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Industrial Automation in Ghanaian Industries (The Case of Kumasi Metropolis)

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Abstract: This study looked at Industrial Automation in Ghanaian Industries using the Kumasi Metropolis as a case study. It was aimed at investigating the various types of industries in the metropolis in terms of operational conditions. Evaluating which ones was Manually Operated, Computer- Aided, Semi-Automated or Fully Automated. And also evaluate the effects of Automation on the companies that are automated and finding out ways of improving the manually operated companies. This was achieved by the administration of questionnaires to ten companies in the metropolis. All the information was compiled and the necessary deductions were made. It was however realized from the research that Ghana need a lot of improvement in the area of automation since about 70%of the companies were manually operated, about 20% used semi-automated process and only about 10% are fully automated. Therefore it can be concluded that the companies in Ghana were not enjoying the benefits of automation such as reduction in scrap, reduced labour cost etc. as witnessed in advanced countries. Hence the clarion call in this study that Manufacturing Industries in Ghana should embrace automation so as to enjoy the benefits of automation to its fullest as witnessed in the developed countries of the world.

Key words: Industry, automation, manufacturing, ghana

INTRODUCTION

Automation is defined[1] as an automatic operation and control of machinery or processes by devices, such as robots that can make and execute decisions without human intervention. The principal feature of such devices is their use of self-correcting control systems that employ feedback, i.e., they use part of their output to control their input. Once the automated process is set up, human participation in the manufacturing process involves little more than maintenance and repair of the equipment. In a typical automated manufacturing process, the feeding in of materials, the machine operation and the transfers from one machine to another, the final assembly, the removal and the packing are all done automatically.

In some automated manufacturing, a single robot with interchangeable tool heads performs all of the various manufacturing assignments. At various stages in the operation are inspection devices that reject substandard products and adjust the machinery to correct any malfunction. Since electronic computers are able to store, select, record and present data systematically, they are widely used to direct automated systems. Automation is applied in industry to the manufacture of foodstuffs, chemicals, Pharmaceuticals and electronic equipment and is used in steel mills, automobile plants and coal mines. Another application is its use in the launching, aiming and guidance of military rockets. Automation has also been applied to information handling, resulting in automatically prepared bills and reports and the solution of many engineering problems. It offers high quality products together with great savings in costs.

Automation has been around for a long time; however recent, technological developments and the use of computers have had a significant impact on the production process. According to[2] some of the production process affected by recent development in technology includes; enhanced capabilities of designers through the use of Computer Aided Design (CAD).The use of Computer Numerical Control (CNC) Machine Tools have increased the capabilities of machinist

Industrial: According to[3] the term "industry" refers to large manufacturing companies, such as the big multinational car companies. It is a place noted for manufacturing of items to satisfy the public or consumers. An industry derives its name from the specific product it is noted for. An example of Industries include; the computer industry which is based on the electronics industry, which manufactures integrated circuits (silicon chips) and other parts. It overlaps with other industries such as consumer electronics, office systems and telecommunications, so it is difficult to put a value on it separately. Also Textile, petroleum industries etc. Food industry noted for growing and processing of food. This is the largest industry in the world. According to[3] he grouped the industries into three broad categories; primary, secondary and tertiary industries.

Primary industries: These are the industries responsible for the extraction of natural resources. They comprise agriculture, hunting, fisheries, forestry, mining and quarrying. A distinction is often drawn between those primary industries concerned with renewable resources such as forests and those concerned with non-renewable ones, such as minerals.

Secondary industries: Secondary industries engage in the manufacturing and production of goods. They use the natural resources of the primary industries (and possibly the goods of other secondary industries) to make products. Secondary industries include house building and the manufacture of clothes, food processing, shoes, luggage, furniture, packaging, chemicals, metal products, machinery, electrical products, electronic products, computers, cars, trains and airplanes. They also include utilities, which provide services such as gas, water and electricity.

Tertiary industries: Tertiary industries comprise those companies involved in services, as opposed to those providing an extractive or manufacturing function. The Large scale category includes retailers (of clothes, food and so on), banks, insurance companies, hotels, restaurants, estate agents, lawyers, doctors, accountants, teachers, golf professionals and television presenters.

