

# Analysis of the Characteristics and Operations of Small Scale Industries In Ghana

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## Abstract

This paper provides empirical evidence and analysis of the characteristics of firms and assesses the nature of operations of Small-Scale Industry (SSI) in Ghana. Special attention has been paid to the roles that gender, education and other social elements play in the operations of the sector. The data used in this study were collected from a population of manufacturing firms in the SSI sector through the use of a structured questionnaire survey administered in rural settlements throughout the Mfantseman District in the Central Region of Ghana. The analysis covered the structure and operations of firms. The broad pattern which emerged from the analysis of the results is that, a higher percentage of firms has been in operation for less than 10 years and therefore relatively young. The sizes of firms were predominantly small and dominated by sole proprietorship making the sector the domain of owner managers. The capital requirement of the sector was very modest and the evidence showed that proprietors tended to rely more on their own funds as start-up capital of their businesses.

**Keywords:** Characteristics, Operations, Small-Scale Industries, Firms, Handicrafts Proprietors

## 1. Introduction

From the earliest beginning in the known history of Ghana, the SSIs particularly the handicrafts have constituted the central elements in the organic unity and culture of the people. In many societies the colourful strands of tradition and culture were woven into these unique objects making each of them individualistic and beautiful. Most of the items produced served the domestic and religious needs of the people (see for example Edusah and Tribe 1992:1). SSI activities thrived through the ages when society was organised more or less into self-sufficient and self-contained units and in the modern times SSIs have played a very important role in supplying the needs of the local consumers where the formal sector was under pressure.

The SSIs came into prominence in recent memory, during the decline period (1970-83) in the economy of Ghana. During the period, SSIs filled many of the production gaps created by the poor performance of the large-scale industries. (see for example Sowa, Baah-Nuakoh, Tutu and Osei 1992:7). Although some firms closed soon after they had been established, others survived and operated for a considerable number of years. Storey (1997:49) referred to the total number of businesses in an economy at any one time as the 'stock' of business. Over time this stock changes as a result of new firms being created (birth) and firms ceasing to operate (death). It is therefore important to study the characteristics and operations of the sector in Ghana.

## 2. Literature Review

Frimpong-Ansah(1991) has noted that modernisation was usually based on industrialisation programmes such as those for import-substitution and strategies of unbalanced economic development, (see also Elkan 1995:7). This usually resulted in the establishment of large-scale capital-intensive industries in urban areas. Chuta and Liedholm (1985:1) argued that this strategy has often produced disappointing results. In a number of cases not only has the over-all rate of growth of the economy been low but also employment in the industrial sector has failed to keep pace with population growth and in some cases has even declined in absolute terms. (See for example Morawetz, 1974; and Eckaus, 1977).

The anticipated overall advantages from the new industrial development failed to 'trickle down' and this led to the suggestion that, where large-scale production for export was not immediately feasible, small-scale industry was likely to be more efficient and therefore more appropriate (Elkan 1995:91). This idea was forcefully influenced by the publication of Schumacher's book *Small is Beautiful*, in 1974. The philosophy behind the book

is still relevant to the needs of developing countries, many of which are struggling to find the best options for their economic development. As a result, developing countries have become increasingly aware of and interested in assessing, the role that small-scale enterprise might play in their industrialisation strategies. By their nature if, for example, small-scale industrial establishments are more widely dispersed, generate more output per unit of capital, require less foreign exchange, and produce to satisfy the needs of the rural poor, then strong (socio-economic) justification would exist for promoting small-scale firms.

Chuta and Liedholm, (1985:1) and also Bruch and Hiemenz (1984) were of the opinion that Small and Medium Industries (SMIs) can play an important role in industrial development even at advanced levels of industrialisation. Mead (1991) contended that recent development trends have produced an explosion of interest in the SSI sector observing that third world governments, bilateral and multilateral aid agencies, and non-governmental institutions have all come to emphasise the potential of small producers to the development process. This has created considerable interest in the field and as a result the literature on it has grown in volume and diversity and the concept and definitions complex.

Gray and Gamser (1994:6) expressed the opinion that although definitions may differ, it is clear that every country has some working definition of SMIs because it is important to each government to it be able to identify SMIs and direct policies towards the sector. Therefore definitions for SSIs have been selected to help direct promotional assistance to the appropriate levels. The ILO (1972) refers to industries with not more than five workers as “informal” activity. Livingstone (1990) notes that boundaries selected in terms of numbers employed vary widely but among researchers a common denominator is (i) 0 – 9 employee as micro-enterprise; (ii) 10 - 49 small industry or enterprise; (iii) 50 - 99 employees for medium industry or enterprise; (iv) 100 and over employees for large scale industry or enterprise depending on the level of development of the country. In Ghana SSI sector covers a wide range of activities and forms a very important part of the rural off-farm activities (see Edusah, 2014, Edusah 2013, Edusah and Tribe 1996). According to Agbuabor et al (2013), the Federal Republic of Nigeria defined small scale enterprises as businesses that have total capital (land, building machinery equipment and working capital) of up to N60,000 and employ up to 50 persons. Ifechukwu (2000) viewed a small scale enterprise as a business operated mainly with hired labour usually not exceeding 50 workers if no motive power is used. Generally, such businesses are characterized by labour intensive mode of production, flexible operation as they adjust quickly to various factors, use indigenous raw materials, localised operations, low gestation period, and low level of education and skills.

### **3. Methodology**

The data for this study were gathered from a population of manufacturing firms in the SSI sector through the use of a structured questionnaire survey administered in rural settlements throughout Mfantseman which is one of the 18 Districts in the Central Region of Ghana. The Mfantseman district has further been sub-divided into 5 Zones (sub-district areas) namely (1) Anomabo, (2) Dominase, (3) Ekumfi, (4) Mankessim and (5) Saltpond.

The Mfantseman District was chosen for the research for a number of reasons. First, the district represents a typical rural district. This is because over 90 per cent of its population is found in the rural area and in settlements of less than 5000 inhabitants. Second, the district has both coastal and inland characteristics which offer a wide range of opportunities for the SSI sector activities. Third, the district like most rural districts suffers from lack of formal sector investment and development and decline in agricultural production. Fourth, typical of rural areas, unemployment and underemployment are high because of lack of any formal sector employment opportunities. The situation has encouraged the migration of the youth from the district to the urban areas.

