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The Trend of Metalworking Techniques and Skills: Its Transmutation to Jewellery Production in Wa Municipality, Ghana

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Abstract:
Metal works have become global commodity highly patronized for living. In Wa municipality metal works are used in both the formal and informal sector for various purposes. These to some extent have created jobs for the technical and vocational incline individuals in the municipality. Although there are a lot of metal works used in the municipality, some are produced for use while others of equal demand are not produced but used in the municipality. The study seeks to find out the types of metalwork produced and used and those not produced but used in the municipality.
Descriptive survey research was used as the methodology and random sample technique was used in sampling the metal design and fabricator. The study uncovered many techniques and methods used in fabricating metal works and Jewellery works in Wa municipality. These techniques and methods though have different orientations, yet they all stride on similar processes. The study recommends that with the discovery of similar processes that are used by the metal design and fabricators in Wa municipality which are also the processes that are used in fabricating Jewellery which they are not producing there should be a training seminar to practically teach them to start producing Jewellery for the people in Wa municipality.

Keywords*: Jewellery, metal, metalwork*

1. Background to the Study

Wa Municipality is situated in the southeastern part of the Upper West region. The youngest among the 10 regions in Ghana is the Upper West Region. It was created on January 14th, 1983 by the Provisional National Defence Council (PNDC) Government in a bid to bridge the development gap between the Upper West area and the rest of country. The Upper West Region, with Wa as the regional capital, was formerly part of the then Upper Region which was itself carved out of the Northern Region in July 1960 (Upper West Region/Ghana Districts and Ghana census statistics, 2010). It has a land mass area of approximately 579 square kilometres or 579,358,252.449 square metres, which is about 6.4% of the size of the region (Lands Commission; Wa Municipal Town Planning Officer, January 2017).

The implication of the location of the municipality for development is, enhancing bilateral trade and commerce with Francophone countries and the Southern part of the country. Wa has the potential to grow and be upgraded into both an industrial and commercial pivot for the north-western corridor of Ghana. In the region, one of the crafts and manufacturing industry accounted for by the Ghana census statistics (2010) included metal design and fabrication. However, in Wa Municipality, metal design fabrication has now become one of the main vocations for the people. This is because the end product of metal design and fabrication which is metalwork is now inevitable in everyday life activity of people.

Labi and Ansah (2008) emphasis that production of metal works in Ghana originated from the Northerners of Ghana. This assertion cannot be disputed since various kinds of metalworks are produced in the municipality but with some exceptions which include Jewellery. This proves that there is a human resource in terms of metalwork technology available in the municipality and must be exploited (UKEssays, 2012). Upon this basis, there was the need to investigate the abilities of metal design and fabricators in Wa municipality and the philosophical ways of how the abilities could be translated into producing Jewellery to solve their Jewellery needs.

1.1. Statement of the Problem

Metalwork plays tactical, strategic and distinctive role encompassing functional imperatives. They are essentially embedded in a wide-range of social needs (Holl, 2000). There are enormous varieties in African metalworks, in terms of the metals used, the techniques employed, and the objects produced (Metropolitan Museum of Art, 2005).
Metalwork embraces a wide area of profession; some of which include blacksmithing, goldsmithing, silversmithing, casting, welding and jewellery fabrication.

In Wa municipality almost all kinds of metal works are used of which most are produced by the metal design and fabricators whereas some are not produced but significantly used. Particularly among those not produced but used is jewellery. The study therefore seeks to find out the kind of techniques used in producing these types of metalworks used in the municipality and how it can be adapted in producing jewellery in the municipality.

2. Objective of the Study

To identify and describe the techniques used in fabricating types of metal works used in Wa municipality and how it can assist in jewellery fabrication in the municipality.

2.1. Introduction

There are many techniques and skills used in producing metal works. These techniques are applicable depending on the type of metalwork one intends to produce (Singh, 2006). Aside this, metal materials contribute to the techniques and skills employed in metal work production. Kennett (2013) reminds us of the fact that tools and equipment cannot be exempted in how techniques and skills can be employed to produce metal works. These arguments have great influence of metal work production in Wa municipality. It draws attention on the philosophies of the metal works produced and the growing trend of technology to advance production of other metal works that are used but yet not produced in the municipality.

2.2. Metal Fabrication Processes

McCreight (1991) opines that the emphasis is on how technical insight of metal manipulation can lead to forging metals into desired shapes to serve a lot of purposes in our environment. That is precisely the point that this study is seeking to make in Wa Municipality in the Upper West Region of Ghana. Schey (1997) defines fabrication process as the ability of a metal to be fabricated by various manufacturing processes such as formability, workability, castability, forgeability, machinability and weldability. Schey in his definition uses techniques in fabricating metal to elucidate what metal processes is all about? Schey's definition underpins some of the processes that the metal design and fabricators are using in producing various metal works in the municipality.

