Effect of Power Supply on the performance of Small and Medium Size Enterprises: A comparative analysis between SMEs in Tema and the Northern part of Ghana

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Abstract

Electricity provision in Ghana has been marred by low generation, poor supply, and frequent power outages. The situation compels firms to adopt strategies to cope with this poor public supply of power for their business. To this end, this study analyses the effect of power supply on the performance of SMEs: a comparative analysis between two regions in Ghana where Small and Medium firms are located. The study uses the current World Bank 2013 Enterprise Survey on Ghana with 403 sampled firms. The study employs chi-square and t-test to do pattern analysis. In addition, ordinary regression analysis (OLS) was employed to regress firm performance variable on electricity supply variable and other covariates. The results show that the power outages affected firm's performance (profitability). In addition, it was further realized that power outages (power interruptions) severely affected SMEs located in the Northern part of Ghana than SMEs located elsewhere. The study, therefore, recommends government intervention in policies and programs such as power mix approach and renewable energy, as well as private sector participation to install competition and efficiency should be encouraged. In addition, SMEs should consider alternative sources of power such as solar power, inverter, biogas, generators, which could help curb the cost that is associated with power outage.

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JEL Codes: *M00, M10, M31*

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Introduction

The importance of power supply to economic development of any nation cannot be overemphasized. Availability and access to reliable electricity supply have a rippling effect on productivity and welfare of society. Turning to the small and medium enterprises (SMEs, hereafter also known as firms), power supply serves as an indispensable input in their activities. Apart from its necessity for running many industrial machines, its role in the productivity of human capital is enormous. Virtually, all business activities, especially industrial units, require a constant and effective flow of electricity. Similarly, serving as an input in production processes, electricity also contributes greatly to product marketing. In many cases, availability of power supply plays important role in storing finished goods ahead of demand and therefore enhances consumers' satisfaction by assisting in making the goods available to consumers when needed. This also helps in building firm's image and protects firm's reputation as a result of customer's trust being sustained on having their demand met.

The forgoing issue points out that, poor electricity supply or lack of quality and available power supply to the public and the business enterprises is a hindrance to economic development. Poor power suppoy has the tendency of retarding economic growth and development, as well as the socio-economic welfare of the people. It affects firm's productivities such as causing many inputs to be idle when there is power outage. Adding up to this problem is that power outages result in huge business loss and retard SMEs activities. For instance, growth rate of GDP fell from 8.8% in 2012 to 7.1% in 2013 and its drop is attributed to negative growth in manufacturing subsector and service sector fueled by inadequate supply of electricity (Energy Commission, 2014). This has a long run negative effect on economic growth and development to every country.

Turning to the importance of SMEs in economies around the world, both developed and developing, cannot be overstated. SMEs are the dynamic force for sustained economic growth and job creation and additions to Gross Domestic Product (GDP). They are valid, crucial component of an active industrial country. Frimpong (2014) puts on record that the percentage contribution of SMEs to Gross Domestic Product (GDP) ranges from 60 percent in China, 57 percent in Germany, 55.3 percent in Japan and 50 percent in Korea, compared to 47.3 percent attained by Malaysia. According to Organization for Economic Cooperation and Development (OECD) report, SMEs play a major role in economic growth in the OECD area, providing the source for most new jobs. Over 95% of OECD enterprises are SMEs, which account for 60%-70% of employment in most countries. As larger firms downsize and outsource more functions, the weight of SMEs in the economy is increasing.

In developing regions like Africa, the contributions of SMEs to economic growth are equally, if not more, substantial. An average of 50% of employment avenues in Africa is created by the operations of SMEs. In South Africa, 91% of formal businesses are Micro, Small and Medium Enterprises (MSMEs) and generate significant proportions of GDP and employment. In fact, about 52% to 57% of GDP is produced by MSMEs and 61% of employment is created by MSMEs (Berry, Poortinga, Segall & Pierre, 2002). In Ghana, for instance, 92% of formal businesses are SMEs. In comparison, though, the contribution of SMEs to GDP is greater in Ghana than in South Africa. SMEs contribute about 70% to GDP and provide up to 85% of employment in the manufacturing sector (Steel &Webster, 1991; Aryeetey, 2001; Abor & Quartey, 2010).

Clearly, SMEs play a key role in the economic growth and development and have been recognized as essential sources of endogenous growth. In the light of efforts to alleviate poverty and improve standards of living in Ghana, an efficient SME sector is critical to that end. It is then imperative to create a congenial environment for their operation and growth. In assessing the above core role the

availability of power supply plays, and the contribution of SMEs to economic development brings to light the need for a sound business atmosphere if an economy is to see development and to improve the lives of its people.

Although SMEs continue to be the fastest growing sector of the economies of developing countries, despite this, their operations have been engulfed by inadequate and unreliable power supply rendering most SMEs unproductive and inefficient. Access to a reliable electricity supply is considered to be to very important to the operations of most small and medium size companies.

Research works on electricity supply and firm performance suggest that taking the middle and lower income countries as a case, firms consider access to power supply to be one of the major limitations to their business. In addition, the 2013 enterprise survey, identified electricity as the second major obstacle to enterprise development. Thus, 49.8% of businesses in Ghana consider insecure electricity supply as a major constraint (World Bank Enterprise Survey, 2013). Notwithstanding the costs associated with the replacement or repair of machines and other equipment, cost related to spoilage of finished goods and also the cost of incurring an alternative source of electricity like rented or self-owned generator. Coupled with all these back and forth problems is really a bane on SMEs activity that needs in-depth research. Research in this area too is limited from the Ghanaian context. And specifically on regional analysis.

This brings to light why investigating the effect of power supply on firm performance from the Ghanaian perspective, through a comparative analysis is deemed important. On this premise that this paper aims to assess the effect of unreliable power supply on the performance and operations of SMEs in Ghana. This analysis is done through a comparative analysis between two major regions: SMEs located in the North and Tema. This is in an attempt to answer questions such as: are there differences between firms performances between SMEs located in different region of the counter? Are there significant effect of power interruptions on the performance of the firms in the various regions and to identify patterns of power supply in the regions.