Lastly, the largest traditional market in the Central Region is located at Mankessim in the district and this offers unique opportunity for SSI sector activities. Due to the lack of data on firms in the district, an estimated sample size of about 300 firms of SSI was anticipated. However, it became apparent at the initial stage of the questionnaire administration that the number of firms in various settlements varied considerably. In the event, a total number of 215 firms were located. A carefully prepared and structured questionnaire was administered randomly over 60 villages and covered 215 enterprise owners over a period of about 3 months.

## 4. Results and Discussion

### 4.1 Profile of Proprietors

#### 4.1.1 The age and gender structure of Proprietors

The age composition of proprietors as shown in Table 1 indicates a striking feature of the age distribution of respondents showing that only about 10 per cent of proprietors came from the age group 15-25 years. This is because most people at that age are either in high school or under apprenticeship and on attachment with older proprietors preparing themselves for future life. The table reveals further that the majority of the proprietors (81%) fell within the age group 26-58 years. This represented the active and the working age group of the population who were also active in every sphere of life. Finally, there was a very small segment of older age group (59-70 years) representing 7 per cent of the sample. The youngest age cohort in the sample is 15-25 and the oldest 70 with a mean age of 39 years, a mode of 35, and a median of 38. The sample exhibits a fairly young age group of proprietors and this implies that the small-scale proprietors surveyed were mainly of a prime economically active and productive age. This finding is consistent with the results of another study in Ghana by Anheier and Seibel (1987:47).

The gender composition shows that male proprietors made up about two-thirds of the proprietors. This is explained by the fact that males are more likely to be found in manufacturing activities than in trading and other service sector activities where females are more likely to be found but which were not covered by the survey. The larger size of male proprietors in the SSI sector is consistent with other studies in the Central Region (see for example Acquah-Harrison, 1990). Bosworth and Jacobs (1989) have noted that despite a growing number of female entrepreneurs, most small-business owner-managers are male. This revelation is interesting and runs contrary to the popular opinion in Ghana and elsewhere that the rural small scale industrial sector is normally the domain of the female. For instance (Funmi 1997) reports that women dominate in the small manufacturing sector in Nigeria. It must however, be added that women do dominate some activities of the SSI sector and this ought to be examined in more detail later.

Table 1: Age and gender structure of proprietors

Age	Gender		Total	%
	Male	Female		
15-25	18 (12.8)	4 (5.4)	22	10.2
26-36	56 (39.7)	20 (27.0)	76	35.4
37-47	27 (19.1)	30 (40.5)	57	26.5
48-58	29 (20.6)	17 (23.0)	46	21.4
59-69	9 (6.4)	3 (4.1)	12	5.6
70+	2 (1.4)	- -	2	0.9
Total	141 (65.6)	74 (34.4)	215	100.0
Mean	37.8			
Standard Deviation	11.8			

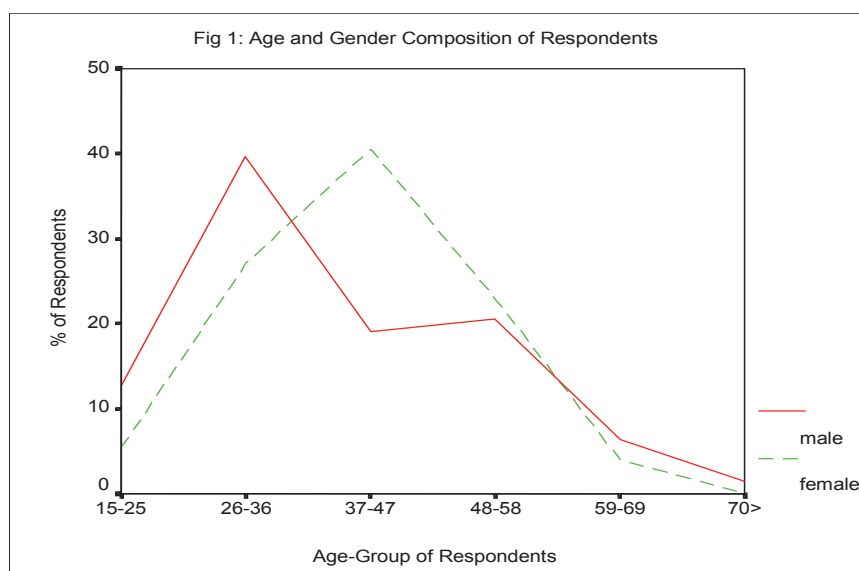
Source: Field Survey (2012) **Note:** (1) Figures in parentheses are column percentages. (2) Figures in bracket under totals are row percentages.

Figure 1 shows a graphic representation of the age and sex groups and reveals that there was the tendency for males to enter into industry at younger age than their female counterparts. The male distribution curve demonstrated positive skewness and also displayed bimodal tendencies peaking at age groups 26-36 and low at age group 48-58 years. On the other hand the female distribution curve was symmetrical and mesokurtic in nature with 37-47 years being the modal age group.

The distribution curves showed that female proprietors were younger on average than their male counterparts and illustrated some social and cultural tendencies of the Ghanaian society and the way of life of the people. Early

marriage for women in Ghana, particularly in the rural areas, is not uncommon. The average age at first marriage among women in most ethnic groups in Ghana is 18 years (see for example Ware (1983:15-17). This falls within the age group of between 15 and 25 years of the survey, thus girls marry while still in their teens. On the other hand, the average age at first marriage for men generally falls within the age group of between 26 and 36 years. Ware (1983:15) has noted that all West African societies attached great importance to age and seniority in status ranking. Marriages in Ghana are usually very elaborate and involve the payment of dowry to the would-be in-laws, wedding and other customary rites which can be expensive depending on the ethnicity and social background of the prospective wife.

More importantly, Ghanaians do not enjoy social benefits such as unemployment benefits from the state, meaning that the burden of maintaining a family lies heavily on the husband who is the head of the family. As a result, the tendency is for prospective husbands and would be fathers to get employed and be assured of a secured and regular income before contracting marriages and raising families. Indeed, the chance of a man who has come of age to secure a wife depends very much on his occupation and earning power. Women do not face such a problem and usually get married before they get into self-employment. It is customary in Ghana for a man to prepare his marital home and to maintain the young wife once married. The wives begin to play active role in fending for the family when children are born and the family increases in number. Generally, the woman cannot depend on her spouse for complete support but have to find additional independent ways to maintain herself and her children (Fapohunda 1983).