2.3. Metal Forming Processes

According to Singh (2006), forming processes encompass a wide variety of techniques, which applies suitable force or pressure like compression, tension and shear or their combination to cause a structural change of the raw material into a desired design. These processes are also known as mechanical working processes and are mainly categorized into two major classes; which are hot working processes and cold working processes. In these processes, materials are not mostly removed. Rather, it is deformed and displaced with the aid of suitable stresses like compression, tension and shear or a combination of the two to cause an alteration of the material into a desired design.

Such processes lead to production of directly usable metalworks which include kitchen utensils, rods, wires, cold drink bottle caps, collapsible tubes, jewellery and many others. Some of the important metal forming processes are: 1) Hot working Processes: Forging, Rolling, Hot spinning, Extrusion, Hot drawing and Hot spinning. 2) Cold working processes: Cold forging, Cold rolling, Cold heading, Cold drawing, Wire drawing, Stretch forming, Sheet metal working processes such as piercing, punching, lancing, notching, coining, squeezing, deep drawing, bending etc. All these processes are applicable in jewellery production (Tetteh, 2018).

2.4. Joining Processes

Many products observed in our day-to-day lives, are commonly made by putting many parts together; somewhat in a sub-assembling form (Untracht, 1985). For example, the ball pen is made up of a body, barrel, cap, and refill operating mechanism. All these parts are put together to form the product; pen. Over 800 parts are put together to make various sub-assemblies and final assembly of a car or an aeroplane. Similarly, in metalworks or jewellery fabrication the same process of putting together goes on. Draw wires, gemstones, shape metals are put together to fabricate jewellery works. A complete machine tool may also require assembling more than 100 parts in various sub assemble or final assembly. The process of putting the parts together to form the product, which performs the desired function, is called assembly. An assemblage of parts may require some portions to be merged together using various joining processes.

Fabrication and assembling according to Singh (2006) are the most widely preferred joining processes used in metal work. In these processes two or more pieces of metal parts be it ferrous or non-ferrous, are joined together to produce a desirable metal art work. The joining processes are carried out by soldering, fusing, pressing, rubbing, riveting, screwing or any other means of assembling. These processes are used for assembling metal parts and in general fabrication work. Such requirements usually occur when within a piece of metal artwork, there are several areas to be joined. Some of the essential and well-known joining processes include: Soldering, Welding (plastic or fusion), Brazing, Riveting, Screwing, Press fitting, Sintering, Adhesive bonding, Shrink fitting, Explosive welding, Diffusion welding, Keys and cotter joints, Coupling and Nut and bolt joints.

2.5. Surface Finishing Processes

Surface finishing processes are employed for implementing intended surface finish on the surface of a metalwork. According to Untracht (1985) by imparting a surface finishing process, the measurement of the part is not changed functionally; either an additional metal is used on top of the surface; that is building on the base metal to give it a desired

finish or remove an amount of the metal to give a desired look. These processes should not be misunderstood as metal removing processes in any way since they are basically meant to provide a good surface finish or a decorative or protective coating onto the metal surface. Surface cleaning processes are also known as surface finishing processes. Some of the commonly used surface finishing processes are: Honing, Lapping, Super finishing, Belt grinding, Polishing, Tumbling, Organic finishing Sanding, deburring, Electroplating, Buffing, Metal spraying, Painting, Inorganic coating, Anodizing, Sherardizing, Parkerizing, Galvanizing, Plastic coating, Metallic coating, Anodizing and Sand blasting. Some of these techniques earlier mentioned are applicable in jewellery fabrication.

2.6. Jewellery Production Techniques

Books (1981) acknowledge that knowing how a jewellery item was fabricated can help appreciate its quality and worth to our society. Many specialised techniques are used currently, but the most used ones are the four basic methods – die-striking, electro-forming, casting, or hand fabrication (The Diamond Studies Course, 2011).

2.6.1. Die-Striking or Stamping

In this jewellery making method, a mass of metal is designed by shaping solid metal with a mold, or die, made from hardened steel. The mold is designed to contain two parts, and the form of the finished metal work is defined by the inner vacuum that is created when those parts are joined with G-clamp or other joining devices. During production, working metal is placed in the mold and machine-stamped. The force of pressure is exerted on a working metal at a closer distance, increasing its density and strength. Coins as a currency are examples of works produced through die-struck in our everyday life. Most jewellery items such as bangles, earrings, necklace, bracelet and rings, can be manufactured using the die-struck method. Die struck works are most often produced by means of putting components together. In another vein, jewellery with hollow parts are produced through the process of soldering two die stamped pieces together. Due to the strength this process gives the metal, die-struck method is one of the methods of producing metal or jewellery works.