Manufacturing: Manufacturing was defined[4] as any process in which materials or items is brought together and work is performed on them to make a saleable product. The is done to convert the separate components into an object that has more value. To convert raw materials into finished products that would satisfy the human needs, certain basic functions must be carried out. They stated that for firms engaged in producing discrete products, the functions are:

- Processing;
- Assembly;
- Material Handling and storage;
- Inspection and Testing; and
- Control.

Manual systems of manufacturing: There are several differences between automated systems and manual batch- driven system. The differences in automated systems and manual systems are like those of post office mail when measured against email. Both methods of delivery are effective. However, the automated system, email, has internal measures to edit the message and a record of the message can be stored and easily accessed at any time. Plus, email delivers messages much more quickly than the post office[1].

Computer Aided Design (CAD): Computer Aided Design can be defined[5] as that phase of manufacturing in which the computer is used to assist in design of products. It is also the process by which computers are employed to enhance the manufacture and development of products. Products may be produced more quickly, more accurately, or with reduced cost, by the appropriate application of computer technology.

Computer-Aided Design (CAD) systems may be used to model making, if not all, of the features of a particular product Typically, these would be the size, shape and form of each component part, stored as two-dimensional and three-dimensional drawings. Once this dimensional data has been entered and stored in the computer system, the designer is able to manipulate or modify design ideas with great ease as the product development is pursued. Moreover, the combined ideas of many designers are shared and integrated as data is moved rapidly across computer networks, enabling designers and engineers located in different global locations to work together as a team. CAD systems are also able to simulate the performance of a product.

Computer Aided Manufacturing (CAM): According to[5-7] said that when CAD systems are linked to manufacturing equipment which is also controlled by computer, they form an integrated CAD/CAM (Computer-Aided Design/ Manufacture) system. CAM offers significant advantages over more traditional approaches by controlling manufacturing equipment with computers instead of human operators. CAM equipment is usually associated with the elimination of operator error and the reduction of labour costs. However, the consistent accuracy and predicted optimum use of the equipment lead to even more significant advantages.

Computer Numerically Control (CNC): According to[5] this is a form of programmable automation of a machine tool, using numbers, letters and symbols? The NC program is a sequence of codes followed by X, Y and Z coordinates information. The code is instruction is for machining the part An NC machine consists of three major components; the computer program, the controller unit and the machine tool.

Computer Aided Process Planning (CAPP): Computer Aided Process Planning (CAPP) is an intelligent computer system that is used to determine the optimal sequence of operations for manufacturing a part. The part is designed on a CAD/CAM system and the drawing geometry is transferred to the CAPP system. The CAPP system matches the characteristics of the part to the machines and process available and then prints the optimal process and routing sheets for moving the part through the manufacturing process.[5]

Automation: Automation as the use of machinery in place of human labor in production process.[8-10]

Automation is also defined[2] as a technology concerned with the application of mechanical, electronic and computer-based systems to operate and control production. According to some of the authors mentioned above said that this technology includes:

- Automatic machine tools to process parts.
- Automatic assembling machine tools.
- Industrial robots.
- Automatic material handling and storage systems.
- Automatic inspection systems for quality control.
- Feedback control and computer process control.
- Computer systems for planning, data collection and decision making to support manufacturing activities.

According to[8], the automation processes include the use of;

- Semi automatic process machines
- Fully automatic process machines.

The semi automatic machines can be defined as those machines used in production processes capable of performing automatically functions such as;

- Working and auxiliary motions
- Cycle for machining operation
- Stops automatically.

But cannot remove the finished work and reload a new work. Some of its activities are carried out by the machinists.

The fully automatic process machines are capable of performing automatically, functions such as;

- Working and auxiliary motions
- Cycle for working on different work
- Removing finished work /job and loading a new one without the help of the machinist.

Types of automation: The automated production system can be classified into three basic types:[12]

- Fixed automation.
- Programmable automation.
- Flexible automation.