Source: Field Survey (1996)

#### 4.1.2 Proprietors' level of education<sup>i</sup>

In Ghana due to the educational programme of successive governments since independence in 1957 the overall rates of schooling and literacy have increased considerably. The 2010 Population Census classified about 67 per cent of the total population as being literate (GSS 2012). In the survey, proprietors were asked to indicate the level of their formal education and Table 2 provides the extent of the formal education of proprietors, by gender and industry sub-sectors. The most striking result is the high percentage of proprietors with formal education 85 per cent of the proprietors had some form of formal education (from primary to tertiary level). However, the results show that primary education is the highest level of educational attainment for the majority of the proprietors (approximately 62 per cent). The literacy figure is quite high as compared with the results of an earlier survey. By comparison of Chuta and Liedholm's (1985) sample of proprietors in Sierra Leone 77 per cent possessed no formal education.

The results show that males are more likely to have more education, and that twice the number of females has no formal education. No female has a tertiary education as compared to 5 per cent of male proprietors with tertiary education. This is not unexpected and can be explained by the fact that females drop out of school and marry

early. Ware (1983:16) has noted that the spread of education for girls results in a rise in their age of marriage, but in some societies there is a very strong resistance to allowing post-puberty girls to stay in school and run the risk of becoming pregnant before marriage.

The comparison of the educational level of proprietors by industry sub-sector shows a fairly even distribution of education over the industry sub-sectors although the results revealed that there was a concentration of proprietors with primary education in all industry sub-sectors. This was not unexpected because of the fact that opportunities for higher education in the rural areas are limited. After primary education, people tend to take to the learning of trade as apprentices and become masters on their own after few years of apprenticeship.

Table 2: Educational level of proprietors by gender

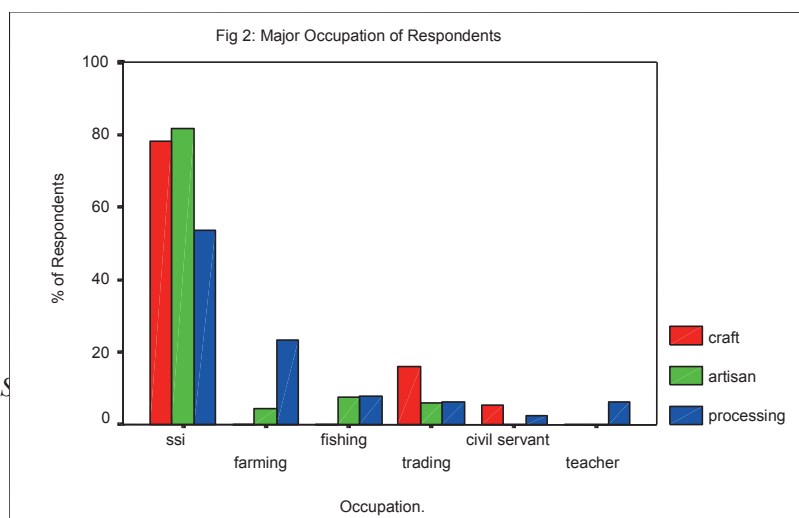
Industry Sub-Sector	Education								Total	%
	None		Primary		Secondary		Tertiary			
	Male	Female	Male	Female	Male	Female	Male	Female		
Craft	4 (36.4)	1 (4.5)	17 (16.8)	2 (6.1)	7 (38.9)	3 (15.8)	3 (27.2)	-	37	17.2
Artisan	4 (36.4)	2 (9.1)	36 (35.6)	10 (30.3)	5 (27.8)	7 (36.8)	2 (18.2)	-	66	30.7
Processing	3 (27.2)	19 (85.4)	48 (47.6)	21 (63.6)	6 (33.3)	9 (47.4)	6 (54.4)	-	112	52.1
Total	11 (5.1)	22 (10.2)	101 (47.0)	33 (15.3)	18 (8.4)	19 (8.8)	11 (5.1)	0 0	215	100
Total All	33 (15.3)		134 (62.3)		37 (17.2)		11 (5.2)		215	100.0

Source: Field Survey (2012)

Note: (1) Figures in parentheses are column percentages. (2) Figures in parentheses under totals are row percentages

#### 4.1.3 Major/minor occupation of proprietors

The results of some studies suggest that SSIs provide only part-time or seasonal employment for most owners. For instance, Thomi and Yankson (1985) concluded for Ghana that most SSIs do not offer much scope for substantial permanent wage employment. In Eastern Burkina Faso, Wilcock (1981:30) found that of 193 owners three-quarters had another job. On the contrary this survey revealed that the sector provided full-time employment for the majority of the proprietors (see Figure 2). The diagram shows that a comparatively small proportion of proprietors had SSI as a minor occupation and other occupations as major. This may be partly due to the very low returns from agricultural activities in the area as a result of the erratic rainfall pattern in the area. Also there is a general lack of employment opportunities in the formal industrial sector and in the public and civil services in the district.



## 5. Characteristics and Operations of Firms

### 5.1 The overview of the SSI sector

In Ghana the SSI sector forms a very important part of the off farm activities of a number of households particularly in the rural areas. In the major cities of Ghana such as Accra, the capital, Kumasi and many others SSIs are the source of livelihood of the unemployed and the under-employed. The sector in Ghana therefore covers a wide range of activities including pottery, woodwork, straw work, leather work, gold and black smithing, carpentry, tailoring/dress making. Other activities include oil extraction, powder making, fish processing, cassava processing, vegetable/fruit processing, brewing etc. The size and the overall distribution of firms found in the SSI sector and its categorisation are summarised in Table 3, where they are arranged by gender and industry sub-sector. Table 3 shows that the Processing Industry (PI) sub-sector predominates the SSI activities and accounts for more than half of all firms. The Artisan Industry (AI) and the Craft Industry (CI) sub-sectors follow in order of importance. The dominance of PI was not unexpected given the economic activities of the study area which is based strongly on agricultural production – farming and fishing. The relatively strong position of AI sub-sector was also expected because the sub-sector serves as a safe haven for school dropouts in the rural areas.

### 5.2. Age of firms and gender of proprietors

The number of years of operation of firms was recorded and the results are presented in Table 4 by gender. Although it was not possible to survey firms that had ceased to operate or to assess the failure rate of firms, the table demonstrates that the age of the firms ranges from those formed recently to those formed 20 years ago. The results show that over 60 per cent of the firms were less than 10 years old. In a previous study in Ghana it was also found that 80 per cent of firms surveyed were relatively young (Dawson 1988:13). More than one-third of the firms (37 per cent) were between 6-10 years old. This period falls roughly within the decade of the Structural Adjustment Programme (SAP) and the Economic Recovery Programme (ERP) Period in Ghana (ie1983-93).