2.6.2. Electro-Forming

This is a process where particles of precious metal alloy are deposited on the surface of a metal through electro-deposition. The design is usually made from wax and then coated with graphite, so it conducts electricity. After that, it is then connected to the negative terminal of a power source and dipped in a chemical solution that contains positively charged atoms of the alloy metals. The design will then attract the precious metal dissolved in the chemical solution after another conductor is attached to the positive terminal in the bath. When the power is switched on, the model or the design attracts the metal atoms. The metal then accrues on the model and builds a layer on it. The metal piece is removed, and a tiny hole is pierced inside. Then the piece is heated causing the wax to melt away. All these are done after the layer shell is thick enough. The resulting jewelry is hollow and lightweight, but strong. For this reason, electro-forming is a common method for producing large earrings, necklaces, and pins (The Diamond Studies Course, 2011).

2.6.3. Casting

Some jewellery are fabricated by pouring molten metal into a mould and letting it cool. Customarily, the procedure starts by either hand carving a model from wax, or sand or Plaster of Paris (PoP) or imbedding it in a liquid plaster-like material called investment. There are many types of casting through which jewellery can be produced. These include lost-wax casting, sand casting, die casting and investment casting. The most commonly used ones in jewellery fabrication are the sand casting and the lost-wax casting. With the lost-wax casting, a wax mould is created on which a mold is built and later the wax is melted out to create a pattern in which the molten metal is poured to take the shape of the pattern; it is then allowed to cool. Afterwards the mould is broken apart to take out the finished work. According to Schey (1997) this method is commonly used in the southern part of Ghana. Sand casting on the other hand is the process whereby a jewellery work can be produced using sand to create a mould in which a molten metal is poured and allowed to cool; the mould is later broken apart to get the finished cast work. This method is typical in the northern part of the country.

Most of these techniques used in jewellery production are used in non-jewellery metalworks fabrication in the municipality. This underscores the ability of the metal design and fabricators to produce jewellery works on their own.

3. Methodology

The study is descriptive survey design driven. Descriptive Survey research is a quantitative research that collects data about one or more group of people to ascertain trends in their thinking, feeling, attributes, features, attitudes, opinions, behaviours and experience (Leedy & Ormrod, 2005). The method accurately considered the data and describes precisely what it sees relating to the metal works produced and the skills used in producing the metal works by the metal design and fabricators (Sanders, Lewis & Thornhill, 2007).

The specified total group of persons from which a sample was selected was metal design and fabricators in Wa municipality. These persons were the accessible population of the study (Rubin and Babbie, 1997). Simple random sampling was used to sample (114) respondents for the study. This was made up of metal design and fabricators across the three zones in the municipality. The accessible population (108) was categorised into two; metal design workers and its fabricators. Descriptive statistical tools such as excel software, table and percentage were used to analyze the facts sought from questionnaire, observation and interview. Photographs were taken to empirically substantiate description

and analysis of data (Banning, Camstra & Konttnerus, 2012 & Student Learning Centre, 2013). The metal design works and its fabricators sampled were one hundred and fourteen (See Table 1 and Figure 1).

Zone	Frequency	Percent
Busa zone	24	21.06
Bamahu zone	38	33.33
Wa Central zone	52	45.61
Total	114	100.0

Table 1: Area of Location of the Metal Design Works and Fabricators and the Number Used for the Study in Wa Municipality

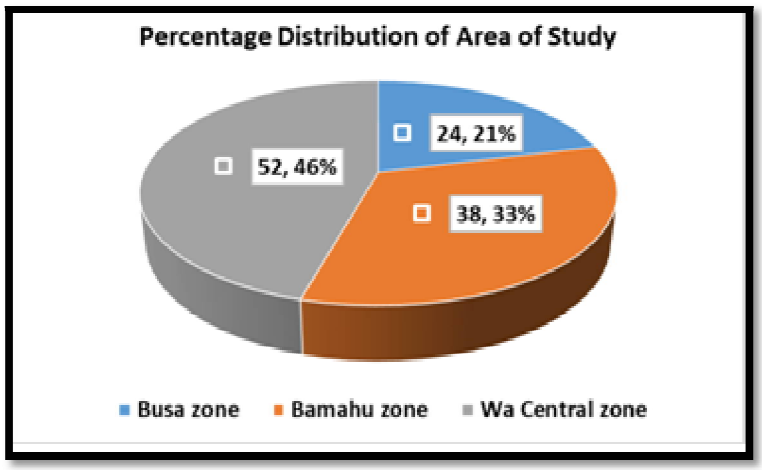

Figure 1: Percentage Distribution of Area of Location of the Metal Design Works and Fabricators and the Number Used for the Study in Wa Municipality