The rest of the paper is organized as follows; the nest section review related literature, followed by a discussion of the methodology. The last section looks at the results, conclusions and policy recommendations

Review of Literature

Availability of extant literature indicates limited work that relates to the study of manufacturing SMEs and power performance from Ghanaian context. Most of the literature reviewed was concerned with the broad category of SMEs, of which manufacturing SMEs is a subset. In Ghana, very few studies have been conducted to decipher the specific effects that unreliable electricity supply on SMEs' operations and activities. The study develops its literature from concepts and definition of SMEs in general.

Concept and Definitions of SMEs

The use of any single definition of SMEs for multiple countries in diverse stages of growth and development can lead to policy distortion (Gibson & Van der Vaart, 2008). In spite of the aforementioned belief, there have been several attempts to arrive at a single and unifying definition for SMEs around the world. Some define SMEs in terms of firm size while others use skill of labour and turn over level. Still, others use the legal status and method of production of the firm (Abor & Quartey, 2010).

SMEs are categorized differently from country to country and within countries depending on the objectives of various regulatory and incentive systems (UNIDO, 1999). The U.S considers SMEs to include firms with fewer 500 employees. Small firms are those usually with fewer than 50 employees whereas micro enterprises have at most about 10 workers. In Canada, SMEs are defined as businesses with fewer than 500 employees. Small businesses are those with fewer than 100 paid employees while medium sized enterprises have at least a 100 paid employees but fewer than 500 paid employees. Canada and the U.S have the same upper limits for medium sized enterprises but different upper limits for small businesses. The disparity in the definition of SMEs between these two countries is a recognizable trait in the definitions formulated by different international bodies and organizations such as UNIDO, the European Commission, and the World Bank. UNIDO defines SMEs in terms of the number of workers the firm employs. But the definition of what of an SME is in developing countries is differentiated from that of developed countries. The definition of SMEs in developing countries is as follows: Large - firms with 100 or more workers; Medium - firms with 20-99 workers; Small - firms with 5-19 workers; Micro - firms with less than 5 workers. And for developed countries, UNIDO classified SMEs as follows: Large - firms with 500 or more workers; Medium - firms with 100-499 workers; Small - firms with 99 or fewer workers.

The World Bank and the European Commission, on the other hand, defined SMEs based on their annual turnover level, asset base and the number of persons that the firm employs. The World Bank defined SMEs as firms with a maximum of 300 employees with an annual turnover level and asset base of not more than 15 million US dollars. While SMEs, according to the European Commission are firms with no more than 250 employees with an annual turnover level that does not exceed 50 million Euros and an annual balance sheet less than 43 million Euros. A further break down of the EC definition of SMEs definition in relation to the number of employees' criteria is as follows: Micro-enterprises have up to 10 employees; Small enterprises have up to 50 employees; Medium-sized enterprises have up to 250 employees. As international organizations have tried to come up with a single encompassing definition for SMEs, individual authors and scholars have also come up with various descriptions of what SMEs are. Authors including Van der Wijst (1989), Jordan et al (1998), Michaelas et al (1999), and López and Aybar (2000) variously described SMEs either in terms of the number of employees, annual turnover level or both (Abor & Quartey, 2010). Gibson and Van der Vaart (2008) instead drew up a definition for SMEs that uses only the annual turnover level and uses neither the asset base of SMEs nor their employment level. They believed that the practice of using employment level and asset base leads to distortions in policy and if applied to any other sector may lead to numerous firms being categorized as small whereas it could lead a different result when the same size or definition is applied to different sector. Thus according to Gibson and Van dr Vaart (2008), an SME is a formal enterprise with annual turnover in U.S dollar terms of between 10 and 1000 times the mean per capita gross nation income at the purchasing power parity of the country in which it operates. The descriptions of SMEs are as varied as their sources and in Ghana, it is no different. A Ghanaian perspective on SMEs is needed to put into context our study of how manufacturing SMEs cope with unreliable supply of electricity.

In Ghana, SME as defined by Ghana Statistical Service (GSS) as the number of employees of the given firm. According to the GSS, firms with fewer than 10 employees are small scale enterprises and those with employees greater than 10 are medium and large sized enterprises. The GSS definition makes it improbable to distinguish between a medium sized enterprise and a large sized enterprise thus rendering it vague and elusive. NBSSI, on the other hand, defines SMEs based

on the number of employees and the fixed asset value of the firm. It defines a small-scale enterprise as a firm with not more than 9 workers and has plant and machinery (excluding land, buildings, and vehicles) not exceeding 10 million cedis.

Characteristics of SMEs in Ghana

In general, SMEs share traits in their pattern of operation and structure that make the distinct from large sized enterprises, irrespective of where they are located in world (Gibson &Van der Vaart, 2008). The shared traits of SMEs outlined by Gibson and Van der Vaart (2008) include the following. SMEs are more often managed by their owners, more centralized in their management, with substantially weaker delegation and departmentalization; are more focused on short-term needs and medium-term survival than on long term profitability or market share; less technologically sophisticated and slower to take advantage of available and affordable technology; more dependent upon personal relationships between management and workers and between management and customers; Less able and less inclined, to prepare and follow business plans.

Kayanula and Quartey (2000) also outlined certain features that distinguished SMEs from large sized enterprises. They asserted that while large scale firms have direct access to international and local capital markets whereas SMEs are excluded because of the higher intermediation costs of smaller projects. SMEs in Ghana share all the characteristics above but these characteristics are a bit more general and not specific to the Ghanaian context only but also developing countries overall. In Ghana, SMEs can be categorized into urban and rural enterprises. The former can be subdivided into "organized" and "unorganized" enterprises. The organized ones mostly have paid employees with a registered office, whereas the unorganized category is mainly made up of artisans who work in open spaces, temporary wooden structures, or at home, and employ few or in some cases no salaried workers (Kayanula & Quartey, 2000). They rely mostly on family members or apprentices. Rural enterprises are largely made up of family groups, individual artisans, women engaged in food production from local crops. The major activities within this sector include:- soap and detergents, fabrics, clothing and tailoring, textile and leather, village blacksmiths, tin-smiting, ceramics, timber and mining, bricks and cement, beverages, food processing, bakeries, wood furniture, electronic assembly, agro processing, chemical-based products and mechanics (Osei et al., 1993; Kayanula & Quartey, 2000).