It can be deduced that the formation of the majority of firms within that period was in response to favourable market conditions as a result of the economic measures taken between the period. More importantly most firms were established during the period to take advantage of the shortages created by the exit of many large-scale firms in the 1970s. Another third of the firms (38 per cent) were between 11 and 20 years old. This was least expected and shows that some firms in the survey are likely to have a longer life span contrary to the view that small-scale industries die young (see for example Storey 1997:78).

The number of years that a firm has been operating should also provide an indication of the owner's ability to run the firm. Table 4 shows that the age of firms varies by gender with male owned firms tending to be older. Substantial number of female-owned firms were newly formed and were between 0 to 5 years whilst 82 per cent firms of between 16 to 20 years are owned by males.

Table 3: An overview of SSI sector by sub-sector activities and by gender of Proprietors

Industry Sub-sector	Firm Level Activity	Total	Gender of Proprietors	
			Male	Female
			%	%
Crafts	1. Pottery	7	28.6	71.4
	2. Woodcarving	7	100	0
	3. Rattan	9	88.9	11.1
	4. Leather-work	5	100	0
	5. Goldsmithing	1	100	0
	6. Blacksmithing	2	100	0
	7. Net-making	6	100	0
	Sub Total	37	83.8	16.2
Artisan	1. Carpentry	15	100	0
	2. Dressmaking	18	0	100
	3. Tailoring	11	100	0
	4. Smelting and Foundry	3	100	0
	5. Block-making	5	80.0	20.0
	6. Canoe Building	9	100	0
	7. Shoe Making	2	100	0
	Sub Total	63	69.8	31.2
Processing	1. Cassava Processing	6	16.7	83.3
	2. Edible Oil Extraction	9	22.2	77.8
	3. Soap making	7	28.6	71.4
	4. Grain milling	16	100	0
	5. Baking/Confectionery	7	0	100
	6. Food Processing	11	0	100
	7. Charcoal Production	12	100	0
	8. Brewing	4	0	100
	9. Distilling of Alcoholic Beverages	19	95.0	5.0
	10. Beekeeping and Honey Processing	6	100	0
	11. Fish Processing	9	0	100
	12. Talc Extraction and Processing	8	100	0
	Total	215	65.6	34.4

Source: Field Survey (2012)

Table 4: Age of firms by gender of proprietors

Age of Firm	Male	Female	Total	%
	0-5	26 (49.1)	27 (50.9)	53
6-10	53 (67.1)	26 (32.9)	79	36.7
11-15	22 (64.7)	12 (35.3)	34	15.8
16-20+	40 (81.6)	9 (18.4)	49	22.8
Total	141 (65.6)	74 (34.4)	215	100.0

Source: Field Survey (2012) **Note:** Figures in parentheses are row percentage

### 5.3 Type of firm ownership

The nature of ownership of firms has important implications for the development and sustainability of the SSI sector and is of interest for the study. For that reason, proprietors were asked to indicate the type of ownership of their firms and the results are presented in Table 5. The table shows that ownership of SSIs is largely in individual or family hands. An overwhelming majority of firms (75 per cent) were organised as sole proprietorships. While only 15 per cent were in family ownership, partnership was the least preferred form of ownership (9 per cent). The form of ownership identified in the survey is consistent with previous studies. For instance Liedholm and Mead (1986:182) present evidence to show that over 97 per cent of small firms in Nigeria, Sierra Leone and Burkina Faso are organised as sole proprietorships and in Ghana Sowa, Baah-Nuakoh, Tutu and Osei (1992:23) reported 91 per cent of Urban Small-Scale Industries (USSIs) under sole proprietorships.

A number of reasons account for the large number of sole proprietorship in the sector. First, the sector requires very little capital and this allows individuals to set up new firms with relative ease. Second, the apprenticeship system allows individuals to acquire the relevant skills over a relatively short period and to set up on their own as masters in their trades. Third, sole proprietorship avoids the complications associated with partnership and therefore suits the rural investor. Turning to the relationship between gender and ownership, Table 5 shows that the patterns of proprietorship were very similar to both genders although female proprietors were more likely to be found in family businesses. The main explanation for this is that females engaged more in the PI sub-sector activities which are organised most often around the family.

Moser (1995:32) argues that although patterns of segregation run through all societies, exactly which job falls to men, and which to women, has varied enormously. The gender dimension is made even more complex by customs, rites and taboos within the SSI sector. In some societies in Ghana taboos bar men from engaging in pottery and women are prevented from practicing woodcarving. In some situations the nature of the activity involved prevents the participation of men or women in it.

It is of interest to examine the nature of gender involvement in SSI sector. Table 6 also reveals that the CI and AI sub-sectors are male dominated activities with female dominant only in pottery and dress making activities.. However, in the PI sub-sector female proprietors dominate in 6 out of the 12 activities. The result was expected and it is consistent with the cultural and the socio-economic set up of rural areas in Ghana where there exists a fairly well defined gender-based division of labour. Sowa, Baah-Nuako, Tutu and Osei (1992:28) noted that certain traditionally masculine-run industries, such as shoemaking, gold- and blacksmithing, there is total male dominance.

Table 5: Ownership of firms by gender of proprietors

Ownership of Firms	Gender of Proprietors			
	Male	Female	Total	%
Sole Proprietor	110 (78.0)	53 (71.6)	163	75.9
Family Business	18 (12.8)	15 (20.3)	33	15.3
Partnership	13 (9.2)	6 (8.1)	19	8.8
Total	141 (65.6)	74 (34.4)	215	100.0

Source: Field Survey (2012)

**Note:** 1. Figures in parentheses are column percentages 2. Figures in parentheses and italics are row percentages

### 5.4 Start-up capital requirements of the SSI sector

Capital is used here to mean (1) the total initial investment including the working capital and capital for different stages of the operations of the firms (e.g. the value of material inputs), (2) the value of equipment and (3) the value of structures which in most cases were very simple. In most instances production took place under shades of trees and at the proprietors' backyards and therefore no structures were needed. The summary of the results is



presented in Table 6 by gender.

A large number of proprietors started their businesses with very little capital. Approximately, two-thirds of all proprietors indicated an investment of less than GH¢200. A further 21 per cent indicated a capital of less than GH¢400. Overall, an overwhelming majority of proprietors, about 86 per cent established their business with very small capital of less than GH¢400. The results revealed an average investment of GH¢206 suggesting that the capital requirement for the SSI sector was quite modest. The small investment of proprietors reported was not unexpected and it is consistent with the results of other studies, (see for example Anheier and Seibel 1987:63).