4. Presentation and Discussion of Findings

The intent of the study was to delve into the metal industry in the municipality to unearth the history of metal fabrication in the region in order to identify types of metalworks produced and used in the municipality. The principal element of findings and discussions was centred on the techniques and skills used in fabricating the types of metalworks used in the municipality to assess the technical potential of metal design fabricators in relation to unearthing their potential to fabricate jewellery which is not produced in the municipality. It also looked at the philosophical, aesthetical, symbolical, usage and socio-cultural implications of the metalworks that the municipality is identified with. In order to make the discourse comprehensible the presentation of findings and analyses are made as follows:

Types of Metalworks	Frequency	Percent	Valid
Agricultural Equipment	14	12.28	12.28
Food processing machine	11	9.64	9.64
Edifice and Security complement	47	41.22	41.22
Fun equipment	3	2.63	2.63
Temporary Structure	31	27.19	27.19
Working tool	8	7.01	7.01
Total	114	100	100

Table 2: Types of Works Produced by Metal Design and Fabricators

4.1. Selected Metal Design and Fabricated Works Uncovered

Through questionnaire, observation and photography, the study discovered detailed information of the works produced by the metal design fabricators and / or used in the municipality. They include; 1) Edifice and Security complement, 2) Temporary Structure, 3) Food processing machine, 4) Agricultural Equipment, 5) Working tool and 6) Fun equipment.

4.2. Categories of Metalworks Produced or Used and Their Philosophical Significance in Wa Municipality

`Although there were six types of metalworks produced or used that were identified in Wa municipality, philosophically the metalworks fall under four broad distinct categories. Eze (1998) expatiates philosophy to cover shelter, existence, occupation and body adornment. This philosophy underscores the categories of metalworks produced or used in Wa municipality. The study names the four categories of metalworks produced or used in Wa municipality as:

4.2.1. Metal Works for Shelter: Edifice & Security and Temporary Structure

Place of habitation is considered as the mid-point between sustainability and growth where God meet the living. The philosophical significance of these types of works for the people of Wa is the resting place of divinity and God. Fabricating shelter needs special skills and ingenuity. The believe attached to this type of works makes the fabricators manufacture them with tough metal material strong to resist rough handling and to be able to resist weather conditions as much as possible. Metals therefore can be used as a source of strength for man and his relationship with God. Designs portrayed are inspired by the spirit. Colour application is weather condition oriented; dark colours are used due to the dusty environment and hot weather condition. Welding is the major process used in fabricating theses metalworks.

4.2.2. Metal Works for Processing Food: Food Processing Machine

These types of works connote sustainability of life. The people in Wa municipality are of the view that their fore-fathers produced these works which gave them sustainability at their settlement in the region. Therefore, they use solid metal in producing works related to these works. They use metals such as ferrous and non-ferrous metal. Even the non-ferrous metals used are thick and strong. Characteristically, the metal used to contain food is non-ferrous metal. On the other hand, ferrous metal is used in producing works which are not supposed to hold food and if it does, the food must be cooked using the non-ferrous metal. Non-ferrous metal used in producing these works include aluminium. The ferrous metals used include stainless steel, cast iron and wrought iron. Most techniques used in fabricating these types of metalworks are casting, forging and welding.

4.2.3. Metal works for Profession: Working Tools and Agriculture Equipment and Tools

These types of works philosophically signify companion for survival. It is a working friend for the people of Wa municipality. Survival depends on these works. The people in Wa municipality cherish working. According to 2010 Census, the major work of the people in Wa is farming; this is followed by individual exploration of skills and trading. As the means to sustain human existence, materials used in producing such metal works are ferrous metal. The works produced are meant for hardwork and so the metal is fashioned very thick in width and in length to enable them resist breakage and easy wear. Metals such as cast iron, wrought iron, stainless steel, carbon steel, and mild steel are used in this category. The main process used in fabricating these works is forging. Scientifically forged products are strong, capable of accommodating stress. Metal is a source of livelihood.