They are discussed below thus;

Fixed automation: Fixed automation is defined as a system in which the sequence of processing (or assembly) operations is fixed by the equipment configuration. The operations in the sequence are usually simple. It is the integration and coordination of many such operations into one piece of equipment that makes the system complex. The typical features of fixed automation are:

- High initial investment for custom- engineered equipment
- High production rate
- Relatively inflexible in accommodating product changes.

Programmable automation: Programmable automation, the production equipment is designed with the capability to change the sequence of operations to accommodate different product configurations. The operation sequence is controlled by a program which is a set of instructions coded so that the system can read and interpret them. New programs can be prepared and entered into the equipment to produce new products. Some of the features that characterize programmable automation include;

- High investment in general-purpose equipment
- Low production rate relative to fixed automation
- Flexibility to deal with changes in product configuration
- Most suitable for batch production.

Flexible automation: Flexible automation is an extension of programmable automation. The concept of flexible automation has developed only over the past 15 or 20 years and the principles are still evolving. A flexible automated system is one that is capable of producing a variety products or parts with virtually no time lost for changeovers from one product to the next. There is no production time lost while reprogramming the system and altering the physical setup (tooling, fixture, machine settings). Consequently the system can produce various combination and schedules of products, instead of requiring that they be made in separate batches. The features of flexible automation can be summarized as follows;

- High investment for accustom-engineered system
- Continuous production of variable mixtures of products
- Medium production rates
- Flexibility to deal with product design variations

The essential features that distinguish flexible automation from programmable automation according to[11] are:

- The capacity to change part programs with no lost in production time and
- Capability to change over the physical set up, again with no lost in production time. Examples of flexible automation are the flexible manufacturing systems for performing machining operations.

Reasons for automation: The reasons for automation as;[11]

- Increased productivity.
- High cost of labour..
- Labour shortages.
- Safety.
- High cost of raw materials.
- Improved product quality.
- Reduced manufacturing lead time.
- Reduction of in-process inventory.
- High cost of not automating.

Artificial intelligence: According to[2] the human interfaces, could ideally, be replaced by specially programmed computers to 'reason' and solve problems faster than could otherwise be solved by humans. A branch of computer science that attempts to give computers the ability to understand language, to solve problems that call for reasoning and to emulate human methods of learning and of solving problems is Artificial Intelligence (Al).These Al systems are, to a good extent, able to perform tasks that otherwise must be done by humans and are able to produce adequate solutions. Computers process data make logical conclusions and mathematical calculations faster than the human brain. Another good thing about them is, they do not become fatigued and bored by repetitious tasks. Properly programmed computers, like Al, could therefore be considered to be 'smarter' than humans at many tasks.

Industrial robotics: A robot is defined[5] as a computer controlled device/machine or a reprogrammable multi-functional manipulator designed to identify and move materials, parts and tools, using various motions A robot can be used to transfer parts from one machine tool to another. They can be used to paint, weld and perform other repetitive jobs/functions in the production process. Term robot itself is derived from the Czech word robota, meaning "compulsory labour". It was first used in the 1921 play R.U.R. (which stands for "Rossum's Universal Robots") by the Czech novelist and playwright Karel Capek, to describe a mechanical device that looks like a human but, lacking human sensibility, can perform only automatic, mechanical operation.

Flexible Manufacturing Systems (FMS): According to[4] the Flexible Manufacturing Systems (FMS)employs the Group Technology. An FMS consists of a group of production cells or equipment (mainly CNC machines), connected by means of a reprogrammable automated material handling and storage system and controlled by an integrated computer system. Most of the FMS in operation today are utilized in machining. According to[4] FMS components are basically the production cells, the material handling unit and the computer system.

Manufacturing development in ghana after independence: The following are the milestones in the Manufacturing development of Ghana according to (Microsoft Encarta 2004, U.S. Library of Congress)[12] and (www. homepage Ghana.com)[13] can be summarize thus;

- In 1957, the Nkrumah government launched an industrialization drive that increased manufacturing's share of GDP from 10 percent in 1960 to 14 percent in 1970.
- This expansion resulted in the creation of a relatively wide range of industrial enterprises, the largest including the Volta Aluminum Company (Valco) smelter, saw mills and timber processing plants, cocoa processing plants, breweries, cement manufacturing, oil refining, textile manufacturing operations and vehicle assembly plants.
- Underutilization of industrial capacity, which had been endemic since the 1960s, increased alarmingly in the 1970s, with average capacity utilization in large- and medium-scale factories falling to 21 percent in 1982.
- Nevertheless, by 1987 production from the manufacturing sector was 35 percent lower than in 1975 and 26 percent lower than in 1980.
- This venture in indstrialisation began in the mid-1960s with the construction of a 1,186-megawatt hydroelectric dam on the lower Volta River at Akosombo. Built with assistance from Britain, the United States and the World Bank.