Majority of SMEs are female-owned businesses, which more often than not are home-based, compared to those owned by males. They are operated from home and are mostly not considered in official statistics. This clearly affects their chances of gaining access to financing schemes, since such programmes are designed without sufficient consideration of the needs of businesses owned by females (Abor & Quartey, 2010). Indeed SMEs in Ghana are usually unable to access financial assistance from formal financial institutions. SMEs rely primarily on personal savings of owners, business profits, family members or friends for their financial needs (Okraku & Croffie, 1997).

The role of electricity in SMEs activities

Mayer-Tasch (2013) asserted that the most dominant use of electricity among SMEs is for lighting and communication purposes. However, SMEs, especially manufacturing ones, have other major uses of electricity ranging from production and storage to powering of machines and office equipment. Within straightening and welding SMEs, electricity powers machines that aid in the production of metallic gates, canopies, scaffolds and anti-burglary devices. Sachet water producers

use electricity to power machines that fill polythene bags with water, cut and then seal them. Food processing firms also use various machines that require electricity to power them for the produce to their product. Likewise, dressmakers use electricity to power machines that they use to sew dresses and shirts. The primary use of electricity within manufacturing SMEs is thus to power machines that are usually critical to their respective production process. There is a symbiotic relationship between electricity and business. Energy supplies have a significant impact on economic activities (Velasquez & Pichler, 2010). In fact, the manufacturing sub- sector consumes about 14% of generated electricity annually (Energy Commission, 2006).

Empirical Literature

The dependency of SMEs and more importantly manufacturing SMEs, on stable supply of electricity for efficient production at cost effective levels is unequivocally sensitive. In addition, several research papers have shown that electricity supply shortage negatively affects the productivity of SMEs. Mchopa, Kazungu, Moshi (2014) in their research survey conducted in the Moshi municipality of Tanzania, revealed that power rationing resulted in a decline in SME productivity. Also, as a result of power rationing, a decline in productivity was reported to have a positive relationship with loss of income within SMEs.

Likewise, a qualitative survey in the Kumasi metropolis by Braimah and Amponsah (2012) revealed that blackouts last about 10.3 hours in a month on average. As a result of the power outages, 44% of the 320 SMEs surveyed spent the duration of the power outage in redundancy while the remaining 56% owned alternative sources of electricity (generators) which cost Ghc 15.5 per month to run on average. The paper resolved that frequent blackouts increased the cost of production of SMEs and affected the effectiveness of meeting contract deadlines.

Cissokho and Seck (2013), on the other hand, found that power outage duration had a positive and significant impact on productivity, as measured by technical efficiency, of SMEs. Just like productivity, the cost efficiency of SMEs was also found to have a positive and significant relationship with the duration of power outages. However, scale efficiency of SMEs was negatively affected by both the frequency and duration of power outages.

In terms of access to electricity services, Maleko (2005) asserted that the availability of grid electricity services in rural areas supported the development of micro enterprises but at a slow rate. He also revealed that the structural set-up of micro-enterprises was directly affected by the arrival of electricity services and cited instances whereby mills with a diesel powered motor switched to an electrical power.

In conclusion, power outages or unavailability of power supply or electricity insecurity has a negative impact on the productivity of SMEs. Productivity is affected at the end. Thus, unreliable electricity supply has a negative impact on both cost competitiveness and investment decisions of SMEs. Hence, those firms experiencing outages end up having higher unit costs of production than their counterparts who do not experience power outage. This brings competitive disadvantage to the firms affected.

Methodology

Data

Data used for this study comes from the World Bank Enterprise Survey (2013), the most current and the Ghanaian version. The World Bank enterprise data is a firm-level survey of a representative sample of an economy's private sector. The data was conducted by private on behalf

of the World Bank consisting of 720 firms. The sampling methodology for Enterprise Surveys is stratified random sampling. In a simple random sample, every subset of a statistical population has an equal probability of being chosen. The enterprise survey is conducted in selected urban centres which are intended to coincide with the location for the implementation of the main enterprise survey. The urban centres which were identified in Ghana were Accra, Tema, Takoradi, and North (i.e. Kumasi and Tamale). The data have been used in recent years by a number of studies examining the relationship between firm performance and the business climate (Dethier et al., 2011).

Estimated Theoretical Model

Situating this study into positivist philosophy which allows for an objectivity in explaining the relationship among social processes and between variables, the study estimates the functional form for the study as

$$\mathbf{Y} = \mathbf{f}\ (PS,\ \boldsymbol{Reg},\ Z) \qquad (1)$$

Where outcome variable is a function of the main explanatory variables and other covariates. Ordinary Least Square method (OLS) is used to show the relationship between the dependent variables (firm performance) and the explanatory variables (power supply) and other covariates. Equation 1 above helps to evaluate the influence of power supply on firm performance. Where Y, is captured as the dependent variable such as performance of the firm (measured in terms of profitability of the firms), and PS is captured as power supply, Reg is represented as the region of the firm and Z captures the other covariates variables such as FO is the female ownership, MRK is the market size, LS is the legal status of the firm and EDU is the education level of workers in the firm.