4.2.4. Metalworks for Adornment: Jewellery Made in Metal

All over the world, men and women adorn their bodies. This acceptable way of living is no different in Wa municipality. The people in Wa municipality use jewellery for many reasons. Some of which include identity, healing, protection and worship. In view of these reasons all types of metals are used in producing jewellery. Majority of the people who make maximum use of jewellery in Wa are women. In that regard the dominant metal used is the non-ferrous metal. These metals are soft and easy to manipulate. It is the feminine metal as compared to the ferrous metal. The non-ferrous metal jewellery are used for body adornment purposes while the ferrous metals are used for medicinal or spiritual protection purposes. The non-ferrous metals used in jewellery works used in Wa are gold, silver, copper, brass and aluminum. The gold and silver are not used in producing the entire jewellery works but rather are used to plait the works. On the other hand, those jewellery works made in ferrous metal are left in the ferrous metal state. Because the jewellery are used on the body, precious metals are used. Philosophically the metals used are earthly defined and naturally discovered metals. Jewellery is for women and so care must be taken when producing it. The purpose of the jewellery work determines the design and the type of metal to use. The jewellery works used in the municipality serves as identity, protection, healing, livelihood (black power) and worship.

It was recognized that apart from Metalworks for adornment: that is Jewellery, all the other identified metalworks are produced in the municipality.

4.3. Techniques Used in Producing Identified Metal Works

The data collected points out that huge works mostly fabricated with arc welding and oxy acetylene joining and forging processes are the most patronized in the municipality and as such specialization in these areas should be one of the major focus of potential metal design and fabricators. Welding, casting and riveting have been used to fashion these metalworks. Processes such as grinding, filling, emerging and spraying have been employed to finish the artworks. According to Higher Still (1999) fabrication processes can be argued along five defined main ways. These main processes used in the manufacturing fabrication are as follows: 1) Design 2) Marking out 3) Cutting 4) Forming 5) Joining and 6) Assembly and Inspection.

Significant to this study, all the processes asserted by Higher Still have influenced the fabrication process of all the metalworks identified either produced or not produced but all the same in use in the municipality. Arguably, there is no metal design and fabrication work that does not pass through the acknowledged processes by Higher Still (1999). This philosophically buttresses the argument that metal fabrication processes encompass all fabrication processes involved in jewellery fabrication.

A discovery was made concerning the technical processes that the metal design and fabricators use in their production. Key among them are designing, drawing, transferring of drawing or marking out, cutting, forming or joining and finally inspection; according to Mr. Joseph Kola a teacher and head of Department for Welding and fabrication section of St Basil Senior High Technical School, Kaleo and a former COTVET Coordinator for Wa municipality division. The

trainees in Wa municipality among the Garages which is being coordinated by Mr. P Botri (President), Mr. Ahmed Kankuronye (Secretary), Mr. Francis Ekow Banlang (Deputy Secretary) and Mr. Joseph Kola (former COTVET Coordinator for Wa municipality division) were trained as technical artisans.

4.3.1. Design

Designing is the process of scientifically and technologically fabricating or manufacturing a product. It provides the oriental display of how a finished product would be (CBI Colofon, 2014). The designing aspect of every art work is necessary for the metal artist and this is not exceptional to the technical knowledge of the metal design fabricators. The metal design fabricators have two forms of designing: pictorial observation or personally customized drawing either from the metal design fabricators or customers own designs. In a focus interview with the metal design and fabricators they revealed that they design through inspirations from catalogues and their own designs. They identified some customers who would either bring their design or come along with pictures to produce the same work for them. None of them produced without design or drawing. Producing works without designs can lead to unattractive works and loss of capital (J. Kola, personal communication, January 28, 2016).

4.3.2. Transferring of Drawing

Design is transferred on the metal figure using the dimension of the work that would exactly represent the finished product. The metal design and fabricators transferred their design onto the working metal before fabricating it. Most of the transference is done when the measurement of the created design is marked onto the metal. The means by which they transfer their designs include paper drawing, using pointer to mark and direct creation of the design on the metal figure. See Figures 6.1 to 6.2.

Figure 2: Marking on an Ungalvanised Sheet Metal

Figure 3: A Metal Design and Fabricator Tracing the Blade of a Hoe

4.3.3. Cutting

The process of splitting, parting a piece of metal to the required form or dimension is cutting (Singh, 2006). Different forms of cutting are often applied in the Wa municipality by the metal design fabricators. They cut using simple equipment such as hammer, chisel, hacksaw blade and its frame. Some of them also use equipment like oxy-acetylene, arc welding and guillotine machines. The processes are applied based on the size, nature, type and the request of the customers. See Figures 6.3 and 6.4.

Figure 4: Cutting with a Chisel

Figure 5: Cutting Taking Place

4.3.4. Forming and Joining

The forming and joining techniques the research unearthed were, sand casting, die casting, arc welding/electric welding technique, oxy acetylene welding, straightening technique, forging, blacksmithing and joining (bolt and nut, welding, riveting, glue). Arguably, the assertion by Higher Still (1999) singling out forming and joining as the fourth and fifth steps can be subjected to one step including the last step it identified. In metalworking, technically one can do assembling through the means of forming and joining.