The investment levels of male and female proprietors would now be examined. Table 6 shows that females were more likely to invest relatively smaller capital of less than GH¢200. In all, the table reveals that male proprietors were more likely to have access to bigger investment of between GH¢400 and GH¢600. This is not strange since in Ghana men tend to control more resources including financial resources than their female counterparts and also men are more likely to take business risk than women.

Table.6: Initial Capital of Proprietors by Gender and by Industry Sub-Sector

Industry Sub-sector	Initial Capital						Total		Total All
	GH¢100- GH¢199		GH¢200- GH¢399		GH¢400- GH¢600		Male	Female	
	Male	Female	Male	Female	Male	Female			
Craft	22 (26.8)	6 (10.3)	9 (24.3)	- -	- -	- -	31	6	37
Artisan	32 (39.0)	10 (17.2)	10 (27.0)	6 (85.7)	5 (22.7)	3 (33.3)	47	19	66
Processing	28 (34.1)	42 (72.5)	18 (48.6)	1 (14.3)	17 (77.3)	6 (66.7)	63	49	112
Total	82 (58.2)	58 (78.4)	37 (26.2)	7 (9.5)	22 (15.6)	9 (12.2)	141	74	215
Total All	140 (65.1)		44 (20.5)		31 (14.4)		215 (100.0)		

Source: Field Survey (2012)

**Note:** 1. Figures in parentheses are column percentages 2 .Figures in parentheses and italic are row percentages

In session 4.1.2, it was revealed that the majority of the proprietors have had some basic education. It is therefore of interest to examine the link between their educational and investment levels. Table 7 presents analysis of the educational level of proprietors and the size of their investment. The trend is that investment increases with increasing education. The table shows that a greater percentage of proprietors with no formal education (97 per cent) had a capital of less than GH¢200, as compared to their counterparts with formal education (primary - 58 per cent, secondary - 70 per cent and tertiary - 36 per cent). There were more proprietors with tertiary level education (46 per cent) with larger capital of between GH¢400 and GH¢600 as compared to 16 per cent and 15 per cent of those with secondary and primary education. The striking feature of the results is that only 3 per cent of proprietors without formal education made an investment of between GH¢200 and GH¢399 and none invested above GH¢400.

Table.7: Educational Level of Proprietors and Initial Capital

Initial Capital	Educational Level of Proprietors				No	%
	Primary	Secondary	Tertiary	None		
< GH¢100-¢199	78 (58.2)	26 (70.3)	4 (36.4)	32 (97.0)	140	65.1
¢200,-¢399	36 (26.9)	5 (13.5)	2 (18.2)	1 (3.0)	44	20.5
¢400-¢600+	20 (14.9)	6 (16.2)	5 (45.5)	0 -	31	14.4
Total	134 (62.4)	37 (17.2)	11 (5.1)	33 (15.3)	215	100

Source: Field Survey (2012)

Note: 1.Figures in parentheses are column percentages 2 .Figures in parentheses and italic are row percentages

### 5.5 The size of firms

The number of workers engaged in an enterprise is another indication of the size of the firm and the level of entrepreneurial and managerial qualities required to organise and to operate the enterprise (Rani, 1996:41). For these reasons the sizes of firms were examined and the results of the distribution by gender and by the industry sub-sectors are presented in Table 8. The number of workers most frequently recorded was between one and three. Firms with between four and six workers form the next important group and, as was expected, firms with seven to nine workers were few. There were on the average two workers per firm. The firm sizes reported were expected and typical of the SSI sector firms and consistent with the results of other studies. Sowa, Baah-Nuakoh, Tutu and Osei (1992:23) found that 91 per cent of all firms in their survey in Ghana employed less than 6 persons while Milimo and Fisseha (1986:41) found in Zambia that the average size of firms was 1.6 workers.

Turning to the analysis of the industry sub-sectors, it was observed that CI and AI sub-sector firms tended to be smaller. Table 8 shows that the proportion of CI and AI sub-sector firms employed from 1 to 3 workers. The table further reveals that the CI sub-sector tended to have more firms of 4 to 6 workers whilst the AI sub-sector firms tended to be of 1 to 3 workers. The expectation was to have found smaller CI and PI sub-sector firms than AI sub-sector firms as the activities of CI and PI were more traditional and were more likely to be family based. An examination of the results by gender shows that the number of workers per firm was not gender-sensitive. Although marginal, the table shows that there were more male-owned firms of larger workforce of between 7 and 9 workers. This suggests that males were more likely to be found in SSI activities that required more work force, such as carpentry, as compared to the more traditional pottery, food processing and dressmaking activities that females were mostly found.

### 5.6 Mode of operations

Table 9 shows data on the mode of operation by industry sub-sector and by gender. Proprietors were asked to indicate the annual pattern of their operations. They were asked to state whether their operations during the year were 'all year round', 'seasonal' or 'intermittent'. Over half of all proprietors reported 'all year round' operations and this meant that production activity for this group took place throughout the year. Seasonal operations account for over a third of all SSI activities. Intermittent operations are very limited and accounted for only seven per cent of SSI activities. The significant number of proprietors in seasonal operations indicated that multiple occupations were important in the area. This meant that some proprietors engaged in other income generating ventures such as farming and trading to fill in the gap between production cycle and to ensure regular income.

Attention will now be turned on the analysis of the mode of operations of the industry sub-sectors. Table 9 shows that there are some variations in the operations of the industry sub-sectors though not very significant. The results show that more of CI (65 per cent) and AI (58 per cent) sub-sector firms operated all year round whilst more of PI sub-sector firms (50 per cent) are found to have seasonal operations. This phenomenon is influenced by and follows the seasonal supply of raw materials such as cassava, oil palm and fish. In Ghana most of the raw materials needed by the PI sub-sector are seasonal and at the peak of harvest seasons raw materials such as cassava, palm fruits, coconuts, maize and fish are in plentiful supply and this enables firms in the sector to operate at maximum capacity. On the other hand some firms shut down during the lean seasons when supplies

are erratic. During those periods some of the proprietors turn to other activities and wait for the next harvest season to reactivate their businesses. Table 9 suggests that the operations of CI and AI sub-sectors tended to be more intermittent than the PI sub-sector. This was contrary to expectation since raw material base for the PI sub-sector is mostly seasonal.