The empirical model

From equation (1) the empirical model can be specified as

$$FP_i = \beta_0 + \beta_{1i}\, PS + \beta_{2i} FO + \ \beta_{3i} MRK + \ \beta_{4i} LS + \beta_{5i} AGE + +\beta_{6i}\, Reg + \beta_{7i} EDU + \epsilon_i \qquad (2)$$

Where the variables are as explained before as *FP* is the firm performance, *PS* is the power supply, *FO* is the female ownership, *MRK* is the market size, *LS* is the legal status of the firm. *REG* is the region of the firm, *EDU* is the education level of workers in the firm, e_i is the error term

[Table 1]

Descriptive Statistics of the variables

The descriptive statistics of the relevant variables employed in this study are presented in Table 2. The mean measures the average values of a group of values. The standard deviation measures how the values are spread around the mean. The minimum and maximum values capture the range of variables. From table 2, it can be concluded that there is less variability among the relevant variables used in this study. All the relevant explanatory variables indicate a lower standard deviation as compared to their means.

[Table 2]

Results

The section presents findings of the empirical study carried on the comparative analysis of firm performance and power supply. The analysis is done from two angles. First, comparative analysis is done on the whole sample size covering the four regions. However, on the regression analysis, the model was regressed on only the two regions of concern. This was done to test the differences in the performance of firms between the two regions (Tema and North).

Average number of Power Outages (Electricity Supply) in typical month in last fiscal month Across Region.

One question that the study delves into was to find out examine whether firms that experience power cut are less profitable than their counter parts who did not experience power cut across regions. Table 3 shows that the Accra region (92.88%) experienced the highest power interruption. This is followed by firms in the North (87.86%), Takoradi (87.86%) and Tema (87.86%) respectively. Comparatively, Firms in North experienced power cut more than firms located in Tema. A scenario which can have influence on the performance of firms located in the North.

[Table 3]

Distribution of Average number of hours of power cut by region of establishment

The graph below shows the average number of power outages experienced in the last fiscal year. On the average, firms in the Takoradi region experienced the highest number of power outages, followed by North, Accra, and Tema respectively. This is in proportion of 14.59, 14.11, 10.39 and 8.8 hours in that order. Comparing North and Tema, it can be observed that firms located in North had the highest number of power outages on the average while firms in Tema had the least. One of the reasons than can be attributed to the highest average hour power cut in the North than the Tema could be the distribution. On the average, more firms are located in the north than in Tema. As can be observed from Table 3 and Figure 1, it is likely that firms in the North are to be less profitable than their counterpart located in Tema. This is because such firms have least registered requirement. Again, such firms experienced highest power interruptions. These are likely to worsen the activities of such firms in the North.

[Figure 1]

Duration of Average Power Outages (Electricity Supply) in hours Across Region

Describing the duration of average power cut last in various location centres, Takoradi, North, Tema, and Accra, show that power cut experienced in typical month lasted for about 9 hours a day in Accra, about 5 hours a day in the North, approximately 8 hours in Takoradi and about 8 hours in Tema. Firms operating in Accra were hit severely by power outage duration. Comparing Tema and the North show that firms in Tema have the least hours to have power back when there is power outage than firms located in the North. It is on record that power cut could lead to a loss in profit. For instance, Corporate Ghana Port and harbour Authority (GPHA) was reported to have lost over US $100,000 profit in 24 hours continuous power failure at Tema harbour site. Such could also lead many investors to withdraw their decision to invest in the country as a result of the consistent uncontrollable and unreliable power supply in the country. The power interruption

across the various regions has ended the firms to resort in diverse form of alternate power such as generator. Firms in the Tema compared to the North has more percentage of electricity from generator owned/ share by establishment as shown in Figure 3. This implying that firms are looking amicable ways to overcome the deteriorating effect of the power interruption in their activities.

[Figure 2 & 3]

Percentage of Annual sale losses by Power Outages (Electricity Supply)

Figure 4 depicts average sale losses due to power outages. Comparing the North and Takoradi from the graph below shows that averagely firms located in the North experienced the highest average sale losses due to the power outages. Firms in the North accounts for 22.57% of its sale loss to power outages while those in Tema accounted for 15.45 %. That is power cut effect resulted in a combined effect of more expenditure, less revenue. An indication that power fluctuations have a negative effect on profit and on the operations of the firm businesses.

Among the objectives of this paper to examine patterns of power supply on firms (SMEs) in the North and Tema. The results so far show that firms in North have less power supply (availability of power) than firms located in Tema. This has resulted in firms in the North having higher percentage of sales loss due to power outages than firms in Tema. Adding to the picture than firms in Tema are more likely to be profitable than firms in the North.

[Figure 4]

Table 4 presents analysis of variance (ANOVA) test on the relationship firm performance and region of operation. The test shows the overall significance of the independent variables. The null hypothesis is when all the regressors do not affect the regresand. From the results, the F-value (10.84) follows the F distribution with 3 and 538 df. This F value is highly significant, as the computed p value is 0.000. This explains that there are significant differences in the firm's performance and region of operation. This result shows that region of operation from the Ghanaian context mater in SMEs activities.

[Table 4]

Table 5 sought to investigate the extent of variation in firm performance by region of operation. The Bonferroni Test indicated that firms in Accra have higher probability of doing better than firms in North. Again, firms in Tema are likely to do better than firms in the North. As indicated in table 5. This is so because there is significantly positive variation between these firms and the regions of operation.

[Table 5]

Estimation results and discussions

The regression analysis is done (Table 6) on the power supply variable with reference to all the two models. Model one has power supply variable captured binary. An indication of assessing the effect of those who have experienced power cut and its effects on the SMEs (Firm) performance. Model two, on the other hand, has power supply variable captures in two ways: one examining the number of hour's power cut last typical month and the frequency of power cut, and

how these indicators affect SMEs performance. Among other covariates explaining the SMEs, performance are also captured in the models (all other independent variables). The Link test for model specification indicating whether the model is well specified and of good fit. The test underscore hat square predicts that the two models are well specified and of good fit. The chow test for ***differences in firm performance between North and Tema on the claim that there*** are difference between North and Tema on firm performance. At 5 percent significance level, we fail to reject the research question that there are difference in firm performance between SMEs located in Tema and the North. The t-test confirms that SMEs in Tema are more likely to do creditably well in terms of profitability than SMEs located in Northern part of Ghana. Again, there is a significant influence between power supply and SMEs performance. The regression result revealed shows that we fail to accept the null hypothesis at 1 and10 percent significance levels in the two models respectively. Thus, the study confirms an influence power supply on firm performance. This gives credence that power supply plays crucial role in the activities of the SMEs (firms) as evidenced in the two models.