- Foreign capital for the construction of an aluminum smelter in Tema was obtained from US-based Kaiser Aluminum, which acquired a 90% share in Valco and from US based Reynolds Aluminum, which held a 10% share. Valco became the principal consumer of VRP hydroelectricity, using 60% of VRP-generated power and producing up to 200,000 tons of aluminum annually during the 1970s.
- Changing global economic conditions and severe drought dramatically affected the Ghanaian aluminum industry during the 1980s.
- Severe drought compounded the effects of unfavorable market conditions by reducing the electricity generating capacity of the Akosombo Dam and by forcing a temporary shutdown of the smelter from 1983 to 1985. Aluminum production was slow to recover in the wake of the shutdown. In the early 1990s, aluminum production and exports continued to be negligible.
- Local press reports have estimated the closure of at least 120 factories since 1988, mainly because of competitive imports. The garment, leather, electrical, electronics and Pharmaceuticals sectors have been particularly hard hit. In 1990, even the New Match Company, the only safety match company in the country, closed.
- In 1986 the government established the Ghana Investment Center to assist in creating new enterprises. Between 1986 and 1990, the vast majority of projects approved-444 of 621-was in the manufacturing sector.

The dominant trends in manufacturing, nonetheless, were the involvement of foreign capital and the initiation of joint ventures. Significant new enterprises included a US$8 million Taiwanese-owned factory, capable of turning out ten tons of iron and steel products per hour, which began trials at Tema in 1989. Although approximately 500 projects had been approved since the investment code came into force in 1985, almost half had still not been launched by the end of 1989. Between 90 and 95% of the approved projects were joint ventures between foreign and local partners, 80% of which were in the wood industry. Restructuring of the sector was proceeding through divestiture, import liberalization and promotion of small-scale industries.

Industrial locations: Ghana has eleven regions; Ashanti, Brong Ahafo, Central, Eastern, Northern, Western, Upper west, Upper East and the Volta Region. Ghana has most of its large industries located in Accra, Tema, Takoradi, Kumasi and the other part of the country. Some of the industries include; Volta Aluminum company, Guinness Ghana Limited, Ghana Breweries Ltd. A.G Timbers, NAJA David veneer and Plywood, Golden Wed Oil Extraction and more.

MATERIALS AND METHODS

Questionnaires were developed and distributed to some selected industries in the Kumasi metropolis. The analysis of the results obtained from the questionnaire distributed to the various industries is presented in Tables below. (Tables 2 to 12).

Table 1:Company size and population

		Sizes			
Serial No.	Company	Small	Medium	Large	Population
1	A	√			23
2	B		√		175
3	C		√		100
4	D		√		42
5	E		√		75
6	F			√	226
7	G			√	282
8	H	√			5
9	I	√			25
10	J	√			40
	Total	4	4	2	993

Source: Data collected from questionnaire distributed and coolected

Table 2: Company's operational conditions and shifts type

		Operational condition			Shifts		
Serial No.	Company	Manual	Semi- automated	Automated	Three shift (8 h)	Two shift (12 h)	Single shift (8 h)
1	A	√				√	
2	B	√				√	
3	C	√				√	
4	D	√				√	
5	E		√				√
6	F			√	√		
7	G		√			√	
8	H	√					√
9	I	√					√
10	J	√				√	
	Total	7	2	1	1	5	1