Table 8: Number of Workers by Gender and by Industry Sub-sector

Industry Sub-sector	Initial Number of Workers						Total		Total (All)
	1-3		4-6		7-9				
	Male	Female	Male	Female	Male	Female	Male	Female	
Craft	19 (25.0)	1 (2.2)	9 (23.1)	5 (23.8)	3 (11.5)	0	31 (22.0)	6 (8.1)	37 (17.2)
Artisan	34 (44.7)	18 (40.0)	7 (17.9)	1 (4.8)	6 (23.0)	0	47 (33.3)	19 (25.7)	66 (30.7)
Processing	23 (30.3)	26 (57.8)	23 (59)	15 (71.4)	17 (65.4)	8 (100)	63 (44.7)	49 (66.2)	112 (52.1)
Total	76 (53.9)	45 (60.8)	39 (27.7)	21 (28.4)	26 (18.4)	8 (10.8)	141 (100)	74 (100)	215 (100)
Total All	121 (56.3)		60 (27.9)		34 (15.8)		215 (100.0)		

Source: Field Survey (1996)

**Note** 1. Figures in parentheses are column percentages; 2. Figures in parentheses and italic are row percentages

Turning to the examination of gender and operations of firms, the results reveal that male proprietors were more likely to engage in firms that operate “all year round” (59 per cent) while the majority of female proprietors (55 per cent) were likely to operate seasonally. The results suggest that female proprietors are more likely to engage in SSI activities that offer the best opportunity to combine family and economic activities such as food processing activities. This view is supported by the strong presence of female proprietors in the PI sub-sector and in food processing in particular.

Table 9: SSI Sub-Sector and Mode of Operations

Industry Sub-sector	Mode of Operation						Total		Total All
	All Year Round		Seasonal		Intermittent				
	Male	Female	Male	Female	Male	Female	Male	Female	
Craft	24 (28.9)	-	5 (11.6)	6 (14.6)	2 (13.3)	-	31 (22.0)	6 (8.1)	37 (17.2)
Artisan	28 (33.7)	10 (30.3)	8 (18.6)	9 (22.0)	11 (73.4)	-	47 (33.3)	19 (25.7)	66 (30.7)
Processing	31 (37.3)	23 (69.7)	30 (69.8)	26 (63.4)	2 (13.3)	-	63 (44.7)	49 (66.2)	112 (52.1)
Total	83 (58.9)	33 (44.6)	43 (30.5)	41 (55.4)	15 (10.6)	-	141	74	215 100
Total All	116 (54.0)		84 (39.0)		15 (7.0)		215 (100.0)		

Source: Field Survey (20126)

*a. Figures in parentheses are column percentages. b. Figures in parentheses and italic are row percentages*

### 5.7 Major raw materials

As has been observed earlier on, a significant proportion of SSIs is locally resource-based. This is particularly true with PI and CI industry sub-sectors. Availability of basic raw materials is therefore a major inducement for the establishment and operation of SSIs. Consequently the type, quantity and quality of local raw materials determine the type of operations and magnitude of SSIs in a locality. For that reason proprietors were asked to indicate the sources of their major raw materials. Table 10 presents data on the sources of major raw materials of firms by industry sub-sector. The major raw materials for the majority of firms were obtained from local sources – from the district and from other parts of Ghana. Over 82 per cent of the proprietors obtained their major raw materials from local sources. Imported raw materials accounted for very small percentage of major input requirements and include items such as yarn, dyes, polish and some additives. These materials were purchased from importers in Cape Coast, Mankessim or from Accra. The strong raw material base is important for the development of a viable SSI sector in the district

Turning to the major sources of raw materials for the sub-sectors, Table 10 shows that all the sub-sectors depended heavily on local materials for their operations. About 96 per cent of PI, 76 per cent of CI, and 64 per cent of AI firms obtained their raw materials locally from within the district and other parts of the country. It was however, observed that imported raw materials are essential for the operations of AI (36 per cent) and CI (24 per cent) sub-sectors than the operations of PI (4 per cent). This is because firms in the two sub-sectors like weaving; tailoring, fashion designing and carpentry relied on imported machines and tools, fabrics and yarns for their operations. It could therefore be concluded that local raw materials were the major sources for SSIs although imported raw materials were also important components for the operations of firms.

Table 10: Industry Sub-sector and Sources of Major Raw Materials

Industry Sub-sector	Sources of Major Raw Materials		Total	%
	Local	Imported		
Craft	28 (75.7)	9 (24.3)	37	17.2
Artisan	42 (63.6)	24 (36.4)	66	30.7
Processing	107 (95.5)	5 (4.5)	112	52.1
Total	177 (82.3)	38 (17.7)	215	100.0

*Source: Field Survey (2012). Note: Figures in parentheses are row percentages*

### 5.8 The market outlets of SSIs

The details of the main market outlets for the SSI sub-sectors were examined and summarised in Table 11. Over half of all firms relied on markets around the villages in which they were located for the sale of their produce. Markets within the district were the second most important market outlets for all the industry sub-sectors. Markets in other parts of the country were important outlets for only 6 per cent of all firms. Export market was of little importance and accounted for less than 2 per cent of the total market. The analysis suggests that the local market was the main target of the SSI sector and the insignificant export market was an indication that SSIs were not exploring their export potentials. It also suggests that producers were not directly involved in export trade or perhaps agents were likely to do bulk purchases and repack them for export.

With reference to the industry sub-sectors, the expectation was to have found marked market outlet or niches for the different industry sub-sectors. However, the results suggest that the industry sub-sectors shared the same market outlets. The significance of the results is that there were noticeable variations in the individual shares of the market outlet because of differences of product. A closer look at the table shows that the market around the village was the largest for CI and AI sub-sectors but was recorded as the second largest market for the PI sub-sector. Markets within the village were most significant for the PI sub-sector but were the second most important outlet for AI and CI sub-sectors. The AI and PI sub-sectors have little markets in other parts of the country regarding export. The CI sub-sector did not have access to market outside the district and did not export either.

The market of CI sub-sector was very much concentrated around their immediate vicinity but the markets for AI and PI sub-sectors were relatively spread and suggests that the AI and PI sub-sectors had a broad base market.

Table 11: Industry Sub-Sector and the market outlet

Industry Sub-sector	Main Market Outlet				Total	%
	Around the Village	Around the District	Other Parts of the Country	Export		
Craft	35 (94.6)	2 (5.4)	0 -	0 -	37	17.2
Artisan	36 (54.5)	24 (36.4)	4 (6.1)	2 (3.0)	66	30.7
Processing	37 (33.0)	64 (57.1)	9 (8.0)	2 (1.8)	112	52.1
Total	108 (50.2)	90 (41.9)	13 (6.0)	4 (1.9)	215	100

Source: Field Survey (2012)

Figures in parentheses are row percentages.

