higher leading to higher probability of

customers purchasing substitute products which provides similar levels of service (Delince, 2014).

Exchange rate had second highest correlation with cost of production (r=0.714; p<0.01). Different currencies have different values at different times (Byström, 2014). Pricing of products are mostly affected by currency exchange rate which has an influence on the prices of raw materials used in the production of concrete products thus the higher the exchange rate, the higher the cost of production which directly affects the price of the final product (Isnowati, 2015).

A positive correlation exists between exchange rate and product substitution (r=0.665, p>0.01). Prices of products are affected by the exchange rate; the higher the exchange rate, the higher the effect on the prices of the products produced which tend to result in an increase in customers' interest in substitute goods with similar satisfaction. Exchange rate and competition were positively correlated (r=0.601, p>0.01). Since exchange rate directly affects pricing, producers would be competing amongst themselves depending on their prices set for the products with the motive of capturing a higher percentage of the market.

However other causes also had positive relationships between each other namely; product substitution and competition (r=0.475, p>0.01), cost of production and competition (r=0.365, p>0.01), demographics and demand for products (r=0.604, p>0.01), demand for products and exchange rate (r=0.413, p>0.01), demographics and exchange rate (r=0.574, p>0.01), and demand for products and competition (r=0.516, p>0.01).

Clearly, there exists a relationship between the various factors responsible for differential pricing of concrete products.

4. Conclusions

Concrete products are widely used in the construction industry. Respondents (with more than six years industry experience) are all building professionals in the industry and have reliable knowledge on the products. Majority of respondents are of the view that material input largely determines prices of concrete products. None of the respondents gave any critical factors under determinants, causes and effects apart from what has already been established in literature. The main impact of concrete differential pricing is uncertainty in project estimation. It could also be concluded that there are various price determinants of concrete products, which in turn adversely affect the construction industry.

5. Recommendations

It is recommended that steps should be taken by Government to control the factors that determine prices of concrete products in Ghana by setting up legislations to control pricing of these products. Government should

subsidize some taxes on the importation of raw materials and the use of other inputs in the production of concrete products so as not to overburden the end user of the product and also reduce the rate at which prices of concrete products fluctuate and escalate.

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