Source: Data collected from questionnaire distributed and collected

Table 3: Conveyors, robots and their uses/function

Serial number	Company	Conveyors	Robots	Without robots and conveyors	Uses/function	
					Conveyors	Robotics
1	A	-	-	√	-	-
2	B	-	-	√	-	-
3	C	-	-	√	-	-
4	D	√	-		Conveyors for transporting soap for packaging.	
5	E	-	-	√		
6	F	-	-	√	Transport of bottles.	-
7	G	√	√		Carrying bottles and crates.	For recrating and repalleting
8	H	-	-	√	-	-
9	I	√			transport of cushion.	-
10	J	√	-		transport of logs and plywoods	-
	Total	4	1	6		

Source: Data collected from questionnaire distributed and collected

Table 4: Method of production and production volume

Serial No.	Company	Production method	Production volume		
			Low	Medium	High
1	A	Batch		√	
2	B	Batch			√
3	C	Job		√	
4	D	job		√	
5	E	Batch			√
6	F	Flow line			√
7	G	Batch			√
8	H	Batch	√		
9	I	Batch	√		
10	J	Batch		√	
	Total		2	4	4

Source:Data collected from questonnaire distributed and collected

Table 5: Breakdown classification,their effect on production and duration of repairs

Serial No.	Company	Type of breakdown		Effect on production	Repairs duration
		Minor	Major		
1	A	√	√	Affects production.	2 weeks -1 month for major.
2	B	√	√	Does not affect production	A day for minor.
3	C	√	√	Affects production.	3-4 days for major.
4	D	√	√	Affects production.	Few hours.
5	E	√	-	Affects production.	3-7days for major.
6	F	√	√	Affects production.	Few hours for minor.
7	G	√	-	Affects production	3 days for major.
8	H	√		Affects production	Few hors for minor.
9	I	√		Affects production	30 minutes to 1hour.
10	J	√		Affects production	2 days for the major.

Source: Data collected from questionnaire distriebuted and collected

Table 6: Raw materials type end product and estimated time per product

Serial No.	Company	Raw material	Type of end product	Estimated time/product
1	A	Petroleum base plastics	Non-consumable	30 sacks per 24 h .
2	B	Granules, plastics and petroleum		
3	C	Palm kernel, Soya beans, cotton seed copra and groundnut	Non-consumable.	100000 bags per 12 h
4	D	Palm oil and sodium hydroxide		
5	E	Acacia	Consumable	26 million tablets in 20 h
6	F	Malt, sugar, isohop corn etc.	consumable	30 tons per day.
7	G	Barley malts and maize.	Consumable	0.2 seconds per bottle
8	H	Petroleum base plastics	Non-consumable	10000 bags per day.
9	I	Rubber	Non-consumable	5000 foams per shift
10	J	Timber	Non-consumable	5000 plywoods per shift.

Source: Data collected from questionnaire distributed and collected

Table 7: Production type and production relationship

Serial No.	Company	Single product	Multi-product	Are Products related
1	A		√	√
2	B		√	√
3	C	√		
4	D	√		
5	E		√	√
6	F		√	√
7	G		√	√
8	H	√		
9	I	√		
10	J	√		
	Total	5	5	5

Source: Data collected from questionnaire distributed and collected

Table 8: Equipment and machines used

		Machines used			
Serial No.	Company	Manual	Semi-automatic	Automatic	Computer aided
1	A	√			
2	B	√			
3	C	√			
4	D	√			
5	E		√		
6	F			√	√
7	G		√		
8	H	√			
9	I		√		
10	J	√			
	Total	6	3	1	1

Source: Data collected from questionnaire distributed and collected

Table 9: Maintenance period and their effecton production

		Maintenance Period				Effect on Production	
Seriel No.	Comapany	Daily	Weekly	Monthly	Yearly	Affect production	Does not affect production
1	A	√				√	
2	B	√	√	√		√	
3	C	√	√		√	√	
4	D	√	√	√			√
5	E	√	√	√			√
6	F	√	√	√	√	√	
7	G	√	√	√	√		√
8	H		√	√		√	
9	I	√	√		√		√
10	J	√	√	√			√
	Total	9	9	7	4	5	5

Source: Data collected from questionnaire distributed and collected

Table10: Break period for workers and their effect on production

Serial No.	Company	Break time	H/min	Affect production
1	A	√	60 min	√
2	B	√	45 min	√
3	C	√	60 mins	-
4	D	√	60 min	-
5	E	√	90 min	-
6	F	√	60 min	-
7	G	√	60 min	-
8	H	√	60 min	√
9	I	√	90 min	-
10	J	√	60 min	-