At 10 percent significant levels, firms who have ever experienced power cut are 9.38 percentage points less profitable than firms who have never experienced power cut before. Implying that if firms have less power supply, the likelihood for such firms to loose profit is would be high than when there is power availability for production. This loss could be attributed to the fact that some of the SMEs may be having financial problems and may not be able to afford purchase another alternative source of electricity. Hence, they may adopt a strategy of cutting down production which will result in low profitability of the firm. This situation, in addition, has the tendency for adding to the woes of unemployment as firms may institute employment cut strategy, a mechanism to cut cost. This finding confirms the research by (Cissokho and Seck, 2013; Mayer, Mukherjee & Reiche 2013). They reported that poor electricity supply has a negative impact on SMEs profitability. All because most firms rely on electricity for production and cannot substitute cheaply for another alternative source of power. Thus, some SMEs are unable to improve the quality and quantity of their produce leading to low profit. The hours of power cut last as an independent variable also shows that all other variables held constant, the profitability of the firm will fall by 3.13 percentage points when there is one hour of power cut. This is statistically significant at10% alpha level. Thus, the occurrence of frequent power outages brings about output loses as the SMEs are not able to produce normal output per day. The longer the duration of power outages, the higher the firms lost output as they were in no or little position to undertake production Again, at 1% significance level, it is observed that an additional power cut is associated with positive effect on firm's profitability. That is when there is an additional power cut, some firms are able to increase profit by e 3.19 percentage points. This result shows that some firms may have developed techniques and strategies to mitigate the negative effect of power cut into profit. That is, in times of frequent power cut some firms have to devise coping strategies and proper management to overcome poor electricity supply to make profit. This result coincides with the findings of Cissokho and Seck (2013) which states that the duration of power outage had a significant positive effect on firm's performance. Cissokho and Seck (2013) argued that the duration of power cut could at an instance turn out to be more of a motivation than a hindrance to business as always seen. At 5 (1) percent significant levels, SMEs in the North are 52.2 (70.3) percentage points less profitable that firms in other regions. However, at 10 (1) percent significant levels, SMEs in Tema are 36.2 (71.1) percentage points profitable than firms in other regions. Firms located in Tema are likely to be more profitable than their counterparts in North. This result

could be due to the fact that environmental heterogeneity may contribute to this kind of performance.

Examining the extent of firm legal status on firm's profitability revealed that at 5 percent significance level, sole proprietor firms are 13.11 percentage points less profitable that their counterpart shareholding company with shares trade in the stock market. This could mean Shareholding Company with share trade in the stock market is more profitable than sole proprietor firms. Again, size of firm and profitability are seen to have positive relationship. Thus, the larger the firms, the more profitable these firms are. With small size firms as the base category, medium and larger firms are 19.40 (18.54) and 34.11 (33.40) percentage points profitable higher than small size firms all other thing being equal. This could be due to the fact that the lager the firms, the likelihood for such firms to enlarge its capacity base and to thrive well in the environment. Age and firm profitability show that at the initial stage of inception that there is no influence of firm age on firms' performance (profitability). However, as the firm ages, there seem to be positive correlates on firm profitability. At 1 percent significance level, firm profitability increases by 1 percentage points. At 5 and 1 percent significant levels, firms that are owned by female and average years of educated worker has negative and positive relationship on firm's performance (profitability). Thus, SMEs own by females is associated with 44.3 percentage points less profitable than their counterpart male owners. In addition, an additional year of education acquired by workers is associated with 11.8 and 13 percentage points increase in firms profit. The result shows that workers who are educated could contribute to firm performance.

In conclusion, it can be said that generally, power supply and firms performance have positive correlation. An indication that if there is availability of power for production, firms are likely to have higher chance of being profitable and vice versa. Also, firms in the Northern part of the country's performance as compared to Tema is not encouraging. That is firms located in Tema are seen to creditably perform better in terms of having higher profit than firms in the Northern part of Ghana. However, other covariates such as age of educated workers, firm size, ownership of firm and age are contributing factors to firm performance.

[Table 6]
[Table 7]

Conclusions and recommendations

This paper examined the effects of power supply on the performance Small and Medium size Companies using 2013 World Bank Enterprise Survey Data. The main objective of this paper was to analyse the effect of electricity supply interruptions on the performance of SMEs. In addition, the paper examines patterns of power supply on SMEs in Kumasi and Tema through the application of chi square and linear regression (OLS) analysis. The findings confirmed that there is a significant relationship between power supply and firm performance. Thus, power supply had a negative and significant impact on the firm's profit (Mchopa, Kazungu, & Moshi, 2014). Surprisingly, the study found the number of times power cut to be positively associated with firms profit (Cissohko & Seek 2013). An indication that if power outages become enormous, firms end up devising strategies to mitigate against the negative effect of power interruptions and to make profit as well. This may imply that well minded business firms ought to devise strategies to circumvent around power outages impact. The patterns of power supply and its effects on the firm's performance shows that firms in the Tema region are more likely to perfom better than those located in the

North. An indication that locational differences matter in firm's performance. Furthermore, the study shows that female ownership does negatively affect firm performance than firms owned by males. In addition, other covariates such as educated workers, size of the firm play crucial role in the profitability of the firms.

It can, therefore, be said that small and medium size companies play a critical role in the country, both in terms of revenue and employment creation. However, the operations are hindered by many constraints among which is poor electricity supply that shows up as daily power outages since the early 2000s in the country (Ghana). Thus, the negative effect of power cut or power outages cannot be underestimated as a result of the output loss to firms. The policy from this finding is that government should implement policies and program such as power mix approach and renewable energy to mitigate against the poor electricity supply. This will help solve some of the woes of profit loss to the firms through power outages effect. In addition, government can create the environment to enhance private sector participation in the power sector to boost competition and efficiency in the supply of power for the firms. This will in no small way contribute to employment creation by the SMEs in the long run. Finally, SMEs should consider devising strategies such as resulting to power back-ups in any forms in their industries to ensure continual production in cases where power outage occurs. This in no small way reduces profit loss (reduce the operational cost) due to power interruption.