So far as forming and joining has taken place, obviously assembling has occurred. In Wa municipality, though they apply the Higher Still (1999) principles of working metal into finished work, they put steps four and five together in achieving step six of Higher Still (1999) claim. This is expressively fundamental and correct (Singh, 2006).

4.3.4.1. Casting

Thompson and Lawson (2010) suggested that one of the most time-honoured ways to make casting work is through lost wax casting. But the situation is different in Wa municipality as the most popular way of forming their metal work is sand casting. The main material used in this process are ant-hill, clay sand, river bank sand and around a hill or mountain sand. Out of these materials the preferred one is the sand collected around a hill or mountain. This sand contains natural plastic content that gives quality finished work with less casting defects (see Figures 6.5 and 6.6).

Figure 6: Plastic Sand Mould for Metal Pot

Figure 7: Plastic Sand Mould for Pendent

4.3.4.2. How the Sand Is Processed

According to Mr. Seidu Issaka who has been in the profession for more than two decades, the processing of the sand are as follows:

- Sand for casting is sieved to do away with all rough or big particles
- The semi-fine sand particles are sieved with a fine mesh to its finest
- It is sprinkled with water to keep it wet
- The wet sand can then be stored at a shady place to keep it moist.
- Water is sprinkled on within three days to keep it fresh to use

The prepared sand can last minimum of six casting times on the condition that 70% of it is always used in the process. But if less percentage is constantly used at any given casting period, it lasts at a little above ten times. On the extreme, if works cast are only small in size like pendants, medals, lockers, the sand can last very long depending on the quantity fetched at the source.

4.3.4.4. Sand Casting for Intricate Metalworks

Sand casting is a means of forming and assembling intricate metal design work used in Wa municipality. Mould is formed with sand. Molten metal is obtained by heating the metal to the melting point and then poured to fill the mould. Molten metal is allowed to cool. The Mould is destroyed to get the cast work. The cast work is then finished for the market (see Figures 6.7 to 6.10).

Figure 8: Sand Mould

Figure 9: Finished Mould

Figure 10: Molten Metal Poured in Mould

Figure 11: Solidified Cast Work

4.3.4.5. Sand Casting for Large Metal Works

Sand casting is a means of forming and assembling large design metalworks used in Wa municipality. Mould is formed with the sand. Molten metal is obtained by heating the metal to the melting point and then poured to fill the cavity in the mould. Molten metal is allowed to cool or solidify. Mould is then destroyed to retrieve the cast piece. The cast work is then finished for the market. Figures 6.11 to 6.19 give step-by-step method used in sand casting in the municipality.

Figure 12: Sand Mould for Metal Pot Casting

Figure 13: Fixing of Outer Mould to Cast Metal Pot

Figure 14: Completion of Side Mould Fixing

Figure 15: Fixing of the Bottom Mould of the Metal Pot

Figure 16: Mould Ready for Casting

Figure 17: Preparation of Molten Metal

Figure 18: Molten Metal Being Poured

Figure 19: Molten Metal in a Mould Being Allowed to Cool

Figure 20: Finished Cast Metal Pot

4.34.6. Blacksmithing

This process is also used by the metal design and fabricators to produce different kinds of work. In this process not all the metal is heated in fire but the part that needs to be artistically designed to suit the need of the user (see Figures 6.20 to 6.25).

Figure 21: Blacksmith Annealing a Metal

Figure 22: Blacksmith Forging (A)

Figure 23: Metalwork Being Annealed

Figure 24: Blacksmith Forging (B)

Figure 25: Blacksmiths Forging (C)

Figure 26: *Product Made from Blacksmithing*

4.3.4.7. Arc Welding

It is the most used technique by the metal design and fabricators in producing their works. They use electricity to make joining possible. It has its limitations like the other processes of forming and joining metalworks. Examples of the arc welding technique are shown in Figures 6.26 to 6.28.

Figure 27: A Metal Design and Fabricator Welding a Window Frame

Figure 28: A Metal Design and Fabricator Welding a Coal Pot

Figure 29: A Metal Design and Fabricator Welding

4.3.5. Assembling and Inspection

Untracht (1985) explains assembling and inspection as surface finishing processes that are utilized for imparting intended surface finish on the surface of a metalwork. By imparting a surface finishing process, the dimensions of the parts are not changed functionally; either a very negligible amount of material is removed from that particular material which is added to the surface of the work or the reverse (Untracht, 1985). After producing the metalworks, the metal design and fabricators do inspect the work for correction and assembling if need be (See Figures 6.29 and 6.30).