Source: Data collected from questiuonnaire distributed and collected

RESULTS AND DISCUSSION

Information was obtained from ten industries through the administration of questionnaires to these industries. Though the ten companies form just a small fraction of the total manufacturing industries in the city of Kumasi, they were considered as the target industries since they form part of the big companies in the city which are highly

Table 11: Deform products and their uses

Serial No.	Company	Percentage deformed	Uses of deformed products		
			Scrapped	Recycled	Both
1	A	0.5		√	
2	B	2		√	
3	C	0.5	√		
4	D	5		√	
5	E	2			√
6	F	4	√		
7	G	4		√	
8	H	4		√	
9	I	3			√
10	J	2	√		
	Total	27	3	5	2

Source: Data collected from questionnaire distributed and collected

Table 12: Source of energy to power machines

SerialNo.	Company	Electricity	Fuel	Other
1	A	√	-	-
2	B	√	-	Standby generator
3	C	√	-	Standby generator
4	D	√	-	-
5	E	√	-	Standby generator
6	F	√	-	Standby generator
7	G	√	-	Standby generator
8	H	√	-	-
9	I	√	-	Standby generator
10	J	√	-	Standby generator

Source: Data collected from questionnaire distributed and collected

recognized. These companies could be used as the reference for analyzing the other "smaller" industries in the city as to whether they are adjusting to the modern trend of manufacturing in the area of automation or are stack to the old manual systems of production. From the questionnaire, data was collected and analyzed. Tables and pie chart were drawn from the collected data and used to analyse how Ghana and for that Kumasi developed with the automaton. Modern trend of manufacturing in the area of automation.

Operational conditions chart: With the ten[10] industries selected it came up that only one company operates on full automation. This represents ten percent (10%) of the selected industries. This company uses most of the sophisticated machines in their production activities.

Two companies representing Twenty percent (20%) of the total selected industries are engaged in semi-automated operation. These companies have a blend of manually operated machines as well as some automated machines used in their manufacturing operations. The remaining industries which form seventy percent (70%) of the total selected industries are engaged in manual methods of operation as shown in Fig. 1. Although these companies may be using some few modern machines they could not be classified as semi-Automated industries

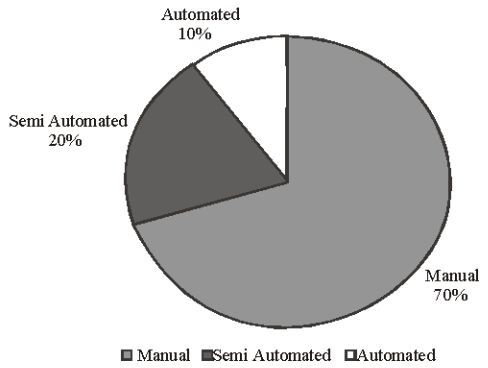

Fig. 1: Operational conditions

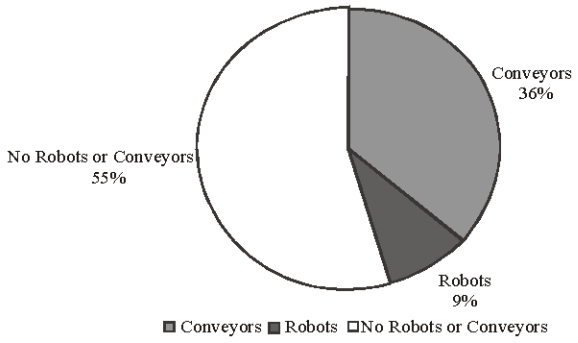

Fig. 2: Companies with robots, conveyors and without any of the two

Industrial companies with robots and conveyors: From the chart, Fig. 2, it came up that only a single company uses robots in their manufacturing process. This is the only