Reference

Adenikinju, A. (2005) Analysis of the cost of infrastructure failures in a developing economy: The case of the electricity sector in Nigeria, AERC Research Paper 148, African Economic Research Consortium, Nairobi.

Attigah, B. & L. Mayer-Tasch (2013) Productive use of Energy (PRODUSE): The Impact of Electricity Access on Economic Development: A literature review, GIZ, Eschborn.

Ayyagari, M., Beck, T & A. Demirgüç-Kunt (2003) Small and Medium Enterprises across the Globe: A New Database, World Bank Policy Research Working Paper 3127, August 2003.

Braimah, I., & Amponsah, O. (2012). Causes and Effects of Frequent and Unannounced Electricity Blackouts on the operations of Micro and Small Scale Industries in Kumasi. Journal of Sustainable Development, 5(2), 25.

Beck, T., Demirguc-Kunt, A. & Levine, R. (2005) SMEs, Growth, and Poverty, NBER Working Paper No. 11224, NBER.

Chakravorty, U., M. Pelliz Beyza and U. Marchandx (2012) Impacts of Reliable Electricity Supply: Evidence from India October 2012.

Chissokho, L. & A. Seck (2013) Electric Power Outages and the Productivity of Small and Medium Enterprises in Senegal, Investment Climate and Business Environment Research Fund (ICBE-RF), Research Report No. 77/13, Dakar, November 2013.

Escribano, A. & Guasch, J.L. and Pena, J. (2009): Assessing the Impact of Infrastructure Constraints on Firm Productivity in Africa. Working Paper 9, Africa Infrastructure Sector Diagnostic, World Bank. Washington D.C.

Fisher-Vanden, K., Mansur, E. & Wang, Q. (2012) Costly Blackouts? Measuring Productivity and Environmental Effects of Electricity Shortages, NBER Working Paper No. 17741.

Frimpong, C.Y. (2013, July 29). Modern Ghana. Retrieved November 24, 2014, from Modern Ghana website: hhp://www.modernghana.com/news/478225/1/smes-as-an-engine-of-social-and-economic-development.html.

Gibson, T., & Vaart, H.V. (2008, September). Defining SMEs: A less Imperfect Way of Defining Small and Medium Enterprises in Developing countries. Brookings Global Economy and Development, 11.

Isaksson, A. (2009) Energy Infrastructure and Industrial Development, Research and Statistics Branch Programme Coordination and Field Operations Division UNIDO, WORKING PAPER 12/2009.

Kaseke, N. & Hosking, S. (2013) Sub-Saharan Africa Electricity Supply Inadequacy: Implications Eastern Africa Social Science Research Review, Volume 29, Number 2, pp. 113-132.

Kayanula, D., & Quartey, P. (2000). The policy Environment for Promoting Small and Medium Sized Enterprises in Ghana and Malawi. Manchester: Institute for Development Policy and Management, University of Manchester.

Kirubi, C., Jacobson, A. & Kammen, D. M. & Mills, A. (2009): Community-Based Electric Micro-Grids Can Contribute to Rural Development: Evidence from Kenya. World Development, 73, pp. 1208–1221.

Kushnir, K., Mirmulstein, M. & Ramalho, R. (2010) Micro, Small, and Medium Enterprises around the World: How Many Are There, and What Affects the Count? World Bank/IFC.

Mayer-Tasch, L., Mukherjee, M. & Reiche, K. (2013) Productive Use of Energy – PRODUSE: Measuring Impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa, Eschborn:GIZ.

Rud, JP (2012a), Electricity Provision and Industrial development: Evidence from India, Journal of Development Economics, Vol 97(2), pp 352-367.

Table and Figures

Table 1: Definition and Measurement of Variables

Variable	Definition	Measurement	A priori Sing
Firm Performance (Profitability)	Profit Margin (PM) of firm. This measured in terms of the differences between total sales less total cost of the firm.	Measured as continuous variable	
Power Supply : **1**. power outages experienced	Whether experienced power cut before of not	Measured as binary. 1=Yes, 0=No	
2. Duration of power outages	The number of hours power cut last in a typical month	Measured as continuous variable	
3. Frequency of power cut	The number of time power cut experienced in a typical month	Measured as continuous variable	
Firm size	the number or value of units sold to a market in a given period usually in a year	Measured as categorical variable	+
Age of firm	Age refers to the date of the establishment of the firm up to 2013 when the data was collected	Measured as continuous variable	+

Legal Status firm	This is defined as type and scale of business that you want to set up. It may include sole proprietorship, partnership, limited partnership or a shareholding company	It is measured in categorical variable	+/-
Female Ownership	It is defined as whether the ownership of the SME is own by Female or not	It is a binary variable	
Region	Region where SMEs are located	It is a binary variable to capture the regions SMEs located	+ or -
Education Level	It is measured as the average years of an educated worker	Measured as countinuous variable	+

Table 2: Descriptive Statistics of the variables

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Log of profit	403	11.97	2.48	6.29	20.01
Experienced power cut	403	NA	0.30	0	1
Number of times power cut	403	11.12	12.53	0	99
Hours of power cut	403	7.84	5.19	1	48
Region	403	NA	1.21	1	4
Legal status	403	NA	1.05	1	5
Firm size	403	NA	0.64	1	3
Age of firm	403	15.12	11.71	1	104
Age square	403	365.45	763.99	1	10816
Female Ownership	403	0.29	0.46	0	1
Average years of Education	403	66.95	33.74	0	100

Source: Computed from 2013 Enterprise Data

Table 3: Did Establishment Experienced Power Cut in Last fiscal Year

Region	No	Yes	Total
Accra	7.12	92.88	100
North	12.14	87.86	100
Takoradi	12.73	87.27	100
Tema	13.07	86.93	100
Average Total	9.87	90.13	100
Pearson Chi2(3)	6.0588	Pr=0.109	

Source: Author's own construct from 2013 Enterprise Data.