### 5.9 Growth of firms

It is often argued that once established SSIs are unable to grow or expand their activities to any appreciable level but rather most of them stagnate and do not prosper. This phenomenon has been blamed by Storey, (1997:154-158) on (i) lack of access to resources, knowledge and improved technology, (ii) inadequate supply of quality raw materials, (iii) inadequate infrastructural facilities and (iv) continued use of simple but obsolete technologies. The lack of training in planning, record keeping and marketing further compounds the constraints faced by SSIs and as a result the quality and the market of their products are restricted. The survey was interested in finding out how these constraints affected the operations of the SSIs. Proprietors were asked to state the form of expansion their firms have experienced since their establishment and the contributing factors. The responses are presented in Table 12. There was a fairly even spread of increases over work force, output and capital outlay although increased output contributed more to the growth of firms. In all, approximately 7 per cent of firms have not experienced any form of expansion in their activities.

Proprietors gave a number of reasons for the expansion experienced by their firms. Table 12 shows that a sizeable number of firms experienced increased market demand. Access to funds was cited as the second important factor for expansion in the activities of firms. Introduction of new products, acquisition of new skills and access to raw materials resulted in the expansion of the activities of the firms. The results are consistent with the findings of Sowa, Baah-Nuako Tutu and Osei (1992:29) but contrary to the result of others. Mannan (1993:63) explains that Urban Small-Scale Industries (USSIs) in Bangladesh were unable to expand and prosper mainly because of (i) un-assured supply of quality raw materials, (ii) inadequate infrastructure facilities, (iii) lack of access to resources, knowledge and improved technology, and (iv) lack of simple but obsolete technologies.

Table 12: Form and Factors driving Expansion

Form of Expansion	No	%	Factors of Expansion	No	%
Increased work force	55	25.6	Access to funds	41	19.1
Increased output	83	38.6	Increase in demand	102	47.4
Increased Capital outlay	62	28.8	Introduction of new products	33	14.4
None	15	7.0	Acquisition of new skills	24	12.1
			Access to more raw materials	15	7.0
Total	215	100	Total	215	100

Source: Field Survey (2012)

### 5.10 Production technology

The type of technology used varied greatly according to the SSI sub-sector and product type. Three main technology types identified were; (1) traditional technology - use of rudimentary tools and methods of production, (2) modern technology - the use of advanced machinery and tools, and (3) combined - the use of a

combination of traditional and modern technologies.

Table 13 presents the types of production technology employed by proprietors in their operations by industry sub-sector and by gender. An examination of the table shows that more than half of firms used traditional technology. Also a sizeable number of proprietors used modern technology. The use of traditional and modern technology accounted for 85 per cent of SSI operations. The use of combined technology was therefore limited to a few proprietors. The analysis of the results suggests that there were important variations in the level of technology used by the industry sub-sectors. The PI and CI sub-sectors were more traditional in the use of technology than the AI sub-sector. Over 44 per cent of AI firms used modern technology as compared to PI (16 per cent) and CI (17 per cent) sub-sector firms. Again more AI firms used combination of traditional and modern technologies than PI and CI firms. The emerging trend from the analysis is that the AI sub-sector is more modern in production techniques than the PI and CI sub-sectors.

Table 13 shows significant variations in the choice of technology by male and female proprietors. Although the technology preference was skewed towards the use of traditional methods of production female proprietors were more likely to use traditional methods of production (above 70 per cent). Male proprietors on the other hand were more likely to adopt modern (about 25 percent) and combined methods (20 per cent). The differences in the use of technology by male and female proprietors were partly explained by the fact that more female proprietors operate in the PI sub-sector whilst the male proprietors were more into AI sub-sector which required the use of some level of modern tools of production.

Table 13: Technology Used by Industry Sub-sector and by Gender.

Type of Technology	Industry Sub-Sector								Total ALL
	Craft		Artisan		Processing		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	
Traditional	21 (67.7)	4 (66.7)	16 (34.0)	2 (10.5)	39 (61.9)	47 (95.9)	76 (53.9)	53 (71.6)	129 (60)
Modern	4 (12.9)	2 (33.3)	17 (36.2)	12 (63.2)	17 (27.0)	2 (4.1)	38 (27.0)	16 (21.6)	54 (25.1)
Combination	6 (19.4)	-	14 (29.8)	5 (26.3)	7 (11.1)	-	27 (19.1)	5 (6.8)	32 (14.9)
Total	31 (22.0)	6 (8.1)	47 (33.3)	19 (25.7)	63 (44.7)	49 (66.2)	141 (65.58)	74 (34.42)	215 100.0

Source: Field Survey (2012) **Note:** 1. Figures in parentheses are column percentages. 2. Figures in parentheses and italics are row percentages

### 5.11 Constraints of SSI sector

It is widely acknowledged that the SSI sector is confronted with a number of constraints. For that reason the major problems encountered by proprietors in their operations were examined and the problems frequently cited by them are presented in Table 14, Lack of capital is perceived to be the major problem to the majority of firm owners and was cited most frequently. The problem of capital appears to be severe but not surprising given the low economic activities and the meager household incomes in the rural areas and the fact that personal funds are the main source of capital for firm formation. However, Chuta (1983:194) argues that the emphasis on capital needs cannot be reconciled with frequently observed excess capacities of 35 and 49 per cent on the average for Sierra Leone and Ghana, respectively and also of accumulated inventories.

What is significant about the result is the 24 per cent of the proprietors who cited other problems. Among these, inadequate market (lack of market outlets for production or lack of clients) was the second most frequently cited problem. Employee problems or lack of experienced and skilled labour was the third most frequently cited problem. Lack of managerial skills and infrastructure were also cited.

With reference to gender, the problems of both male and female proprietors were similar although a sharper contrast was expected. For instance, capital was the single most cited problem by both genders. An equal

number of male and female proprietors cited lack of managerial skills and infrastructure as problems. While lack of skilled labour was the second major problem faced by the male proprietors, it was cited as least frequently by the female proprietors. Female proprietors cited inadequate market as the second problem but it was ranked third by male.

The results suggest that both genders would benefit from public sector financial assistance packages such as concessionary loans designed for the development of the SSI sector through the promotional institutions such as the NBSSI. This means that any financial assistance should be targeted at the SSI sector as a whole and should not be influenced by gender considerations. It can also be assumed on the basis of the results that male proprietors would be more interested in skill development programmes whilst female proprietors are more likely to benefit from assistance aimed at market expansion.