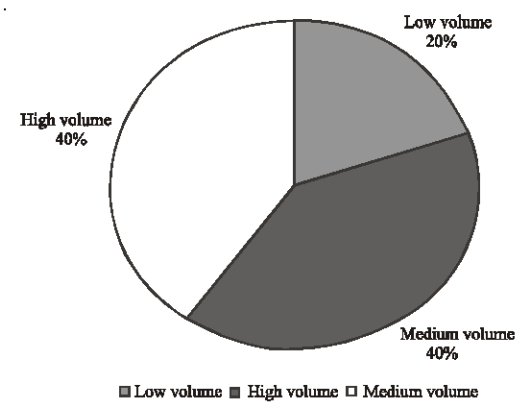

Fig. 3: Production volume

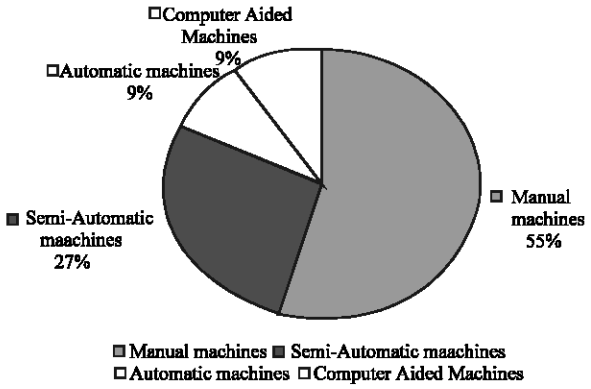

Fig. 4: Machines used in the various industries

company engaged in the full automation operation. Thirty six percent (36%) of the total industry uses conveyors in the movement of their products. This serves as a means of preventing workers from lifting heavy loads which could easily bring about injury and accidents in the work place.

Fifty five percent (55%) of the remaining companies neither use conveyors nor robots in their production activities. These are mostly the smaller scale industries with low turn out or output. Importing and using such high cost equipment will be a difficult task to such industries since they cannot afford it except they have external supports since their profit margins are small.

Production volume: From the production volume chart Fig. 3, it could be seen that forty percent (40%) of the selected industries produces high volume of their products (1000 and above) per day. Another forty percent (40%) also produces medium volume (100 to 1000) per day with the remaining twenty percent (20%) producing low volume (1 to 100) per day. The volume capacity is related with the size of the company.

Machines used in the various industries: From the pie chart of Fig. 4, the machines used in the various industries, it could be seen that out of the ten industries selected, it was only one company which has or uses automatic machines. This represents about nine percent (9%) of the companies on the chart.

Twenty-seven percent (27%) of the companies also uses Semi- Automatic machines in their industry. The 27% represents three (3) out of the ten industries selected. Another one (1) company also uses computer aided machines and this also represents another nine percent (9%) of the companies.

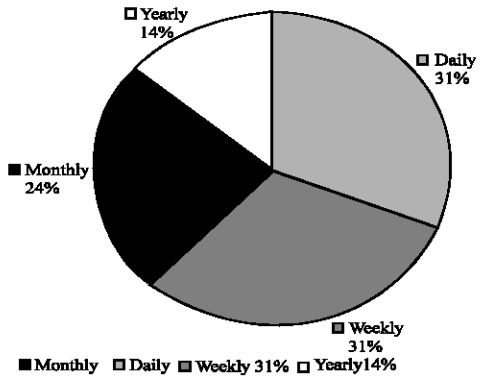

Fig. 5: Maintenance peroids

Companies with manual machines dominated with fifty-five percent (55%) representing six (6) out of the ten companies. This could be attributed to the economic constrain or the high capital involve in the effort to buy and use the modern and automatic equipment in the manufacturing process.

Maintenance periods: From the maintenance period and its effect on production charts Fig. 5, it was clearly shown that most of the industries maintenance periods affect their production volume whiles others were also not affected by their maintenance period schedules.

This was due to the fact that production continues whiles maintenance activities were taking place Fig. 6.