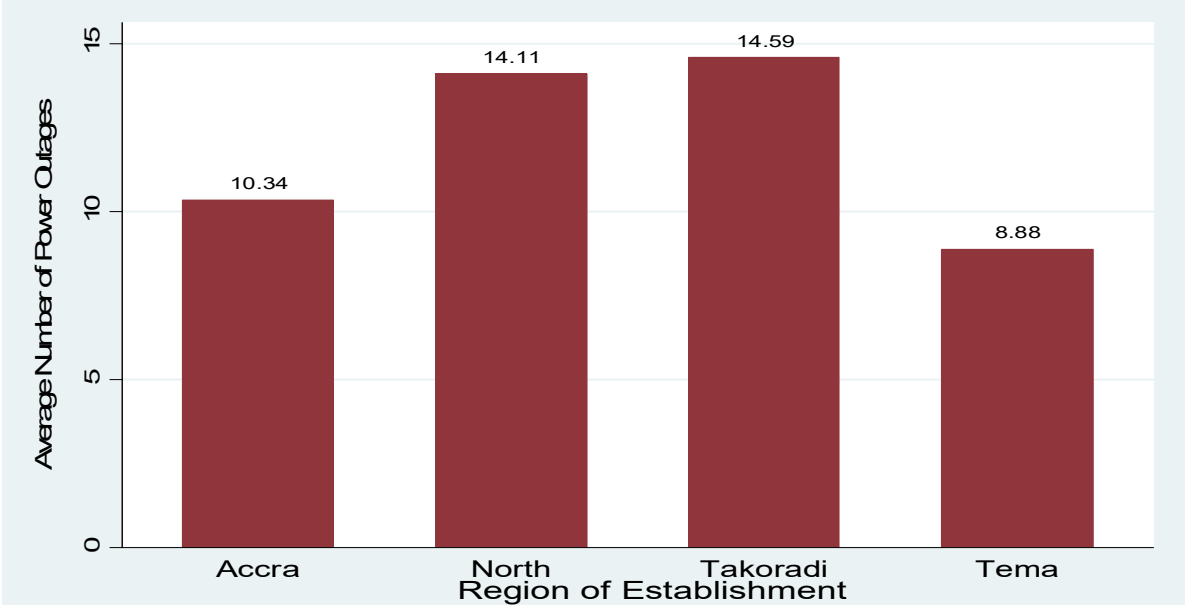

Figure 5: Distribution of Average number of hours of power cut by region of establishment. Source: Author's own construct from 2013 Enterprise Data.

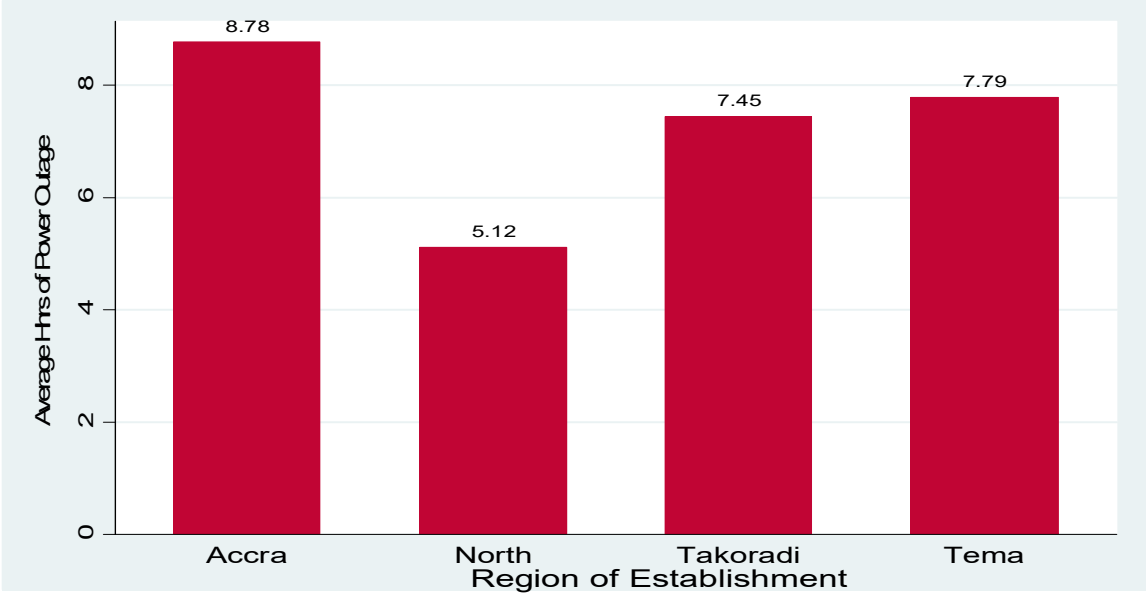

Figure 6: Duration of Average Power Outages (Electricity Supply) in hours Across Region Source: Author's own construct from 2013 Enterprise Data