Table 14: The Major Problems of Proprietors by Industry Sub-sector and by Gender

Industry Sub-sector	The Major Problems of Proprietors										Total		Total All	
	Lack of Capital		Lack of Skilled labour		Lack of Managerial Skills		Lack of Infrastructure		Inadequate Market		Male	Female	Male	Female
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female				
Crafts	22 (20.6)	5 (8.8)	8 (61.5)	1 (100)	-	-	1 (20.0)	-	-	-	-	31 (22.0)	6 (8.1)	37 (17.2)
Artisan	40 (37.4)	15 (26.3)	-	-	2 (50.0)	-	-	2 (100)	5 (41.7)	2 (18.9)	47 (33.3)	19 (25.7)	66 (30.7)	
Processing	45 (42.1)	37 (64.9)	5 (38.5)	-	2 (50.0)	3 (100)	4 (80.0)	-	7 (58.3)	9 (81.1)	63 (44.7)	49 (66.2)	112 (52.1)	
Total	107 (75.9)	57 (77.0)	13 (9.2)	1 (1.4)	4 (2.8)	3 (4.1)	5 (3.5)	2 (2.8)	12 (8.5)	11 (14.9)	141	74	215 (100)	
Total All	164 (76.2)		14 (6.5)		7 (3.3)		7 (3.3)		23 (10.7)				215 (100)	

Source: Field Survey (2012) **Note:**1. Figures in parentheses are column percentages. 2. Figures in parentheses and italic are row percentages

## 6.0 Conclusion

The central point of the paper has been to emphasize the peculiar characteristics and to underscore the role of gender in operations of the SSI sector in Ghana. No policy can be formulated to help the development of the SSIs without the right understanding of the complex nature of the sector.

The broad pattern which emerges from the analysis of the results is that, a higher percentage of firms were recently formed although a sizeable number of firms were above 10 years old. The sizes of firms were predominantly small and dominated by sole proprietorship making the sector the domain of owner managers. The capital requirement of the sector was very modest and the evidence showed that proprietors tended to rely more on their own funds for starting their businesses. A higher percentage of firms operated all year round with raw materials obtained from the localities and within the country. Naturally, the local market served as the major outlet for the firms as the bulk of their products was sold directly to the final consumer.

Traditional technology was the most commonly used among proprietors although there are significant differences in the level of technology used by the industry sub-sectors. It is among others recommended that concessionary loans and other supportive packages be designed to address the financial constraints of the SSIs as a whole and should not be based on gender considerations as both male and female firms face almost the same

challenges.

## References

- Acquaah-Harrison, J. B. (1990); Report on a Survey of Small-Scale Enterprises in Agona Swedru District, Ghana, Accra.
- Anheier, K. H. and Seibel, H. D. (1987); *Small-Scale Industry and Economic Development in Ghana: Business Behaviour and Strategies in Informal Sector Economics*; Saarbrücken, Verlag Breitenbach Publishers.
- Bruch, M. and Hiemenz, U. (1984); Small and Medium-Scale Industries in the ASEAN countries: Agents or Victims of Economic Development. Westview.
- Bosworth, D. and Jacobs, C. (1989); Management Attitudes, Behaviour, and Abilities as Barriers to Growth. In Barber, J., Metcalfe and Porteous M. ed. *Barriers to Growth in Small Firms*; Worcester, Billing and Sons Ltd.
- Chuta, E. (1983); Upgrading the Managerial Process of Small Entrepreneurs in West Africa; *Public Administration and Development*, Vol. 3 p 245-83.
- Chuta, E. and Liedholm, C. (1985); *Employment and Growth in Small-Scale Industry: Empirical Evidence and Policy Assessment from Sierra Leone*; Basingstoke, Macmillan.
- Dawson, J. (1988); *Small-Scale Industry Development in Ghana: A Case Study of Kumasi*; London, Overseas Development Administration, ESCOR (mimeo)
- Edusah, S. E. and Tribe, M. A. (1992); *Rural Small-Scale Industries in Ghana's Economic Development: Agenda for Research*; Bradford, DPPC New Series Discussion Papers, No 26.
- Elkan, W. (1987); *Policy for Small-Scale Industry: A Critique*, Discussion Papers in Economics No. 8701, Brunel University.
- Fapohunda, E. R. (1983); Female and Male Working Profiles. In Oppong, C. (ed). *Female and Male in West Africa*; London, George Allen and Unwin.
- Frimpong-Ansah, J. H. (1991); *The Vampire State in Africa: The Political Economic Decline in Ghana*; London, James Curry.
- Gray, T. and Gamser, M. (1994); *Building an International and Policy Framework to Support Small and Medium Enterprises: Learning from other Cultures*; Washington. United State Agency for International Development.
- ILO, (1972); *Employment, Incomes and Equality: A Strategy for Increasing Productivity and Employment in Kenya*. Geneva.
- Mead, D., (1991); Small Enterprises and Development; *Economic Development and Cultural Change* Vol.39 No2 p 409-420.
- Milimo, J. T. and Fisseha, Y., (1986); *Rural Small-Scale Enterprise in the Zambia: Result of a Country-Wide Survey*; Working Paper No 28. Department of Agricultural Economics, Michigan State University, Michigan.
- Moser, O. N. (1995); *Gender Planning and Development*, London, Routledge.
- Mannan, M. A., (1993); *Growth and Development of Small Enterprises*; Aldershot, Avebury.
- Sowa, N. K., Baah-Nuakoh, A., Tutu, K. A. and Osei, B. (1992); *Small Enterprises and Adjustment*; London, Chameleon Press Ltd.
- Storey, D. J. (1997); *Understanding The Small Business Sector*; London, International Thomson Business Press
- Thomi, W.H. and Yankson, P. W. K. (1985); *Small-Scale Industries and Decentralisation in Ghana*; Legon/Frankfurt, University of Ghana.
- Ware, H. (1983); Female and Male Life-Cycle. In Oppong, C. (ed). *Female and Male in West Africa*; London, George Allen and Unwin.
- Wilcock, D. C. (1981); *Rural Small-Scale Enterprise in Eastern Burkina Faso: Survey Results*. African Rural Economy Programme Working Paper 38. Washington, Michigan State University.

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<sup>i</sup> Ghana operates a three-tier educational system as follows:

- Primary – Primary class 1 to Junior Secondary School (age 6-15 years)
- Secondary – Senior Secondary Schools (age 16-19 years)
- Tertiary – Polytechnics and Universities and other institutions of higher learning (age 20 years and above)



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