Companies population chart: From the companies populations chart Fig. 7 it was realized that the large scale ompanies employs or has higher population of human labour or workers. This is due to the fact that such companies are engaged in three shift operation, which means they operate 24 h a day. The smaller scale

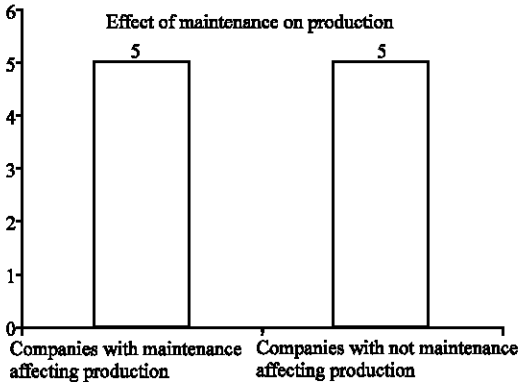

Fig. 6: Effect of maintenance on production

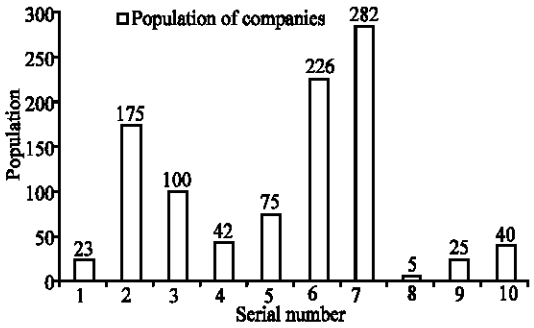

Fig. 7: Companies and their population

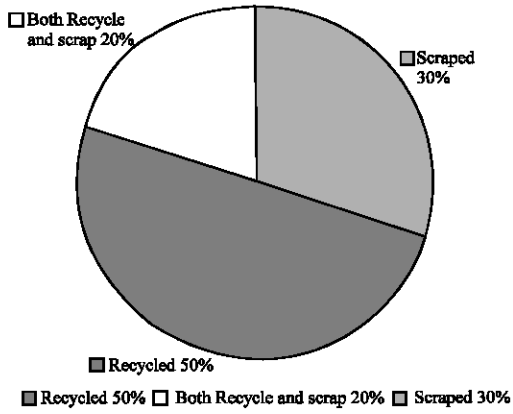

Fig. 8: Problems of the various industries

companies have the minimum number of employees. From the chart it could be seen that the companies with the largest population of labour constitutes the large scale industry and it is also the company which operates on a sort of advanced or a more refined way of production.

Product waste and their uses: From the data collected it came up that all the industries whether the automated, Semi-Automated or the manually operated industries, all encounter some form of defects in their products. Of all the deformations, fifty percent (50%) of the companies are able to recycle their malformed products, thirty percent (30%) scrap their malformed products and twenty percent (20%) both scrap and recycle their deformed products depending on the deformation. Fig. 8.

From the analysis of the questionnaires, it was realized that there are various problems encountered by the manufacturing industries in the country for that matter Kumasi. The major problem faced by almost all the industries was sudden power outage without prior notice. This is because all the industries use electricity as their main power source. Unannounced power cut causes companies without standby generators to loose almost all their products in the line or in process of production. This could also cause the breakdown of most of the industrial machines. Land acquisition is also a major problem of the manufacturing sector due to the poor land tenure systems practiced in the country-Ghana. With the state setting aside lands for industrial purposes this could help solve the problem of land acquisition and thereby promoting industrial growth. High interest rates on bank loans has also prevented from growing. many small scale industries which would developed to the medium scale and then to the large scale have been impeded with the same reason. Also the unavailability spare parts of most industrial machine also pose a lot of problem to some of the industries. When a part breaks down they sometimes have to wait for a very long time for repair work to be done. This phenomenon affects production since production has to come to a halt during the repair period.

CONCLUSION

The research investigated automation in Ghanaian industries using the Kumasi metropolis as a case study. From the findings it was discovered that some manufacturing industries in Ghana with particular reference to Kumasi, now produce for export. Despite this enviable development, they still lack the automation of their manufacturing system. Therefore, a lot still need to be done in the area of automation so that the country can actually compete with other industries in the international level.

Nations like Great Britain, the United States of America and the Japan are now engaged only in automation and with about only five percent (5.0%) human labor involved in the Manufacturing activities. If a country like Ghana wishes to go onto to the global market, then a lot has to be done either by encouraging more investors in the field of automation or the government supporting the local industries with the needed financial support.

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