Figure 30: Filing a Cast Piece

Figure 31: Spraying a Welded Piece

4.4. Metals Used in the Fabrication of Metalworks in Wa Municipality

Metals serve a lot of purposes due to their properties and characteristics. Conversion of metals into a functional mode allows for their fullest importance (Helmenstine, 2010). They are used by many industries as the main source of materials for their production. This is not different in the metal industry in Wa municipality. The two major types of metals; precious or non-ferrous metal and non-precious or ferrous metals have become part of the history of the metal industry in Wa municipality. The commonest ones found in use in the municipality include aluminum, cast iron metal, wrought iron metal, stainless steel metal, copper metal, galvanized sheet metal and ungalvanised sheet metal. The properties of these metals are well noted by the metal fabricators in the municipality. They take advantage of each of the metals to make it more comfortable and better to work with as acknowledged by Mongiatti, Suleman, & Meeks (2011).

4.5. Tools and Equipment Used in Fabricating Metalworks in Wa Municipality

Tools and equipment are the turning point of raw materials into finished product. Bray (2003), states that the vehicle to make goods and services is through tools and equipment. The research discovered the importance of tools and equipment in the existence of the metal industry in Wa municipality. The research identified selected equipment and tools in use for fabricating metalworks in Wa municipality. Tools such as anvil, hammer, hacksaw, plier, tong, tape measure, goggles, hand gloves, apron/overall, wellington boot, hand file, bench vice, sliding arm clamps, trowel, chisel and soldering torch were identified. Equipment identified include mechanized locally manufactured furnace, mould cavity, arc welding machine, oxy acetylene machine, and electric drilling machine.

4.6. Materials Used in Fabricating Metalworks in Wa Municipality

The main material used in the revealed metalworks is metal. These metals can be classified into ferrous and non-ferrous metals. Non-ferrous metals are metals that contain low appreciable amount of iron. Some of these metals include aluminum, brass and copper. Ferrous metals are metals that contain high appreciable amount of iron. Some of the metals used in fabricating metalworks include cast iron, wrought iron, stainless steel, aluminum, galvanised, and ungalvanized; some of which can be used for jewellery works.

4.7. Other Materials Used in Fabricating Metalworks in Wa Municipality

The research also identified non-metal materials such as oil paint, wood, fabric and plastic. These materials were used as finishing medium, integrating material and supplement material. The importance of these materials is that; they

add to the aesthetics of the finished product, they define the strength of the finished product, reduce the price of the product and enhances the durability of the finished product.

4.8. Unskilled Issues Related to the Metalworks Fabricators in Wa Municipality

The study discovered that the metal design and fabricators are not familiar with certain tools, processes, and materials needed in metalworks. Some of the things which the respondents are not familiar with in terms of tools included; soldering torch, jewellery saw frame, jewellery saw blade, stake, and mandrel: for processes, it included; piercing, preparing ingot, wire making, gold refining chemicals, emery finishing, tripoli finishing, rouge finishing, and materials; gold, and silver.

5. Major Findings

The comprehensive study revealed the following on the trend of metalworks techniques and skills applied in Wa municipality and how it can influence Jewellery fabrication.

All kinds of metalworks are used in the municipality, notable among them were the four types of metalworks identified in the study. Metalworks for shelter: Edifice and security and temporary structures; Metalworks for processing food: Food processing machine; Metalworks for profession: Working tools and Agriculture equipment and tools and Metalworks for adornment: Jewellery made in metal. Although Jewellery is one of the most used metalwork in Wa municipality, there were no identified place or places in the municipal that jewellery was produced for sale or by customers' order.

The analysis showed that the metal used most by the metal design and fabricators in producing majority of their metalworks were ferrous metals. These metals include galvanised metal sheet, ungalvanised, iron rod, wrought iron, cast iron and square pipes.

The metal design and fabricators only engage in using non-ferrous metal such as aluminium, brass and copper when the metalwork under production is either for food related items or to contain liquid or substance related to consumption.

The two principal metal fabricating techniques that have given birth to all other metal fabrication techniques in the Wa municipality are blacksmithing and forging.

Arc welding, oxy acetylene welding, casting and forging were the thematic fabrication techniques most applicable by the metal design and fabricators in Wa municipality. Welding, riveting, bolt and nut and seaming are the joining techniques mostly used by the metal design and fabricators in the Wa municipality. Finishing processes employed by the metal design and fabricators as identified through the data collected include grinding, filtering, sanding, and spraying.