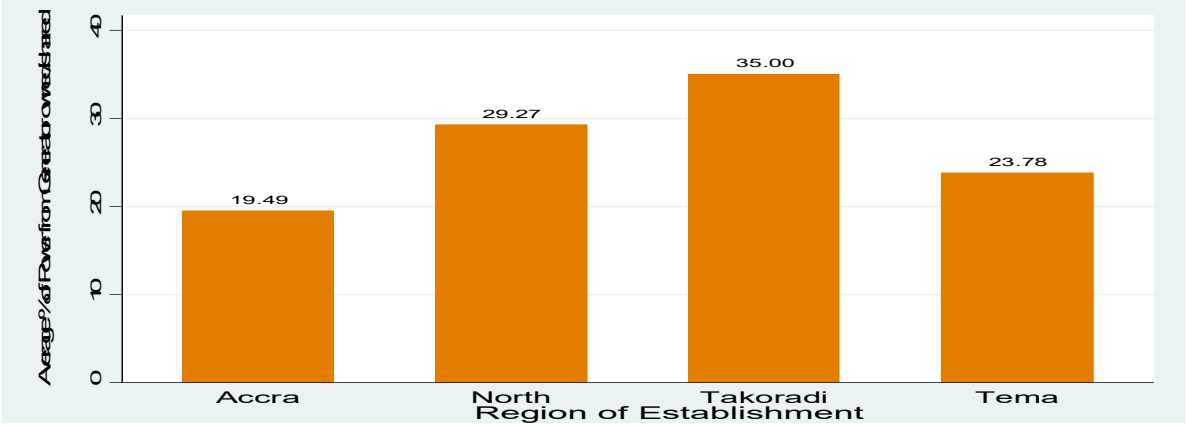

Figure 7: Percentage of Electricity from Generator owned/ Share by Establishment Across Region. **Source: Author's own construct from 2013 Enterprise Data**

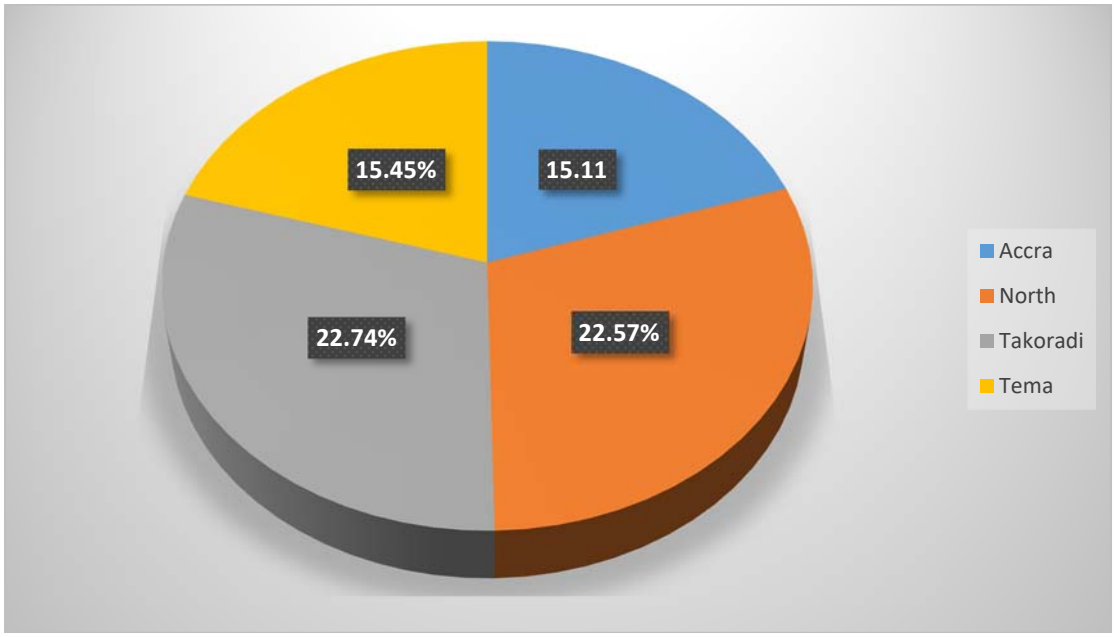

Figure 8: Percentage of Annual sale losses by Power Outages (Electricity Supply) Source: Author's own construct from 2013 Enterprise Data.

Table 4: Analysis of variance test (ANOVA)

Source	**SS**	**Df**	**MS**	**F**	**Prob > F**
Between groups	139.1409	3	46.38	10.84	0.00
Within groups	3182.465	538	5.92		
Total	3321.605	541	6.14		
Equality of variance assumption			H_O: there is equal variance across groups.		
Bartlett's test for equal variances: chi2 (3)			= 0.3803 Prob >chi2 = 0.944		

Table 5: Comparison of lnprofit by Region of Operation (Bonferroni Test)

Col-Row Mean	Accra	North	Takoradi
North	-1.029***		
	0.001		
Takoradi	-0.622	0.407	
	0.953	1.000	
Tema	0.461	1.490***	1.083
	0.505	0.000	0.135

Table 6: Effect of electricity supply on the profitability of SMEs in Tema and North.

Dependent Variable=Profitability	OLS 1	OLS 2
Explanatory Variables	Lnprofit	Lnprofit
Experience power cut	-0.0934*	
	(0.064)	
Number of times of power cut experienced	----	0.0319***
		(0.0106)
Hours of power cut last	----	-0.0313*
		(0.0175)
North	-0.522**	-0.703***
	(0.229)	(0.245)
Tema	0.362*	0.711***
	(0.205)	(0.213)
Legal Status of Firm(**Base = Shareholding company with shares trade in the stock market)**		
Sole proprietor	-1.311**	-0.931
	(0.557)	(0.670)
Limited	-0.495	0.178
	(0.673)	(0.802)
Partnership	-0.0384	0.229
	(0.572)	(0.695)
Firm Size**(Base= Small)**		
Medium	1.940***	1.854***
	(0.198)	(0.198)
Large	3.411***	3.340***
	(0.434)	(0.427)
Age of firm	-0.00613	-0.0153
	(0.0199)	(0.0154)
Age square	0.0002	0.001***
	(0.000385)	(0.000198)
Female Owner	-0.306	-0.443**
	(0.203)	(0.220)
Average years of Educated worker	0.0118***	0.0130***
	(0.00265)	(0.00269)
Constant	11.50***	10.76***

	(0.691)	(0.692)
Observations	403	403
R-squared	0.442	0.504
Link Test _hat sq	0.744	0.795

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: T-test for differences in North and Tema on firm performance

The claim that are difference between North and Tema on performance	North - Tema is not equal to zero (0). Degree of Freedom=224	Prob(T>t) = 0.0912