The study found out that the metal design and fabricators depend mostly on improvised equipment and tools for almost all their production. They locally crafted the equipment and tools to suit their purpose. The equipment that dominate the metalwork industry in Wa municipality are: mechanised locally manufactured furnace used in producing casting works, arc welding and oxy acetylene for joining ferrous and non-ferrous metals, spinning and lathing machine for turning and shaping metals into functional items. Most common and familiar tools used in fabricating in the municipality by the metal design and fabricators included anvil, hammer, hacksaw, pliers, tong, dies, tape measure, goggles, hand gloves, chisel, hand file, bench vice, sliding arm clamps, trowel, hand grinding machine and working bench.

The study found out that brass, aluminum silver, gold, copper, bronze, and stainless steel, were the metals preferred most by the people to use in producing Jewellery.

The study discovered ten different types of Jewellery identified to be the scope of Jewellery used by the people in Wa municipality. They are: Finger rings, Necklace, Earring, Bangle, Bracelet, Hair jewellery, Anklet, Toe ring, Tongue ring, and other forms of Jewellery including nipple ring, naval ring and nose ring. Out of the ten identified Jewellery used, finger ring, earring, bangle, bracelet, necklace and hair jewellery were the most patronised and most used in the municipality.

6. Conclusions

The study upon analysis of data and based on the findings has drawn these conclusions: The argument that the people of Wa municipality cannot produce jewellery on their own cannot hold. More to this fact is the ability and techniques which the researcher was able to bring out of the respondents in the area of jewellery production; buttressing the argument that knowledge can be acquired through putting one's ability and technique to test (Philips & Pugh, 1994).

For close to a century, the people of the Upper West Region have not been able to discover their ability of producing jewellery; although metalworks such as fabrication of shelter items, farm implements, working tools, food processing equipment and others, were made by them. Metalworks relating to body decoration could not be produced by the people; but rather they buy it from elsewhere and use it in the municipality.

In this current metal-fashion dispensation, the argument can be made about the basic principles used in fabricating any set of metalworks to be reflective in another set of metal works. As such, whether or not the people do not produce jewellery but are able to produce other forms of metal works, means the technique they used can be transferred into jewellery production. The fundamental processes such as idea development, forming processes, joining processes and finishing processes that the people were identified with underpin the argument that they could produce jewellery.

Unlike most fields, the people develop their ideas from nature; particularly from their immediate surroundings which is more related to their culture embedded with foreign designs and motifs. They use a method of tracing paper to transfer their designs unto the metal as well as pasting the design on it before forming the works.

Under forming in jewellery production, the most common elements are hammering, forging, milling, casting, annealing, punching, piercing, drawing, doming, soldering, piercing, riveting, grinding, filling, emery, tripoli and rouge application and

gem setting. Philosophically the people of Wa municipality although only familiar with hammering, hacksawing, riveting, weaving, and pliering, also adapted the other forming elements as the mechanism in jewellery fabrication.

Inferably, the people of Wa municipality have made the claim that improvised mediums can as well serve the jewellery industry in Ghana and elsewhere with aesthetically beautiful works produced. It can be emphasised that jewellery cannot be limited to a society that must have all equipment, tools, materials, technical know-how before its production.

There are four major types of metalworks in Wa municipality. All of them are either ferrous or non-ferrous metal fabricated. But the ferrous metal dominated all of them. Four basic principles of fabrication steps were unearthed as a unique step used by the people and this gave the yardstick and the ability to unearth Jewellery fabrication among them.

Aesthetic qualities were philosophically exhibited using the principles and elements of art. Dynamically, the people of Wa municipality drew their designs before production and in these drawings, they used lines, dots, shapes, colours and textures to explore the collective identity of the people as well as gaining access to their way of life. This trend gave insight into the unique aesthetic values and expressions of the people's culture, history, religious beliefs and practices, as well as enhancing their cultural milieu.

7. Recommendations

Based on these findings and conclusions of this study the following recommendations have been made:

An improved well organised history of metal design and fabrication in the municipality and the region as a whole, should be put together by the Metal Design and fabricators, Garages Association supported by Council for Technical and Vocational Education and Training (COTVET) and researchers quickly to serve as a reference point for the metal industry in the region and Ghana as a whole.

The philosophies behind all the types of metalworks identified and used in the Wa municipality must be given the necessary documentation by researchers and the Council for Technical and Vocational Education and Training (COTVET) and the current metal design fabricators should be given the needed information that would influence their sources of ideas and production.

The metal design and fabricators' techniques and skills currently need enhancement with different facets of technical training by Council for Technical and Vocational Education and Training (COTVET) in partnership with the researcher to widen the scope of their abilities for the metal industry.

The myth surrounding metal fabrication should be erased by lecturers of metal design and metal educators through seminars and symposia such that the educated and non-educated; be it male or female can all take part. It should not be that jewellery fabrication is only for the educated or vice versa or male or female.

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